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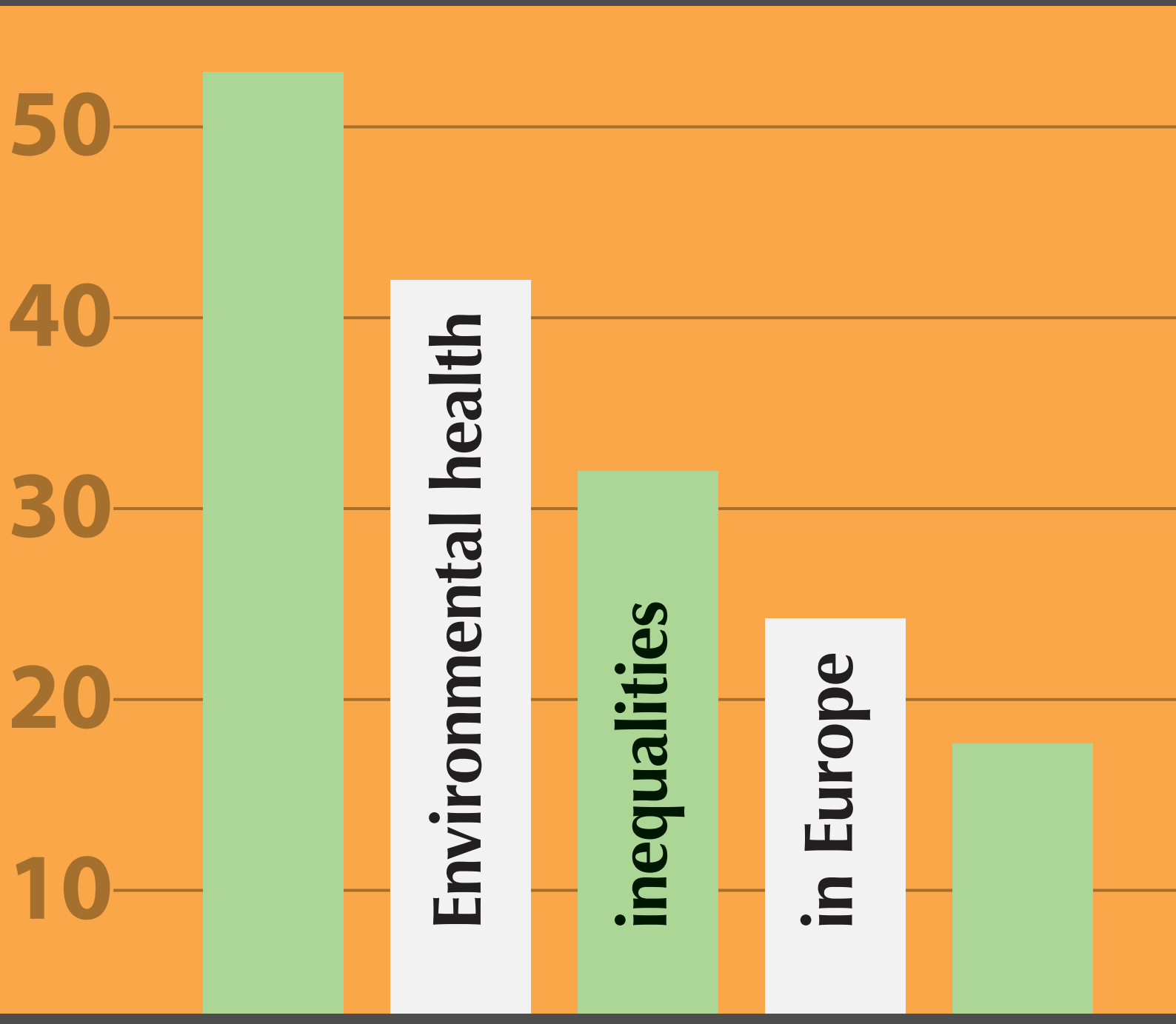

Environmental health inequalities in Europe

The WHO European Centre for Environment and Health, Bonn Office, WHO Regional Office for Europe, coordinated the development of this report.

Abstract

Recent debate on the social determinants of health has indicated that the unequal distribution of health and well-being in national populations is a major challenge for public health governance. This is equally true for environmental health conditions and for exposure to environmental risk, which varies strongly by a range of sociodemographic determinants and thus causes inequalities in exposure to – and potentially in disease resulting from – environmental conditions.

Interventions tackling such environmental health inequalities need to be based on an assessment of their magnitude and on the identification of population groups that are most exposed or most vulnerable to environmental risks. However, data to quantify the environmental health inequality situation are not abundant, making comprehensive assessments difficult at both national and international levels.

Following up on the commitments made by Member States at the Fifth Ministerial Conference on Environment and Health in Parma, Italy (2010), the WHO Regional Office for Europe has carried out a baseline assessment of the magnitude of environmental health inequality in the European Region based on a core set of 14 inequality indicators. The main findings of the assessment report indicate that socioeconomic and demographic inequalities in risk exposure are present in all countries and need to be tackled throughout the Region. However, the report also demonstrates that each country has a specific portfolio of inequalities, documenting the need for country-specific inequality assessments and tailored interventions on the national priorities.

Keywords

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Environmental health inequalities in Europe

Assessment report

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FOREWORD

In 2008, the final report of the WHO Commission on Social Determinants of Health[2] concluded that inequalities in health are a major challenge for both development and overall progress in countries. Such inequalities also exist within environmental health; almost all countries have some groups of their population at greater risk of experiencing harmful environmental conditions than others. Socioeconomic variables such as income, employment or occupation and education are found to be especially strong determinants of environmental health risks. Demographic variables such as age, sex and ethnicity can also affect risk, and in addition can modify the relationship between socioeconomic status, environment and health. The Member States of the WHO European Region declared their commitment to act on socioeconomic and gender inequalities in the human environment and health at the Fifth Ministerial Conference on Environment and Health in Parma, Italy, in March 2010.[3]

This assessment report indicates that environmental health inequalities exist in all subregions and in all countries of the WHO European Region, even though countries may have different patterns of exposure and risk. The report also confirms the expectation that often, although not exclusively, exposure to environmental risks is more frequently suffered by disadvantaged population groups.

The report shows that more and better data on the distribution of environmental risks within the population of the WHO European Region are needed. For many environmental health inequalities covered in this report, data are only available for about half the countries. The assessment of environmental inequalities is further restricted by a frequent lack of data on population subgroups defined by various categories of socioeconomic or demographic variable. This report must therefore be considered an initial baseline assessment using data available from international databases. Clearly, more work is needed to provide more and better data, enabling more insightful assessments.

The existence of significant unjust and avoidable inequalities in environmental risks within a country is not acceptable, and evidence of such inequalities, as presented in this report, thus calls for relevant policies and interventions. In consequence, the environmental health inequalities identified in the respective countries need to be validated and interpreted in the given national context, allowing the design of intersectoral remedial actions[4] as well as the integration of health equity considerations into all national policies.[5] Such interventions would prove that Member States have not only the capacity to identify inequalities in environmental risk but also the political will to address these inequalities and provide environmental justice as declared by the Member States in Parma.

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2 Commission on Social Determinants of Health (2008). *Closing the gap in a generation: health equity through action on the social determinants of health. Final report of the Commission on Social Determinants of Health*. Geneva, World Health Organization (http://whqlibdoc.who.int/publications/2008/9789241563703_eng.pdf, accessed 11 January 2012).

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EXECUTIVE SUMMARY

THE CONCEPT OF ENVIRONMENTAL HEALTH INEQUALITIES

Environmental health inequalities refer to general differences in environmental health conditions. Socioeconomic and demographic inequalities in exposure to environmental hazards exist everywhere and can be expressed in relation to factors that may affect the risk of being exposed, such as income, education, employment, age, sex, race/ethnicity and specific locations or settings. In addition to these differences in exposure, environmental health inequalities are also caused by social or demographic differences in vulnerability towards certain risks.

Many of the environmental health inequalities, particularly where they are linked to socioeconomic variables or sex, also represent "inequities" because they are unfair, unjust and avoidable. The root cause of such inequalities is most often a lack of "distributive justice", indicating that environmental risks are not evenly distributed within societies and populations, and a lack of "procedural justice", indicating that different population groups may have different opportunities to influence decisions affecting their close environment.

RATIONALE OF THE REPORT

The objective of the report is to provide an initial baseline assessment of environmental health inequalities in the WHO European Region. It is based on available statistical data from national or international databases. To undertake the assessment, a set of 14 environmental health inequality indicators was developed, categorized into three inequality dimensions (see Table).

Table. Environmental health inequality indicators

Housing-related inequalities	Injury-related inequalities	Environment-related inequalities
• Inadequate water supply • Lack of a flush toilet • Lack of a bath or shower • Overcrowding • Dampness in the home • Inability to keep the home adequately warm	• Work-related injuries • Fatal road traffic injuries • Fatal poisonings • Fatal falls	• Noise exposure at home • Lack of access to green/ recreational areas • Second-hand smoke exposure at home • Second-hand smoke exposure at work

For each environmental health inequality indicator, data from international databases were analysed to assess, by country or subregion, the existence and the magnitude of inequalities between different population subgroups.

National data were analysed for the development of national environmental health inequality fact sheets and practice examples (see Annexes 1 and 2). These national contributions indicate that more detailed assessments of environmental health inequality can be provided at national and subnational levels and that there are already national experiences with such assessments.

INEQUALITY ASSESSMENT FINDINGS

The assessment of housing-, injury- and environment-related inequalities shows that inequalities exist throughout the WHO European Region. However, there are large differences between countries regarding the magnitude of the inequalities and the most affected population groups. Depending on

the available data, inequality assessments were undertaken in relation to differences by sex, age, income, relative poverty, household type, social position, employment, occupation, education and difficulty paying bills. All of these sociodemographic determinants are found to be associated with significant inequalities.

- Income and poverty-related inequalities are identified for noise exposure, exposure to second-hand tobacco smoke at home and at work, and housing-related inequality indicators, where they are most clearly expressed. Compared to the other determinants applied, income- and poverty-related determinants display some of the strongest inequalities at subregional and national levels. Differences in national income levels are also associated with injury-related fatalities, with low/middle income countries reporting higher mortality rates.
- Sex-related inequality is most strongly associated with injury, where male fatality rates are often three times (and beyond) female fatality rates. Sex-related differences also appear in relation to second-hand tobacco smoke exposure, yet play no important role for housing-related risk factors.
- Age-related inequalities are present for injuries (especially falls) but differ in direction, depending on the indicator. Age impacts are less prominent for the other inequality indicators.
- Household type-related inequalities in housing conditions are especially identified for single-parent households, and increase when combined with low income and relative poverty factors.
- Data on inequalities by education, employment/occupation and self-assessed social position are only available for some of the environment-related inequalities, but they show a diverse inequality pattern: high education level is consistently associated with higher reported lack of access to recreational and green areas, while employment/occupation level shows different inequality patterns in exposure to second-hand smoke, with the direction of inequality depending on sex and subregion.

SUGGESTED PRIORITIES FOR NATIONAL ACTION

Suggested priorities for national action are identified in the report, based on a combined assessment of the absolute magnitude of the respective environmental exposure for the whole population and the relative exposure differences between selected population subgroups. If the respective environmental health risk is greater in one country than in others, and if the distribution of the risk within the population is more unequal in that country than in others, the country thus identified should give priority to national follow-up activities in order to address these inequalities.

Suggested priorities for national action on inequalities are identified for 38 of the 53 countries of the WHO European Region and affect Member States from all subregions and developmental levels. However, of the 15 countries where no priority for national action on environmental health inequalities was identified, 12 countries only reported data for 5 or even fewer of the 30 assessed inequality dimensions covered within the 14 environmental health inequality indicators.

Annex 3 shows the suggested priorities for the individual countries of the WHO European Region. In countries with identified priorities for national action, a more detailed national assessment of the respective inequalities is needed in order to confirm and interpret them in the given national context. However, in countries where no data were available, this lack of information should, in and of itself, be a reason for more detailed investigation.

CONSTRAINTS AND EVIDENCE GAPS

The assessment report is affected by a range of constraints and gaps in evidence. The most significant constraints are (a) the lack of general data on environmental exposure in many countries, and (b) the limited opportunities for stratification of environmental exposure data by socioeconomic or demographic determinants. Further constraints relate to the quality and reliability of the data, and the lack of

methodological consistency between national surveys, restricting the comparison of data collected in different countries. Priority steps to be taken towards the improvement of statistical evidence for environmental health inequality assessments would comprise:

- establishment of surveys covering priority environmental health issues and specific target groups
- increased use of social and demographic variables in environmental surveys
- development of common tools, methods, definitions and criteria
- better access to the available data.

CONCLUSION

The report conveys four key messages.

- Environmental health inequalities exist in all subregions and in all countries, and are most often suffered by disadvantaged population groups.
- The magnitude of inequalities and the distribution of inequalities between advantaged and disadvantaged population groups can be very diverse between countries and also depends on the socioeconomic or demographic variable used for stratification.
- To allow reliable identification of the most relevant target groups and to understand better the national inequality patterns and their causal mechanisms, more detailed environmental health inequality reporting and assessment are needed at the national level.
- The evidence base for the assessment of environmental health inequalities needs to be strengthened. This is valid for both data quantity (number of countries with data, number of risk factors reported) and data quality (reliability, opportunities for stratification).

Therefore, the results presented in this report provide an initial baseline assessment of selected environmental health inequalities in the WHO European Region. Further work is necessary to expand and further refine the assessment.

POSSIBLE ACTIONS FOR TACKLING ENVIRONMENTAL HEALTH INEQUALITIES

Although national priorities and disadvantaged groups vary, action is necessary throughout the WHO European Region to reduce the observed inequalities. The report suggests six general recommendations for action, which can be tailored to the respective national situation:

- action 1: general improvement of environmental conditions, assuring healthy environments for all;
- action 2: mitigation and reduction of risk exposure in the most affected population groups, focusing on the most exposed and/or most vulnerable subpopulations;
- action 3: national environmental health inequality assessments to assess or confirm inequalities based on national, more detailed data;
- action 4: sharing experiences and case studies on successful interventions tackling environmental health inequalities;
- action 5: review and modification of national intersectoral policies in relation to environmental health inequalities;
- action 6: monitoring of environmental health inequalities using a standard set of inequality indicators.

INTRODUCTION

INTRODUCTION

Matthias Braubach

"Decades of experience tell us that this world will not become a fair place for health all by itself."
(Margaret Chan, foreword to Blas and Sivasankara Kurup, 2010)

The *Constitution of the World Health Organization*, established in 1946, provides WHO with a mandate to strive for the highest possible level of health for all people, irrespective of their social status, ethnicity, sex or age (WHO, 1946). The 1978 *Declaration of Alma-Ata* confirms this priority, defining health as a fundamental human right and stating that "inequality in the health status of the people particularly between developed and developing countries as well as within countries is politically, socially and economically unacceptable and is, therefore, of common concern to all countries" (WHO, 1978). However, the *Declaration of Alma-Ata* also points out that action cannot rest within the health sector alone if the goal of attaining health for all is to be met, as health is achieved as a result of the policies and actions of many sectors. This is even more evident when looking at environmental health issues: because these issues are heavily influenced by the way we live, travel, work and consume, they cannot directly be affected or even mitigated by the health sector. Therefore, the provision of adequate and equal conditions – through environmental, social and infrastructural measures – is a task for all sectors and calls for intersectoral action (WHO, 2011a) and a "health in all policies" (HiAP) approach (Ministry of Social Affairs and Health, Finland, 2006).

RATIONALE FOR HEALTH INEQUALITY ASSESSMENT AND MONITORING

The final report of the WHO Commission on Social Determinants of Health (CSDH), *Closing the gap in a generation* (CSDH, 2008), shows that inequalities in health are a major challenge for both development and overall progress in countries. The report provides strong evidence showing that the true causes of health inequalities reside in the social, economic and political environments shaping the conditions in which people live. These environments are affected by laws and regulations and can therefore be improved to ensure greater fairness and equality by developing new or modifying existing policies.

However, the way events unfold in reality can be quite different. Within almost all countries some groups of the population are at greater risk of experiencing harmful environmental conditions as a result of their sociodemographic circumstances. This environmental dimension of inequality and its multiple facets – known as environmental justice or environmental (in)equality – has in recent years been increasingly recognized and documented by both researchers and national governments.

There are significant sociodemographic inequalities in both exposure to and negative health outcomes arising from adverse environmental conditions. Such inequalities exist between countries, within countries and within communities and can devided into two categories – socioeconomic and demographic inequalities. Socioeconomic status (SES) variables such as income, employment, occupation and education are found to be especially strong determinants of environmental health risks. Demographic variables such as age, gender and ethnicity can modify the relationship between SES, environment and health, and can also directly affect exposure and health-related inequalities arising from biological, social, cultural and behavioural differences.

Calling on governments to close the gap in a generation, CSDH (2008) recommended three principles of action.

- Improve daily living conditions.
- Tackle the inequitable distribution of power, money and resources.
- Measure and understand the problem and assess the impact of action.

The first recommendation is strongly related to the environmental conditions to which people are exposed on a daily basis. The third recommendation calls for assessment of the health situation in Member States in order to understand the problem, identify causal mechanisms and set priorities for action. Most importantly, it calls for monitoring of the impacts of actions and interventions. In the context of environmental health inequalities, various reporting and monitoring opportunities arise to connect environmental exposure data with sociodemographic information to describe the disparities of environmental risk within and between population groups.

In response to the CSDH final report, the World Health Assembly agreed in 2009 on a resolution to reduce health inequities through action on the social determinants of health (WHO, 2009a). This resolution provides WHO with a strong mandate to address the social determinants of health in its work, and urges Member States to:

- tackle health inequities within as well as across countries;
- develop mechanisms to integrate inequalities into public health actions;
- consider inequity arguments in their policy-making.

The need for monitoring of and action on inequalities was confirmed by the World Conference on Social Determinants of Health held in Brazil in October 2011. The conference discussion paper (WHO, 2011b) indicates that a dearth of knowledge – resulting from an absence of inequality monitoring and of political accountability – is one of the main reasons for the lack of action and thus calls for increased reporting of inequalities using disaggregated data rather than information based on national averages.

ASSESSING ENVIRONMENTAL HEALTH INEQUALITIES IN THE WHO EUROPEAN REGION

In 2009 the WHO Regional Office for Europe began to review the evidence on social and gender inequalities in environmental risk and exposure, drafting a policy brief and an evidence report on environmental inequalities, published at the Fifth Ministerial Conference on Environment and Health in 2010 (WHO, 2010a; 2010b). At the Conference Member States recognized environmental health inequalities as a priority for future work and adopted the Parma Declaration (WHO, 2010c), which provides WHO with a mandate to monitor the commitment of Member States to act on:

- the health risks to children and other vulnerable population groups (with a specific focus on the water and sanitation situation);
- socioeconomic and gender inequalities in the human environment that are relevant for health.

Work undertaken by academic researchers, as well as by WHO and other international agencies, indicates that countries already have a significant ammount of information on the most vulnerable groups in relation to specific environmental threats. However, the respective data are often scattered and rarely brought together in a systematic way, as concluded by the first WHO expert meeting to review the evidence on environmental inequalities in 2009 (WHO, 2009b). Following up on this lack of quantitative evidence, and based on the Parma Declaration and the World Health Assembly resolution, WHO identified the need to assess in more detail the environmental health inequalities in the WHO European Region as a basis for further action by WHO and Member States.

RATIONALE AND OVERVIEW OF THE PROJECT

The main objective of the project was to assess and report on environmental health inequalities in the WHO European Region, based on available statistical data from national or international databases. The results of the project are presented in this assessment report, which describes the magnitude of environmental disparities in the WHO European Region and identifies the population groups that are most affected. Some academic research work referenced in the report chapters is also applied to put the statistical data into context, to provide information about the health relevance of the risk factors covered, and to shed light on inequalities that cannot be assessed through the data alone. However, emphasis is also placed on identifying and reporting the gaps in evidence that restrict the assessment of environmental inequalities, which may be as relevant for public health practitioners and policy-makers as the findings.

Initiated in 2010 and benefitting from the work reviewing academic evidence for the Fifth Ministerial Conference on Environment and Health, the project aimed to:

- establish a list of environmental health risk factors for which data on socioeconomic or demographic inequalities can be compiled at the national level;
- select and apply an environmental health inequality indicator set for the assessment of country-specific environmental health inequality data;
- produce an assessment report on environmental health inequality together with national inequality fact sheets.

Two milestone meetings took place at the WHO European Centre on Environment and Health in Bonn to mark the project's progress.

Identification of available data and selection of inequality indicators

Informed by the evidence review published for the Fifth Ministerial Conference on Environment and Health (WHO, 2010b), a compilation of available data on environmental health risk factors and their potential for stratification by sociodemographic determinants was put together during summer 2010. 17 Member States participated, searching for available data based on national censuses and surveys. In parallel, the WHO secretariat reviewed international databases (including those of the European Union (EU), the Organisation for Economic Co-operation and Development (OECD) and the United Nations) for data on the environmental health risk factors that could be stratified by socioeconomic or demographic determinants.

In October 2010 at the first project meeting 26 experts from different countries across the WHO European Region and WHO staff from various programmes reviewed and evaluated the compilation of environmental health inequality data and data sources (WHO, 2010d). From an initial 30 risk factors compiled by the WHO secretariat and the Member States, a set of 14 environmental health inequality indicators categorized into three inequality areas (housing-, injury- and environment-related inequalities) was agreed (see Table 1).

Although the review was undertaken on both the national and international levels, the meeting concluded that the data compiled through national surveys and censuses were too diverse to be used for international reporting. The main restrictions relate to the variety of collection methods and definitions used, which do not enable consistent and reliable comparison between countries (see Chapter 5 for details). Nevertheless, national data have strong potential to be useful in environmental health inequality assessments within individual countries, as indicated by the national inequality fact sheets and practice examples in Annexes 1 and 2.

Table 1. Environmental health inequality indicators

Indicator	Sociodemographic stratification options available	Data source
Housing-related inequalities		
Inadequate water supply	Urbanization level	WHO/UNICEF
Lack of a flush toilet	Age, sex, income/poverty status and household type	Eurostat
Lack of a bath or shower	Age, sex, income/poverty status and household type	Eurostat
Overcrowding	Age, sex, income/poverty status and household type	Eurostat
Dampness in the home	Age, sex, income/poverty status and household type	Eurostat
Inability to keep the home adequately warm	Age, sex, income/poverty status and household type	Eurostat
Injury-related inequalities		
Work-related injuries	Sex, age and occupation	Eurostat
Fatal road traffic injuries	Country income, age and sex	WHO
Fatal poisonings	Country income, age and sex	WHO
Fatal falls	Country income, age and sex	WHO
Environment-related inequalities		
Noise exposure at home	Income/poverty status and household type	Eurostat
Lack of access to green/recreational areas	Age, sex, income, difficulty paying bills, employment, education level and household type	Eurofound
Second-hand smoke exposure at home	Age, sex, self-assessed social position, difficulty paying bills and employment	Eurobarometer
Second-hand smoke exposure at work	Age, sex, self-assessed social position, difficulty paying bills and occupation	Eurobarometer

Implementation of indicators and drafting the first assessment report

Using the environmental health inequality indicators, subcontracted experts drafted reports assessing indicator-specific inequalities. Chapters on the concept of environmental health inequality and on the gaps in evidence identified as restricting a more detailed inequality assessment were developed in parallel. In addition, selected Member States were asked to provide fact sheets on environmental health inequalities (showing the potential for more detailed assessments using national data) and practice examples describing the experience and methods applied in recent national work identifying, monitoring and assessing environmental health inequalities.

At the second project meeting in June 2011, the chapter drafts, fact sheets and practice examples were peer-reviewed and discussed by 24 country representatives and experts. The chapters were then revised and finalized, based on their comments.

BENEFITS OF INEQUALITY ASSESSMENTS FOR ACTION

Action to tackle inequalities needs to be informed by evidence on the population groups most affected and the sociodemographic features associated with the unequal distribution of risks and opportunities. Hence, better quality evidence and adequate identification of the specific target groups could help to make interventions more effective. Table 2 indicates the potential benefits of using inequality evidence for policy action, suggesting that such actions can be focused on societal structures and mechanisms as well as on resulting disparities in exposure and/or vulnerability.

Table 2. Benefits of inequality reporting for effective action on environmental health inequalities

Inequality evidence	Policy actions
Evidence on societal structures and mechanisms leading to inequalities	• Provide examples of good/equitable societal practices. • Review and propose policy options on environmental protection. • Engage in public debate to incorporate health equity issues into economic and social strategies and plans. • Support and implement equity-focused health impact assessment of policies and infrastructural projects.
Evidence on differential exposure to social and physical environmental risks	• Advocate for appropriate interventions to improve environmental conditions for the whole population. • Target action on pollution hotspots and population groups with the highest exposures. • Influence the health ministry to shift attention upstream to policies that produce good population health. • Support intersectoral action and extend HiAP approaches. • Actively participate in public education, regulation, infrastructure planning and design, and taxation policy development affecting environmental conditions.
Evidence on differential vulnerability to the risks	• Ensure adequate environmental and infrastructural services and conditions throughout each country. • Increase targeted protection measures in areas or settings with a high density of vulnerable, sensitive or disproportionally affected populations. • Improve environmental standards in the vicinity of child care centres, schools, hospitals, nursing homes, and similar.

Source: adapted and extended, based on a concept outlined in Blas, Sommerfeld and Sivasankara Kurup (2011).

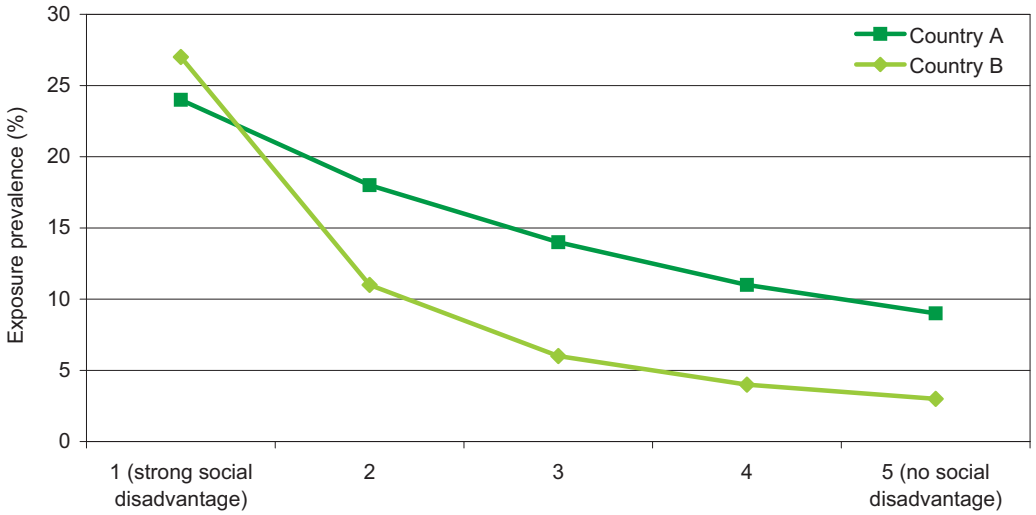
Since the transformation of society structures and procedures may be more of a long-term objective for the improvement of health for all, the reduction of environmental inequalities specifically requires short-term interventions in decreasing exposure (Braubach et al., 2010). In this context, Table 2 indicates that in many cases the decision will be between two separate approaches: interventions assuring environmental conditions for all and targeted interventions tackling environmental conditions specific to certain groups or geographical units. Although both approaches are needed and can often be combined to achieve the best outcome (Dahlgren and Whitehead, 2006), the results of inequality assessments are essential to inform the decision-making process and provide guidance on the most appropriate way forward.

On the one hand, as indicated by the recent report on equity, social determinants and public health programmes (Blas and Sivasankara Kurup, 2010), the existence of linear gradients of environmental inequality (see Fig. 1, Country A) would strongly suggest that universal approaches – improving environmental conditions to reduce exposure for all groups, irrespective of social status – would be beneficial for the whole of society. Environmental actions such as assuring compliance with existing environmental standards throughout the country are likely to have the greatest benefits for the most disadvantaged segment of the population with the highest levels of exposure. Thus, broad-brush environmental actions might help to reduce inequalities more effectively.

On the other hand, actions should not ignore the specific needs of population groups with higher social disadvantage, which might benefit most from dedicated action. Thus, environmental inequality gradients with a skewed distribution (see Fig. 1, Country B) – especially those with excess risk for the poorest population groups – would benefit from the application of targeted actions focusing on the environmental conditions suffered by the most disadvantaged population groups, which, in addition, are often less socially included and less involved in political advocacy.

This assessment report provides examples that show how analysis based on the results of statistical data can assist with the selection of appropriate interventions. However, this approach requires the identification of gradients which cannot be produced when only dichotomous comparisons of, for example, "rich versus poor" and "male versus female" are possible. As demonstrated by the results in this report, data availability often does not facilitate adequate assessment of inequalities using these existing gradients.

Fig. 1. Examples of linear and nonlinear inequality gradients



OVERVIEW OF REPORT

The assessment report begins with an introduction to the concept of environmental health inequalities (Chapter 1). It presents the historic development of the approach and provides insight into the terminology and scientific concepts used. This introduction will provide readers unfamiliar with the concept of environmental health inequality with a basic understanding of the field.

The conceptual introduction is followed by the three main chapters of the assessment report, presenting the environmental health inequalities in the WHO European Region. Chapter 2 looks at housing-related inequalities, covering those related to water and sanitation (water supply and sanitary equipment within homes) as well as those related to the quality and size of the dwelling (overcrowding, dampness and thermal comfort). This is followed by Chapter 3 on injury-related inequalities, which assesses the unequal distribution of work-related injuries and fatal traffic injuries, poisonings and falls. Chapter 4 then considers the inequalities in noise exposure, access to green and recreational areas, and second-hand smoke exposure at home and at work. Each of these assessment chapters also includes a section on the health relevance of the identified inequalities as well as main conclusions and suggested mitigation actions.

The presentation of the findings is complemented by a review of the evidence gaps and the barriers to assessing environmental health inequalities. Chapter 5 shows that the findings presented are far from exhaustive and argues that there are still fundamental gaps in the evidence yet to be tackled.

Chapter 6 then merges the findings to identify the patterns of and possible priority areas for action on environmental health inequality observed in the WHO European Region. The assessment results are reviewed to highlight:

- the main inequalities found in the European subregions;
- the countries facing the largest challenges of environmental health inequalities based on a combination of the absolute magnitude of an environmental problem (prevalence levels or mortality rates in the total population) and the magnitude of relative inequality between selected population subgroups.

Finally, the report concludes by summarizing the most relevant key messages, and provides six recommendations for potential action.

Complementing and extending the international assessment report and its findings, three annex sections focus on evidence, experiences and suggested priorities for action at the national level. Annex 1 presents a national fact sheet for each of the 14 environmental health inequality indicators and shows that proper assessment of environmental health inequalities can be undertaken in all Member States of the WHO European Region, irrespective of social or economic level. Annex 2 provides specific examples and experiences from selected Member States, showing steps and methods that can be applied to identify and assess environmental health inequalities. Annex 3 presents in detail the assessment of suggested priorities for national action on range of environmental health inequality dimensions, as presented in Chapter 6.

METHODOLOGICAL NOTES

As mentioned above, availability and consistency of data were the main challenges for putting together this assessment report. The variety of data formats and the available stratification options by sociodemographic determinants have also had an impact on the chapter contents. Table 1 above shows that for each of the three inequality dimensions (housing, injury and environment) different data sources were used for the assessment of environmental health inequalities. Rather than applying one common methodological approach to all indicators, the authors have tried to adapt the analysis to the available information by choosing the most practical analysis methods for the respective data. As a result, each chapter has approached the assessment and presentation of the inequality situation slightly differently. Chapter-specific sections on the data and methods used inform the reader about the information available for the assessment, the associated constraints, and the methods applied.

Nevertheless, throughout the assessment report, the authors have attempted to present two different inequality dimensions:

- absolute dimensions of inequality, as shown by absolute differences in, for example, mortality rates or environmental exposure prevalence levels between population groups;
- relative dimensions of inequality (where appropriate), as shown by ratios comparing, for example, the excess mortality in or prevalence of the most affected population group to the less affected or the total population, thus showing the relative magnitude of inequality.

While the authors believe that a complete assessment of environmental health inequalities must be based on both absolute and relative inequality dimensions, the data sometimes made this approach difficult in practical terms. Several examples shown in this assessment report indicate that the highest relative inequalities can often be found in countries where the overall prevalence of a given problem is very low. Therefore, it is necessary to note that any relative expression of inequality always needs to be interpreted in light of the overall prevalence situation, as well as the absolute differences between the compared population groups. For example, if the overall prevalence of an environmental problem in the general population is 1%, the lowest-income subgroups might have a prevalence of 5%, while the highest-income subgroups might have a prevalence of only 0.5%. The relative difference between these income groups is then described by a ratio of 10:1, while the absolute difference is 4.5%. In comparison, countries with an overall prevalence of 10% in the general population rarely achieve such high relative inequality ratios. It should also be noted that the same absolute difference of 4.5% provides a ratio of only 1.45:1 if the population groups compared have prevalence levels of 14.5% and 10%. Bearing this in mind, it is clear that in countries where both the prevalence of an environmental problem and the relative contrast in prevalence between subgroups are high, political action is more urgently required.

The sample sizes of the surveys used as data sources presented another constraint. Many of these surveys (such as those coordinated by Eurostat or Eurofound) are designed to provide nationally representative estimates for a range of variables for the total population of the country. However, when analysing such datasets from an inequality perspective, the data are divided into population subgroups, quickly reducing the respective sample size. For example, in the United Kingdom the sample size of households

participating in the Eurostat survey on EU Statistics on Income and Living Conditions (EU-SILC) is 7500. Analysing the effect, for example, of poverty (which may affect only 15% of the population) in single-parent households (which may be 5% of all households) reduces this sample size to only 50–60 households that represent single-parent households living in poverty. Similarly, the size of the respective sample is affected by the prevalence level of a given environmental problem, with lower prevalence levels reducing the sample size further. This makes the results less reliable and the findings less representative of the general population.

Another factor was the population size of the respective country: compared to the United Kingdom, which includes 7500 households in the EU-SILC survey, smaller countries such as Ireland and Estonia provide even smaller samples to start with (3750 and 3500 households respectively). Other surveys used, such as the Eurobarometer and European Quality of Life Survey (EQLS), are based on even lower sample sizes. Therefore, the assessment of environmental inequalities between population subgroups may suffer from poor reliability. Nevertheless, these databases seem to be the only sources providing consistent and comparable data for assessment of environmental health inequalities.

A further challenge was that many of the international databases are frequently updated. The main work on the assessment report was undertaken in 2011, all data having been downloaded in spring 2011. Final modifications and changes were made in late 2011 when data for 2010 started to become available for some (but not the majority of) countries. Therefore, the inequality assessment is based on data reported for 2009 or, where this was not available, the last year of reporting for the respective countries. However, the lack of data for many countries, especially non-EU countries, is of much greater concern.

In order not only to compare countries but also to assess the inequality conditions by geopolitical subregion, the data were aggregated to reflect four subregions of the WHO European Region. Subregional categorization reflects the geographical and political situation as indicated by Table 3 and Map 1.[5]

Table 3. European subregions used for the assessment

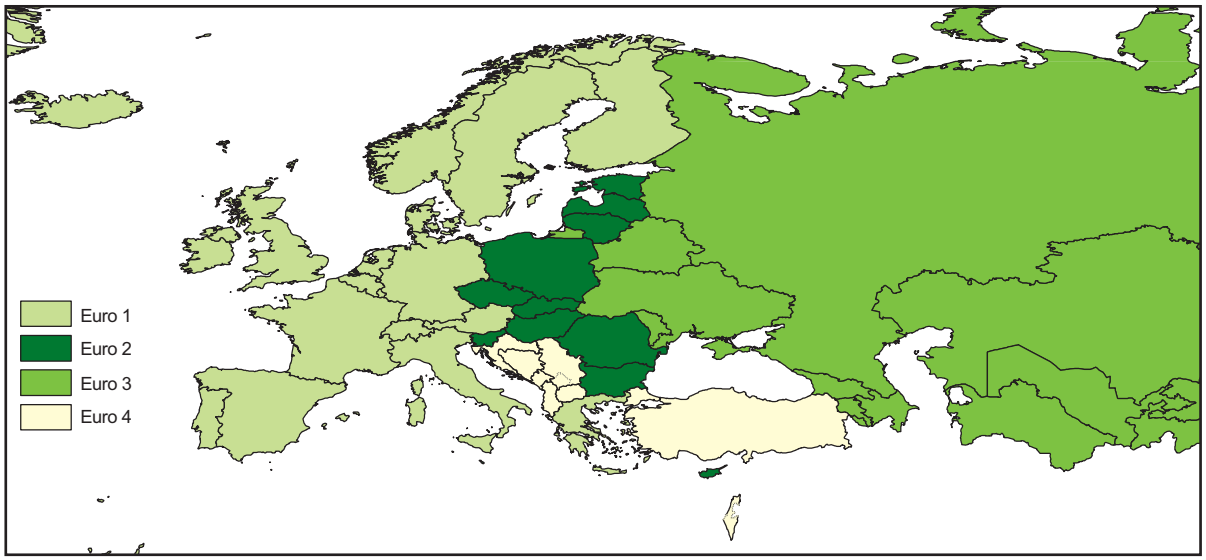
Subregion	Country coverage
Euro 1 (21 countries)	All countries belonging to the EU before May 2004 and western European countries on comparable developmental level (such as Norway and Switzerland)
Euro 2 (12 countries)	All countries joining the EU after May 2004
Euro 3 (12 countries)	All countries belonging to the former Soviet Union (except the Baltic states)
Euro 4 (8 countries)	All countries in the south-east of the WHO European Region including the Balkans, Turkey and Israel

Data from Eurostat, Eurobarometer and Eurofound, which cover only the EU countries and a few additional countries from the European Free Trade Association or EU candidate countries, use the subregional distinctions of "EU15" (for the 15 Member States belonging to the EU before May 2004) and "NMS12" (for the 12 Member States joining the EU after May 2004). Total figures for all EU Member States are labelled "EU27".

For all figures and tables in this report, subregional terms such as "EU15" or "Euro 2", for example, indicate that all the respective countries in these subregions are covered by the data. If data from one or more countries are missing, subregional terms "EU15 countries" or "Euro 2 countries" are used instead, indicating that the data are not based on all the countries within the respective subregion.

5 **Euro 1:** EU countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom. Non-EU countries: Andorra, Iceland, Monaco, Norway, San Marino, Switzerland.
Euro 2: Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia.
Euro 3: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Republic of Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine, Uzbekistan.
Euro 4: Albania, Bosnia and Herzegovina, Croatia, Israel, Montenegro, Serbia, the former Yugoslav Republic of Macedonia, Turkey.

Map 1. European subregions used for the assessment



The aggregation of data for the European subregions demonstrates another important restriction encountered during the assessment. Depending on the data source and the stratification of data, it was very difficult – and sometimes impossible – to derive accurate results for the subregions that would incorporate the population weight of the countries within the respective region. For many indicators, this would require a calculation of population subgroup sizes (by age group, sex, income, and so on) for each country to be used as a weighting factor in calculating the subregional average. In many cases – especially when combining several determinants – this proved impossible due to a lack of adequate data. As a result, the findings presented for the subregions often represent the arithmetic average of the national rates of the countries covered by the respective subregion, not adjusted for the different national population sizes. In each figure, this restriction is clearly marked as the average of national rates for all reporting countries of the subregion. Subregional data that are representative (often provided by Eurostat databases) do not include this indication.

DATA ACCESS

Sources of data are listed in the reference section of each chapter. National data tables downloaded from these sources in spring 2011 can be requested by email from the WHO European Centre for Environment and Health. Please send your requests to *info@ecehbonn.euro.who.int*, marked "National EH inequality data tables".

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CHAPTER 1

THE CONCEPT OF ENVIRONMENTAL HEALTH INEQUALITIES

CHAPTER 1. THE CONCEPT OF ENVIRONMENTAL HEALTH INEQUALITIES

George Morris, Matthias Braubach

A HISTORIC PERSPECTIVE

While priorities and emphases change over time and according to location, the environmental health approach has traditionally centred on protection of population health through identifying, monitoring and controlling the environmental hazards which produce disease in populations. The approach has its origins in the earliest days of the modern public health movement and, by assuring the quality of domestic, community and occupational environments, has greatly extended lifespans and improved health and well-being for communities and individuals. Underpinned by advances in epidemiology and the biological understanding of disease, the disease-centred, hazard-focused approach to environmental health remains a cornerstone of public health activity.

It was clear even to the 19th-century public health pioneers that the degraded, malodorous neighbourhoods where lives were shortest and most blighted by disease were also home to the poorest communities. Recognition of the importance of environmental conditions for population health has always been, and continues to be, accompanied by recognition of the interplay between sociodemographic and physical factors in producing inequalities in health and well-being. The final report of the CSDH, *Closing the gap in a generation* (CSDH, 2008), reinforces the global relevance of this interplay for the 21st century. Notably, the first of the report's three principles of action to tackle social inequity in health is: "improve the conditions of daily life – the circumstances in which people are born, grow, live, work, and age". The report is suffused with references to the alignment of, and interplay between, sociodemographic, economic and physical factors in ways which bear on health and equity. This reinforces the fact that the physical environment – alongside the social environment and genetic endowment – is one key driver in the creation and destruction of health and well-being, and thus also a main driver for health inequalities.

In summary, in the 150 years and more during which there has been tangible interest in population health and action at the level of society to protect and improve it, inequalities in health between different social groups have been an abiding public health challenge. As the second decade of the 21st century begins, it could be argued that remarkable health gains delivered by adherence to a population focus are increasingly overshadowed by persisting and increasing variability between and within countries. Implicitly, the notable achievements of public health are not enjoyed by all. By extension, and despite a sometimes diminished political profile, differences in the physical context for people's lives – referred to as environmental justice issues or environmental health inequalities – remain central to the health inequalities challenge throughout the world.

Acutely aware of this issue, ministers and representatives of Member States of the WHO European Region came together in 2010 at the Fifth Ministerial Conference on Environment and Health in Parma, Italy, to chart the next steps in the European environment and health process and, in the words of the Parma Declaration, "to face the key environment and health challenges of our time" (WHO, 2010).

Listed among the key environment and health challenges on which they made a commitment to act were: "the health risks to children and other vulnerable groups posed by poor environmental, working and living conditions (especially the lack of water and sanitation)" and "socioeconomic and gender inequalities in the human environment and health". Each of these reflects recognition at a political level of the interplay between social and environmental variables and the need to tackle each to create better and more equal health for all. Evidence providers in the scientific, medical and epidemiological communities also recognize shared agendas and methodological challenges and the need to work in partnership. There is, for example, both conceptual and methodological overlap between the activities of environmental epidemiologists who study the effects of environmental exposures on health and disease in the population and social epidemiologists who often use social concepts to better understand and explain patterns of health in the population.

Key message 1

Sociodemographic inequalities in the exposure to environmental hazards exist everywhere and they are not new. These inequalities can be expressed in relation to factors such as income, education, employment, age, gender, race/ethnicity and specific locations or settings.

INEQUALITY AND INEQUITY

Notions of fairness versus unfairness and justice versus injustice now inform the language of public health when speaking about health differences between population subgroups. Like any type of inequality, inequalities in health and its determinants between different groups of people may, on one level, be regarded as natural and inevitable. An example might be differences in a range of health outcomes observed between different demographic groups, such as the elderly versus the rest of the population. However, normally, when health inequalities are observed between socially defined groups, they are more accurately described as "health inequities". This term is now widely used to denote situations in which the distribution of health and its determinants is not simply unequal, but also unjust, unfair and avoidable (WHO, 2011).

Viewed from an environmental health perspective, the differential exposure of groups of people to health-relevant aspects of environment (with potential to create and sustain differences in health status) can often simply be inequalities. This might be the case where a group of people chooses to live in a polluted city centre for reasons of convenience or chooses riverside homes – potentially more liable to flooding – for aesthetic reasons or social status. However, the potential for differences in health outcome linked to environment may have little or nothing to do with choice or biological variation and may have its origin in factors beyond the influence of those affected. Here the environmental health challenge is about addressing health inequities that are unfair and avoidable.

Key message 2

The term "health inequalities" refers to general differences in health. Many of these differences (particularly where they are linked to social variables or gender) represent "health inequities" because they are unfair, unjust and avoidable.

IDENTIFICATION AND ASSESSMENT OF INEQUALITIES AND INEQUITIES

To identify, assess, monitor and ultimately address environmental health inequalities and inequities associated with sociodemographic determinants, it is necessary to develop appropriate measures of environmental quality; this includes health-promoting aspects of environment in relation to social or demographic variables such as income, education, employment, age, gender, race/ethnicity and

specific locations or settings. In practice, this creates a requirement for robust indicators to illustrate the relationship between environmental health risk and different sociodemographic variables and permit better understanding regarding specific risk groups and their exposure. Such indicators might be termed "indicators of environmental health inequality". Thus, the concentration of, for example, particulate matter in different areas might be related to the income of people living there to create an indicator of environmental health inequality. The potential to use such indicators to better understand public health problems and to shape and evaluate the policy response is considerable. They permit an assessment and analysis of the social distribution of exposure and impacts and allow comparison within and between nations which, when used constructively, can benefit all concerned. When used to assess environmental health inequality within nations, such inequality indicators can tease out problems which might otherwise be masked by average figures. Clearly, the importance a country attaches to delivering better life circumstances for its most disadvantaged groups, and its success in doing so, can be considered a telling indicator of its political, social and economic development. This reinforces the value of indicators of environmental health inequality in a broad context.

Nevertheless, indicators have no practical value unless they can be used to gather and process information about environmental health inequalities in practice, and this demands data. In many locations the data are simply absent, perhaps due to a lack of political will or resources to create the systems and structures for data generation. This may, of itself, be an inequality.

Key message 3

Robust indicators of environmental health inequality that combine both social and environmental factors are needed, allowing these inequalities to be identified, assessed and tackled.

ENVIRONMENTAL HEALTH INEQUALITY: HAZARD AND RISK

Environmental health inequalities can result in many ways: a typical mechanism is when areas populated by particular social groups have a greater concentration of environmental hazards and a scarcity or absence of environmental "goods". This will almost inevitably disadvantage or marginalize population subgroups with certain characteristics in relation to, for example, gender, ethnic origin, occupation, income level, urban versus rural location, and so on. This unequal distribution between social groups is frequently described as an absence of "environmental justice" (Bullard, 2008; Curtice et al., 2005). However, the "distributive" element of environmental justice (which is about achieving more equal distribution of hazards and goods between population groups) is inextricably bound up with a need to ensure that different groups have equal capacity to influence decisions about what is and is not situated in their area. This second component of environmental justice is often termed "procedural justice" and a lack of procedural justice, in addition to the lack of distributive justice, often characterizes sociodemographically disadvantaged groups.

However, a comprehensive consideration of the role of sociodemographic factors in environmental health inequality must look above and beyond individual components of environmental justice to consider how a range of sociodemographic variables can modify not only the presence or absence of environmental hazards but also the individual risk of exposure and associated health consequences. Looking more closely at the influence of sociodemographic factors on environmental risk for the individual, it can readily be appreciated that factors such as age, gender, SES and indeed culture may have quite a profound influence on whether an individual chooses to be physically active or not, or to behave in a way which results in higher or lower exposure to a hazardous aspect of environment. There is a need to recognize that where sociodemographic factors influence individual opportunity, empowerment and dignity, they may critically influence an individual's decision, for example, to be physically active or avoid harmful exposures. It is evident that there is a socially-mediated mechanism that affects the individual risk exposure. In any case, all dimensions of environmental health inequality are of equivalent policy relevance.

Key message 4

There are sociodemographically determined inequalities in population-level environmental hazard but, because sociodemographic factors may also modify individual exposure and the health impact for the same degree of exposure, there may also be sociodemographically determined inequalities in individual environmental health risk. Each level needs to be identified and assessed.

SOCIODEMOGRAPHIC FACTORS, EXPOSURE AND VULNERABILITY

As described above, inequalities in environmental conditions and the lack of distributive justice regarding the location of environmental hazards lead to a greater probability of exposure to environmental health threats. Indeed, a wide range of surveys have shown that marginalized and disadvantaged groups – irrespective of the type of disadvantage, which can be education- or income-related as well as gender-specific or associated with ethnicity – are most often characterized as having the highest levels of exposure to environmental problems.

It is further recognized that the same degree of environmental exposure can result in a greater health impact when borne by a disadvantaged population; this may be due to a lower ability to respond to the environmental stress, perhaps exacerbated by other health pressures leading to synergistic effects. For example, sociodemographic and other factors can influence whether, having been exposed to a health-determining environmental factor, an individual goes on to experience a particular health outcome, and to what extent (the "exposure–response function"). The capacity for age, gender, genetic inheritance, pre-existing illness or psychosocial stress – singly or in joint interaction – to influence the exposure–response function is well understood in many cases.

Key message 5

Sociodemographic inequalities can be caused by differences in exposure to environmental risks (exposure differential), as well as by social or demographic differences in vulnerability towards certain risks (vulnerability differential).

THE PSYCHOSOCIAL DIMENSION IN ENVIRONMENTAL HEALTH INEQUALITY

In recent times, observation of and scientific interest in the vulnerability differential between different sociodemographic groups have led researchers to consider the role played by psychosocial stress. Psychosocial stress may have a number of origins but may be directly linked to social and physical characteristics of the places where people live. It is increasingly seen as a key factor in determining individual vulnerability to environmental hazards (Gee, Payne-Sturges, 2004). Psychosocial stress produces acute and chronic changes in the functioning of body systems such as those governing immune and inflammatory response, leading directly to illness or perhaps rendering individuals more vulnerable when exposed to, for example, a toxic environment. This may be particularly important in the absence of any counterbalancing effect from positive life circumstances and resources. Reflecting on the significant health inequalities challenge in Scotland and on the role of the physical environment, Scotland's Chief Medical Officer emphasized the importance of the psychosocial dimension when he observed that "how people feel about their physical surroundings, can impact on not just mental health and well-being, but also physical disease" (Scottish Government, 2007).

Key message 6

People's perceptions of the physical aspects of the places they live in can profoundly impact on their mental and physical health and their longevity.

FRAMING THE PROBLEM

During the meeting of an expert group on environmental health inequalities held in Bonn in September 2009 (WHO, 2009), attendees discussed a WHO contextual framework (see Fig. 2) which seeks to structure and identify potential pathways through which sociodemographic variables influence:

- the nature and distribution of environmental conditions;
- the exposure to these conditions for individuals and groups within society;
- the exposure–response relationships which lead to different health outcomes in individuals with comparable exposures;
- access to, and quality of, health-related services.

The framework offers a useful, holistic approach to framing issues in environmental health, reflecting growing enthusiasm for more integrated policy-relevant strategies for analysing complex multifactorial environmental health issues. This tendency is stimulated by the increasing aspiration to anticipate and mitigate the likely health implications of policies in all sectors of civil society (sometimes referred to as the HiAP agenda). The framework attempts to make explicit to policy- and other decision-makers that better, more equal environmental health for individuals and communities requires attention to environmental factors and sociodemographic conditions, as well as to how these influences interrelate.

The framework suggests four major pathways through which sociodemographic inequalities may influence exposure to and health outcomes from environmental risks.

- Arrow 1: there is a relationship between sociodemographic determinants and environmental conditions. Disadvantaged groups may live and work in, or be surrounded by, less favourable environmental conditions than the general population, resulting in higher exposure risk.
- Arrow 2: factors attributed to sociodemographic inequalities (such as knowledge and health behaviour) compound exposure. Given the same environmental conditions, disadvantaged groups may be more exposed than the general population.
- Arrow 3: factors attributed to sociodemographic inequalities (such as health status and biological sensitivity) influence the exposure–response function. Given the same exposure, disadvantaged groups may be more vulnerable to adverse health effects than the general population.
- Arrow 4: sociodemographic inequalities have a direct impact on health outcomes, which may operate through many mechanisms – some environmental, some independent of environmental factors. However, given the same exposure–response situation, disadvantaged groups may also be more vulnerable to adverse health effects than the general population (through, for example, inadequate insurance, reduced health services use or reduced access to services).

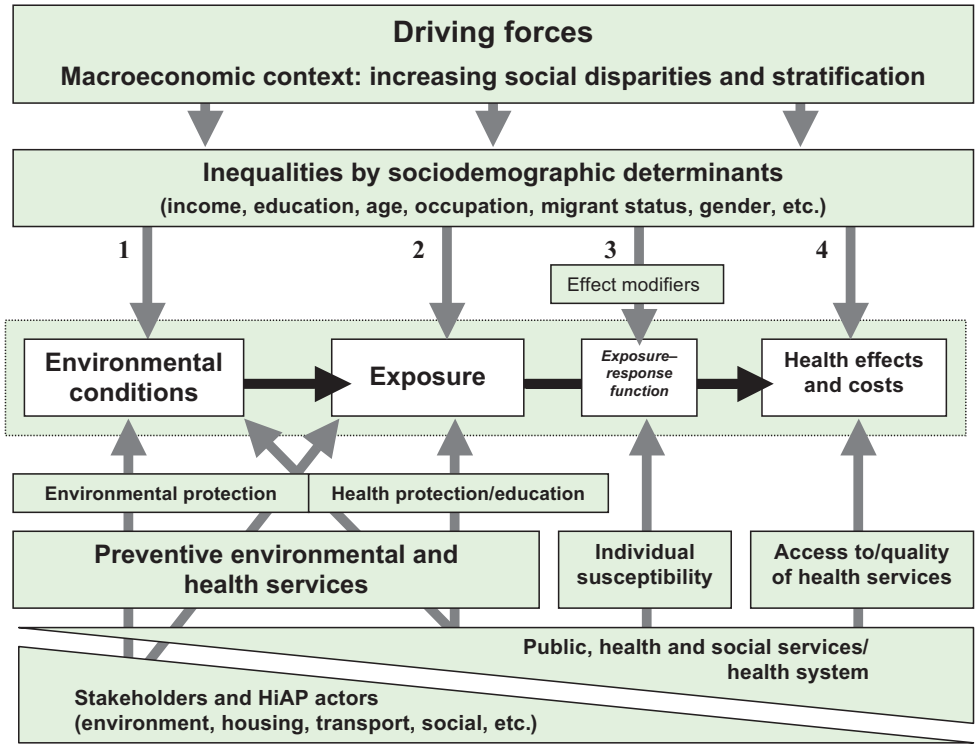
Arrows 1 and 2 together represent the exposure differential, describing the increased exposure risk, while Arrow 3 represents the vulnerability differential, accounting for an increased translation of environmental exposure conditions into negative health effects.

The generic framework may be populated for different environmental health issues but the utility of Fig. 2 is perhaps best illustrated by example. An ostensibly straightforward environmental health issue, such as the risk of serious health effects and even death from carbon monoxide (CO) poisoning in the home, can be expanded using the framework to illustrate its many components and the array of policy options it presents.

Briefly, particular sociodemographic groups – such as the elderly and those on a low income – may be more likely to occupy low-quality housing, possibly with poorly maintained gas or solid fuel heating systems, thus illustrating the potential for sociodemographic factors to create differential exposure to CO. The elderly and cognitively impaired and those with limited education may, in turn, possess less knowledge or understanding of the hazard of CO, yet may actually spend longer in the home environment and, in a struggle to keep warm on a limited income, may deliberately limit ventilation to save on fuel costs. These additional factors illustrate the potential influence of sociodemographic

variables on exposure to CO, and hence the risk to an individual or demographic group. To further compound the risk, the elderly may exhibit particular vulnerability to the health impacts of CO due to pre-existing illness or impaired cardio-respiratory function, thus illustrating that sociodemographic factors may also influence individual vulnerability. Finally, sociodemographic factors may align with factors such as inadequate health insurance, or reduced access to or use of health services, which may affect the effectiveness of medical treatment.

Fig. 2. The WHO framework model on social inequalities and environmental risks



Source: modified, based on WHO (2009).

Key message 7

It is important to take a holistic approach to framing equity problems in environmental and human health if the complexity of the challenge and the policy options are to be revealed.

CONCLUSION

There is strong justification for work to establish indicators and reporting systems that relate health-relevant environmental factors to individual or multiple sociodemographic variables with an appropriate resolution, such as at a small geographical scale. These indicators are a necessary resource for work to improve understanding, reporting, assessing and ultimately acting on environmental health inequalities and the wider challenge of social complexity in environmental public health. There is also strong justification for keeping under review, and extending where indicated, the range of environmental variables which should be linked to sociodemographic variables. Equity-sensitive environmental monitoring and reporting should in future extend its scope to include environmental factors which are potentially health-nurturing and represent a health resource rather than a health risk. Similarly, integration of aspects of physical environments or places which generate negative psychosocial responses is also important.

Increasing reference to the concept of "place" and "healthy places" in public health circles represents recognition of the interplay of social, demographic, economic and cultural factors at the neighbourhood level and the need to ensure that these are jointly managed to create better and more equal health. Such an approach is a significant enrichment of the hazard-focused traditions of environmental public health.

Finally, the current environmental changes and erosion of natural resources linked to climate change, and the policies put in place to mitigate and adapt to them, are likely to impact differentially on sociodemographic groups, exacerbating environmental health inequalities and further reinforcing the case for appropriate indicators and reporting structures of environmental health inequality.

The development and application of environmental health inequality indicators for the WHO European Region – as presented in this report – permits a first baseline assessment of environmental health inequalities. This, in turn, has the potential to inform policy and action and to chart progress in tackling the environmental dimension of sociodemographic inequalities in health.

Key message 8

The range of environmental health inequality indicators should continue to reflect the nature of environmental health threats. The assessment of environmental inequalities, therefore, should be dynamic and based on frequently updated inequality indicators.

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CHAPTER 2

HOUSING-RELATED INEQUALITIES

CHAPTER 2. HOUSING-RELATED INEQUALITIES

Séverine Deguen, Lucia Isabel Fiestas and Denis Zmirou-Navier

Key messages

Generally:

- within the EU, the NMS12 countries are more affected by substandard housing than the EU15 countries;
- for countries beyond the EU, no adequate data (except on water supply) were available, but published literature indicates that the housing situation is worse than in the NMS12 countries;
- inequalities have been found in all European countries with available data;
- subgroups of low-income population and single-parent households have been identified as more exposed to poor housing conditions in all countries;
- poverty increases the level of inequality among single-parent households.

More specifically:

- inadequate water supply is mainly an issue in Euro 3 and Euro 4 countries;
- rural populations are more exposed to inadequate water supply than urban populations;
- the lack of a flush toilet and bath or shower is most prevalent in less wealthy countries;
- lower-income households, and particularly low-income single-parent households, are most likely to lack a flush toilet and lack a bath or shower;
- a low income increases the risk of living in overcrowded housing, particularly among single-parent households;
- living in a damp dwelling is a housing issue in both the EU15 and NMS12 countries;
- low-income subgroups are more exposed to damp dwellings, especially in the NMS12 countries, where a substantial gap exists between the lowest income quintile and the higher ones;
- there is a high prevalence of inability to keep the home warm in most European countries, especially among single-parent households and low-income population groups;
- inability to keep the home cool in summer – even more prevalent in the population than inability to keep the home warm in winter – also shows income-related inequalities, although they are less strongly expressed than those for keeping the home warm.

INTRODUCTION

Awareness of socioeconomic health inequalities has recently put this topic on the priority list when drafting public health policies. It is well known that populations privileged by advanced education, greater income, higher-status jobs and better quality housing standards are in better health. Housing and neighbourhood quality improvement has historically been a key policy instrument to improve health (Howden-Chapman, 2002). Housing in particular has been recognized as an important parameter affecting population well-being and health (Bonnefoy, 2007; Braubach and Fairburn, 2010; Poortinga, Dunstan and Fone, 2008). One reason for this is that a high proportion – approximately two thirds – of time is spent in the home (Bernstein et al., 2008). This proportion varies across countries and is even greater for vulnerable population subgroups such as the elderly, children – at 80–90% of the day (Breysse et al., 2004) – and deprived people, who may be unemployed or have few external activities. Furthermore, less affluent populations are more often affected by inadequate housing conditions (Braubach and Fairburn, 2010).

Inadequate housing conditions generate health inequalities through two main pathways. First, from an environmental epidemiology perspective, the term "housing conditions" may be used as a proxy for environmental exposures influencing health in the home, such as indoor air quality, noise or humidity. Second, it can be an indicator of socioeconomic determinants of health: poor housing conditions are a consequence of a disadvantaged situation. Housing prices vary greatly geographically and consequently the quality of housing and of its local environment is both directly and indirectly associated with income, or more generally with SES (Braubach and Fairburn, 2010; Galobardes et al., 2006).

It is important to note that exposure inequalities may occur at multiple levels: at an individual level (such as personal or household income, or substandard housing) and at a geographical, or ecological, level (such as average neighbourhood income, or proportion of inadequate housing in the neighbourhood). The analysis in this chapter focuses only on information regarding individuals and households.

Associations between inadequate housing and health have been revealed using a variety of approaches and indicators. Living conditions affect both physical and mental health. Data collected by WHO on eight European countries confirm that inadequate housing conditions are associated with risk factors such as moulds or overcrowding, especially in low-income households (Braubach and Fairburn, 2010). Several researchers have found associations between indoor environmental exposures including dampness and a variety of adverse respiratory diseases, such as risk of asthma, pulmonary infections and allergies (Krieger and Higgins, 2002; Sandel and Wright, 2006). Damp houses provide a nurturing environment for mites, roaches, respiratory viruses and moulds known to play an important role in respiratory disease pathogenesis. For this reason, poor indoor air has been advanced as a way of explaining the recent increase in prevalence of respiratory health problems in many developed countries (Rauh, Landrigan and Claudio, 2008).

In addition, overcrowding and lack of hygiene and sanitation equipment are relevant health hazards found in dwellings. Overcrowding has long been associated with the transmission of tuberculosis and respiratory infections. In recent years, epidemiological studies have revealed an increased risk of chronic diseases for those living in substandard housing (Krieger and Higgins, 2002) and documented that poor living environments – including overcrowding, inadequate garbage removal or location near busy transportation routes – may generate chronic stress (Rauh, Landrigan and Claudio, 2008).

Low indoor temperature is associated with lower health status, and particularly with cardiovascular disease (Krieger and Higgins, 2002). A synthesis of intervention studies reviewed several reports assessing changes in health following housing improvements (Thomson, 2011). These confirmed that housing intervention programmes targeting thermal comfort improved health – including mental health – and social outcomes considerably (Shortt and Rugkåsa, 2007). The association between degraded housing characterized by poor thermal efficiency and high levels of excess winter or summer mortality has also been documented (Braubach and Fairburn, 2010). Homes of low-income individuals are more likely to be too cold (or too warm in summer) because of insufficient insulation and lack of air

conditioning. In summary, substandard housing is not evenly distributed across space and population; disadvantaged groups are disproportionately affected. In some cases, low-income households even have to make tradeoffs between having enough food and living in adequate housing conditions (Krieger and Higgins, 2002).

DATA AND METHODS

Data from the WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation (2011) were used to analyse inequalities in inadequate water supply. Data are available for all 53 Member States of the WHO European Region, collected in five different years: 1990, 1995, 2000, 2005 and 2008. Population with inadequate water supply is defined as the percentage of the population supplied with water from unimproved sources (water supply that, by nature of its construction or through active intervention, is not protected from outside contamination – in particular from contamination with faecal matter – such as surface water or water from unprotected wells or springs). Unfortunately, the WHO/UNICEF JMP data available up to 2008 do not include data on individuals (such as gender or income) and only distinguish between urban and rural areas. However, as the recent JMP data collection wave (2010 data to be released soon) includes information on water and sanitation supply by income decile, more detailed assessment of these data will soon be possible.

A bar chart showing the proportion of the population with inadequate water supply for urban and rural areas within each country and subregion was created for the year 2008. Additionally, a time trend graph was drawn to represent the evolution of the prevalence of inadequate water supply in rural areas in the WHO European Region, to detect whether the situation had improved during the last 20 years.

For the water inequality indicator, the data were disaggregated by subregions Euro 1 to Euro 4 to present results for the different subregions.

Data for analysis of the five other housing inequality indicators were retrieved from EU-SILC database (2011). Data were available from 2004 to 2009 and were downloaded from March to May 2011. Information was reported by 30 countries in 2009, but the number of countries repeatedly reporting over time between 2004 and 2009 was lower, so it was not possible to assess time trends for a variety of countries. As a result, only data from the latest year, 2009, were studied. The five housing inequality indicators covered in this report are:

- lack of flush toilet in the dwelling, based on EU-SILC question "Is there an indoor flushing toilet in your dwelling?" with answer options Yes and No;
- lack of bath or shower, based on EU-SILC question "Is there a shower unit or a bathtub in your dwelling?" with answer options Yes and No;
- overcrowding, based on the following Eurostat definition: "a person is considered as living in an overcrowded household if the household does not have at its disposal a minimum of rooms equal to one room for the household, one room per couple in the household, one room for each single person aged 18 or more, one room per pair of single people of the same gender between 12 and 17 years of age, one room for each single person between 12 and 17 years of age and not included in the previous category, and one room per pair of children under 12 years of age";
- dampness in the home, based on EU-SILC question "Do you have any of the following problems with your dwelling/accommodation: a leaking roof, damp walls/floors/foundation, or rot in window frames or floor?" with answer options Yes and No;
- inability to keep the home adequately warm, based on EU-SILC question "Can your household afford to keep its home adequately warm?" with answer options Yes and No.

To complement the inequality indicator on thermal comfort in winter, data from an EU-SILC rotation module question "Is the dwelling comfortably cool during summer time?" with answer options Yes and No (only asked in 2007) were also used and are discussed in an additional section.

The EU-SILC data were stratified by four socioeconomic characteristics: age, income level reflecting relative poverty status, household type and sex. The age variable was divided into three groups: less than 18 years, between 18 and 64 years and over 65 years. The income variable was divided into population below and above relative poverty status (defined as household income below or above 60% of the median income for the respective country). Upon specific request, Eurostat provided additional data on income quintiles for some of the housing inequality indicators. The household type variable had 16 categories, but only three were used in this analysis: "households with dependent children", "single-parent households with dependent children" and "single households with one adult older than 65 years". Analysis by sex stratification was not relevant because most households – except single and single-parent households – are composed of a somewhat similar number of males and females so that statistical analysis rarely results in significant differences.

For the five housing-related inequality indicators based on Eurostat data, two different metrics were calculated:

- a crude metric, denoting the prevalence of a given problem per country or subregion and per socioeconomic or demographic category – results are expressed as a percentage of households or population;
- a relative metric, denoting the ratio dividing the prevalence among one socioeconomic category by the prevalence among another – the higher the ratio, the greater the level of disparity between the two categories.

Given that ratio figures can be misleading, both crude and relative metrics were included in graphs in order to highlight the countries for which housing conditions constitute a major problem – those countries with both a high proportion of the population affected and large inequalities between specific subpopulation groups. Conversely, several countries provide challenging cases when an overall low prevalence of a given problem (such as lack of a bath/shower) affects the calculation of ratios, leading to high ratios when specific population subgroups are compared with the average population. Thus, evaluation must always consider the absolute and the relative dimensions of inequality.

Scatter plots were also used to illustrate the relationship of prevalence of one housing problem between two different population subgroups. This was done to explore whether inequalities in the first population group deviated from the second one, indicating inequalities in exposure. The y-axis was expressed on a logarithmic scale to improve the readability of the graph because several countries had prevalence levels close to 0%. A linear model was fitted to investigate how the two prevalence values were linearly associated as well as to quantify the strength of the association.

In addition, to explore whether prevalence of inability to keep the home warm by country deviates from the general pattern of national inequality, information was extracted from the EU-SILC database on the 2009 Gini index by country. This is a standard economic measure of income inequality that varies between 0 and 100: a value close to 0 signifies a low level of income inequality and a high value indicates a high level of income inequality in the country. The scatter plot illustrates the shape of the relationship between the two variables (Gini index and prevalence of inability to keep home warm).

As the housing inequality data provided by Eurostat covers the EU countries and Iceland, Norway and Switzerland only, EU15 and NMS12 were chosen as subregions. Iceland, Norway and Switzerland are presented separately.

RESTRICTIONS AND DATA LIMITATIONS

The main limitation of the available data on inequalities in adequate water supply is the absence of information on socioeconomic and demographic characteristics, precluding a detailed analysis of inequalities. The only stratification possible is by rural or urban population, although data for 2010 will shortly be published, enabling data analysis by income decile. This information was used as a

proxy for SES because there is consistent evidence that, on average, rural populations experience higher socioeconomic disadvantages than urban ones. A second limitation is that the absence of annual data did not allow for a more precise trend analysis. Having acknowledged these limitations, the main advantage of the database lies in the great number of countries for which this information was available, permitting a large geographical comparison.

Data on all other housing inequality indicators were provided by Eurostat, covering a maximum of 30 Member States. A study of the 53 countries of the WHO European Region would allow a larger spatial view of housing inequalities, possibly improving identification of the most exposed population groups in a more economically and culturally diverse area. Furthermore, the sample sizes for the EU-SILC survey are not very large, varying between 8250 (Germany) and 2250 (Iceland) households, which may result in unstable figures and large uncertainty levels when split according to several subcategories.[6] Nevertheless, a detailed data search (WHO, 2011a) has indicated that these are the best available data to date, although caution should be used when interpreting the results of the analysis.

In particular, information on the composition of households, such as the number of people per age category, would be relevant to improve understanding of the overcrowding phenomenon in certain European subregions. This information might help to distinguish the countries for which overcrowding is related to cultural habits (such as cohabitation of several generations) from those for which it reflects a situation of deprivation.

Regarding analysis of dampness in the dwelling, some qualification of the degree of dampness would also be appropriate. The information used for the definition was rather poor and misclassification of exposure could result in over- or underestimation of the proportion of subjects exposed to damp dwellings, possibly in a different manner across countries.

Climate information is important in order to interpret fully analysis of the inequality indicator on thermal comfort – cold countries could be more affected by inability to keep homes warm. Perception of cold in dwellings might also differ from one group to another; for example, older subjects or unemployed people who spend more of the day inside their home could be more vulnerable to perception of cold compared to those who are out for a greater part of the day. Data on indoor temperature could allow stratification of the analysis and enhance identification of the most exposed populations. In addition, information on the number of rooms per dwelling could also help to explain differences in the prevalence of inability to keep the home warm between countries and subgroups of population.

For all the housing inequality indicators, it would also be of great interest if additional socioeconomic information (such as education level and employment status) were routinely collected as a way to improve the understanding of inequality factors between and within countries.

INEQUALITIES IN INADEQUATE WATER SUPPLY

Introduction

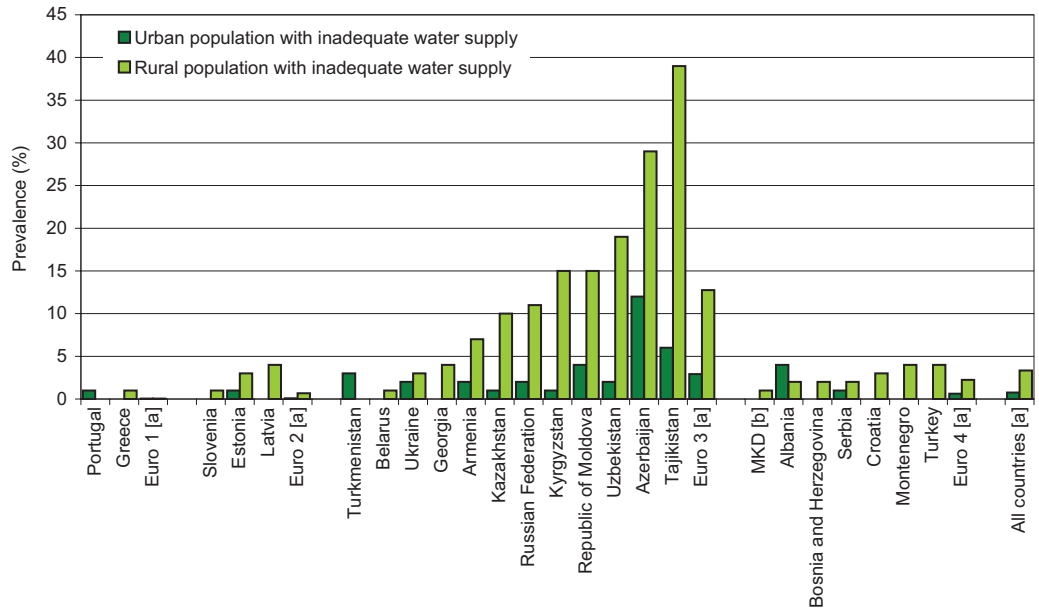
An adequate supply of water is recognized as a basic human need as well as a human right (United Nations Human Rights Council, 2010). Therefore, halving the proportion of individuals without access to safe drinking-water is one of the key Millennium Development Goals (United Nations Millennium Project, 2005). The need for water resources goes beyond quantity and must also consider quality for maintaining good health. The United Nations Development Programme (UNDP) declared in March 2011 that:

6 For details on EU-SILC sample size and methodology see Eurostat website (http://epp.eurostat.ec.europa.eu/portal/page/portal/income_social_inclusion_living_conditions/introduction).

> Water and sanitation infrastructure in many countries in Europe and Central Asia are in a critical state and deteriorating, often posing a threat to human health. Yet, most countries have signed or ratified core UN human rights conventions, and many regional treaties recognize the right to water.… The internationally recognized right to water guarantees that all people have access to safe potable water at an affordable price, regardless of their age, sex, race, gender, or ethnicity.
>
> (UNDP, 2011)

Drinking-water has been defined by WHO as water that does not contain pathogens or chemical agents at levels of concentration that could affect health (WHO 2011b). The greatest hazard associated with drinking-water is contamination by sewage or by human excrement. It is also significant that the UNDP declaration goes on: "The right to water emphasizes the importance of water-related development for marginalized and vulnerable groups, who are commonly socially excluded". In this context, a forthcoming report by the United Nations Economic Commission for Europe (UNECE), WHO and the French Ministry of Health on good practices to ensure equitable access to water and sanitation in the pan-European region concludes that the three major dimensions included in the concept of equitable access to water and sanitation are geographical disparities in service provision, discrimination or exclusion in access to services by vulnerable and marginalized groups, and financial affordability by users (UNECE, in press).

Fig. 3. Prevalence of inadequate water supply by urbanization level (2008) in countries without full coverage



Source: data from WHO/UNICEF JMP, 2011.

Notes: [a] data for Euro 1, 2, 3 and 4 represent the average of national rates for all countries within the subregions, including those with full coverage not shown; [b] MKD: International Organization for Standardization (ISO) code for the former Yugoslav Republic of Macedonia.

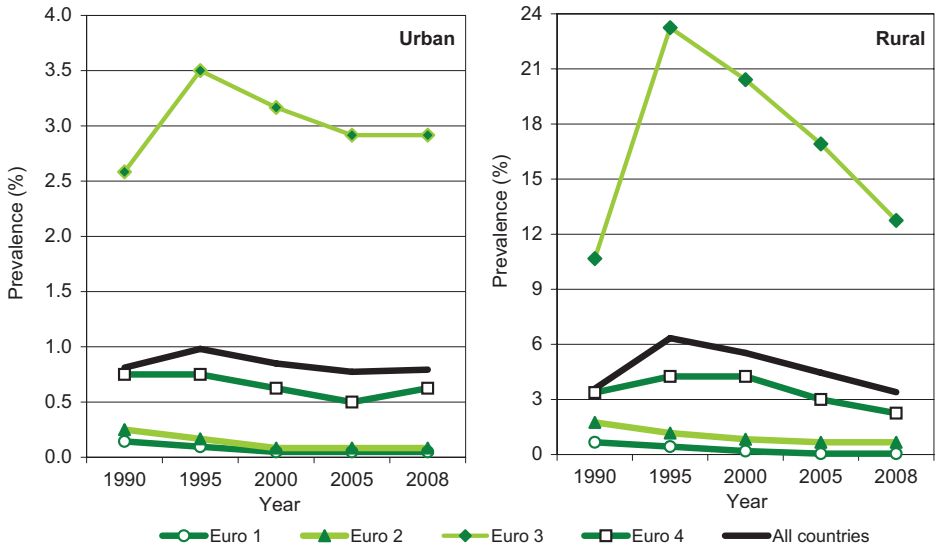
Indicator analysis: inequalities by urbanization level

The proportions of rural and urban populations with inadequate water supply, defined as "unimproved water supply conditions" within the WHO/UNICEF JMP database, were compared (see Fig. 3). The distribution of the prevalence of inadequate water supply in rural and urban sectors varies across countries from 0% in most Euro 1 and Euro 2 countries to about 40% for the rural population living in Tajikistan, a Euro 3 country. Euro 3 countries are by far the most affected by inadequate water supply, followed by Euro 4 countries. However, water supply inequalities were also found among some Euro 1

and Euro 2 countries (Euro 1: Portugal and Greece, Euro 2: Estonia and Latvia). Overall, Azerbaijan has the highest proportion (12%) of urban population with inadequate water supply, whereas Tajikistan has the highest proportion (39%) of rural population without adequate access to water. However, several countries within the Euro 3 and Euro 4 regions present a low prevalence of inadequate water supply in rural and/or urban populations, with figures comparable to Euro 1 and Euro 2 countries. For instance, in Israel the entire population – urban and rural – has adequate access to water, while in Belarus and the former Yugoslav Republic of Macedonia only 1% of the rural population lacks adequate access to water. In terms of rural–urban inequalities, the largest differences are observed for Kyrgyzstan, Kazakhstan and Uzbekistan. For example, in Kyrgyzstan the proportion of the population without an adequate water supply is 15 times higher among the rural population than the urban population.

Inequality trends in inadequate water supply in urban and rural areas between the four Euro regions from 1990 to 2008 were also analysed (see Fig. 4). Already low, the prevalence of inadequate water supply in Euro 1 and Euro 2 countries slowly decreased between 1990 and 2008 from 0.7% to 0% (Euro 1) and from less than 2% to less than 1% (Euro 2) among the rural population. A similar pattern is observed among the urban population. In Euro 3 and Euro 4 countries, the proportion of the rural population with inadequate water supply increased between 1990 and 1995 and then decreased from 2000. However, the time trend variations are lower in the Euro 4 countries than the Euro 3 countries. In the Euro 3 region, the prevalence in 2008 is still higher for both urban and rural areas than the 1990 figure.

Fig. 4. Trends of inadequate water supply by urbanization level



Source: data from WHO/UNICEF JMP, 2011.

A more in-depth analysis (data not shown) by country highlights that the biggest improvement in water supply equality has been observed in Turkmenistan, where all the rural population had access to adequate water in 2008 while 28% had an inadequate water supply in 1995. Large urban–rural equality improvements were also found in Georgia, Tajikistan and Azerbaijan. A worsening trend between 1995 and 2008 was noted for Kazakhstan (2% increase in inadequate water supply in rural areas from 1995 to 2008) and in the Republic of Moldova and in Uzbekistan (4% increase in both cases).

Target groups for action

These data show a clear difference across the WHO European Region, particularly between the Euro 1 and Euro 2 countries and the Euro 3 and Euro 4 countries. Many countries could qualify as "exposed" to the problem of inadequate water supply given the high prevalence of unimproved water sources in the general population: the situation in Azerbaijan and Tajikistan illustrates this point. Moreover, it was seen that in every country (except in the Euro 1 region, in which inadequate water supply is not an issue)

rural populations constitute a disproportionately highly exposed group compared to urban populations. Finally, for the Euro 1, Euro 2 and Euro 4 regions, the prevalence tended to decrease between 1990 and 2008 in both rural and urban areas. However, the prevalence remains very high for Euro 3 countries in 2008: higher than the figure for 1990.

National data sets providing more detailed information need to be applied to identify further inequalities. One example is contributed by Hungary, showing the provision of piped water supply to dwellings in relation to the rate of Roma population in Hungarian municipalities (see Annex 1).

Health implications

A key driver for the provision of safe water is improvement to public health, and many studies have demonstrated that drinking-water interventions can substantially reduce the risk of diarrhoeal diseases (Clasen et al., 2007; Fewtrell et al., 2005). Diarrhoeal disease is one of the leading causes of morbidity and mortality in less developed countries and in less developed areas of emerging countries, especially among children. Rural areas are particularly at risk. Inadequate water supply translates into a major health impact as it leads to a high prevalence of water-borne diseases. In the WHO European Region, an average of 330 000 cases of serious water-related diseases are reported every year, including campylobacteriosis, viral hepatitis A, giardiasis, Shigella (bloody diarrhoea), enterohaemorrhagic *Escherichia coli* infection, legionellosis and cholera (WHO, 2011b). Increased knowledge about the preventable health burden associated with an inadequate supply of drinking-water has strengthened the commitment to increase access to improved water supplies across Europe. Improvements in access to safe water and adequate sanitation could reduce the child mortality rate by 2.2 million each year.

Rural area dwellers are particularly exposed to inadequate drinking-water sources; they face increased vulnerability to water-borne diseases due to lack of access to a water distribution network or to distance from water sources. Moreover, water service costs are comparatively higher in rural and suburban areas than in urban centres. This is due in part to the numerous intermediaries in the retail chain, and in part to the scarcity of the water. This situation translates into a major health impact for rural populations.

Conclusions and suggestions

The two major conclusions of the analysis are that inadequate water supply is mainly an issue in Euro 3 and Euro 4 countries and that populations living in rural areas, particularly in these regions, are more exposed to an inadequate water supply. Improved water supply can enhance health status by enabling better hygiene, and possibly also by decreasing the need for storage in the home and for transport of water – factors that are linked to the risk of water contamination. In addition to quantity, it is well established that quality of drinking-water is an important determinant in preventing diarrhoeal diseases.

Suggested mitigation actions are:

- protection of ground water or effective treatment and disinfection of surface water, and building of water networks that bring protected drinking-water to remote areas;
- linking provision of drinking-water with sanitation improvements to protect water resources and reduce the risk of contamination;
- in rural areas, investment by local and state authorities in community utilities for production and distribution of improved drinking-water and provisions to ensure its permanent microbial and chemical quality, since it has been shown that poor water system maintenance, even for a few days, can jeopardize the expected health benefits (Hunter, Zmirou-Navier and Hartemann, 2009);
- better auditing by funders of water quality programmes of whether interventions are sustainable and whether health benefits are being achieved – this calls for health surveillance efforts to monitor the evolution of diarrhoeal diseases over time.

INEQUALITIES IN LACK OF A FLUSH TOILET IN THE DWELLING

Introduction

Access to safe sanitation facilities and practices is central to human health and dignity, economic well-being, educational opportunities, and sustainability of the environment (Water Supply and Sanitation Collaborative Council, 2010). Inadequate access to safe sanitation services, together with poor hygiene practices, produces a compounded detrimental effect on the health of individuals and may lead to impoverishment via a severe decrease in economic and educational opportunities (UNICEF, 2011). Lack of access to a flush toilet in the dwelling may force individuals to defecate in the open or to use unsanitary facilities (Humphrey, 2009). Open defecation has been described by WHO as "the riskiest sanitation practice of all" (WHO, 2010a) because it constitutes a major cause of ground water pollution, agricultural produce contamination and disease transmission (Water Aid, 2010). Other excreta disposal options in use, including traditional pit latrines, "flying toilets", ventilated pit latrines and pour-flush toilets, are also considered to be unimproved sanitation practices because they are shared by many households and pollute the groundwater through "direct and indirect discharge of pollution loads into the environment" (Katukiza et al., 2010). Poverty is still one of the major distal determinants of diarrhoea, and is closely related to lack of sanitation, poor neighbourhood infrastructure and poor living conditions (Genser et al., 2008): 40% of the world's population – the most socioeconomically disadvantaged and materially deprived – do not have access to improved sanitation facilities (WHO/UNICEF JMP, 2010). Furthermore, the disparities between rural and urban communities are alarming. Without a flush toilet in the dwelling, the most impoverished populations are systematically prevented from experiencing the protective health effects of improved sanitation.

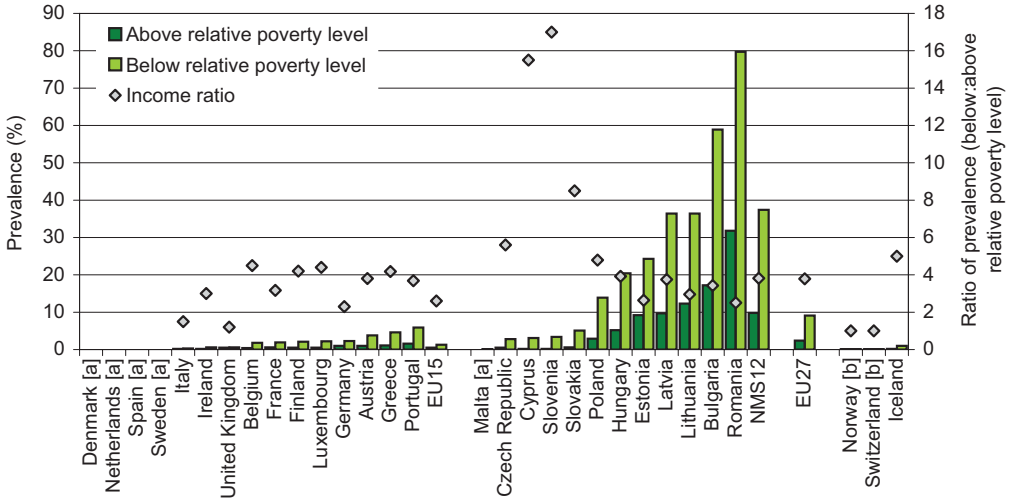
Indicator analysis: inequalities by income and household type

Lack of a flush toilet in the dwelling is not a major issue for the EU15 countries (see Fig. 5). The average percentage of the population lacking a flush toilet in the dwelling is 0.7% for these countries, with Portugal reaching the highest prevalence at 2.4%. Every household in Denmark, Netherland, Spain, and Sweden reported the presence of a flush toilet in the dwelling. Similar results were also observed for Iceland, Norway and Switzerland. By contrast, wide variability was observed between the NMS12 countries. Many countries exhibit a very high percentage of the population lacking a flush toilet in the home – for instance, Romania (42.4%), Bulgaria (26.2%), Lithuania (17.2%) and Latvia (16.6%) – whereas the percentage is very low in other countries, including Slovenia (0.6%), Cyprus (0.7%) and the Czech Republic (0.7%). The entire population of Malta was reported to have a flush toilet in the dwelling.

Fig. 5 also shows the level of inequality within countries: the large majority of countries exhibit an income ratio greater than 1 when comparing the prevalence of households below the poverty threshold with those above it. This demonstrates that the prevalence of lacking a flush toilet is higher among populations living in relative poverty. Higher ratios are reported in the NMS12 than in the EU15 countries: about 17:1 and 15:1 for Slovenia and Cyprus, respectively, versus about 4:1 in Belgium, Finland, Greece and Luxembourg.

In conclusion, analysis of Fig. 5 highlights three main issues. First, it demonstrates that lack of a flush toilet is a significant housing problem in several of the NMS12 countries. Second, it exposes large inequalities between the socioeconomically privileged and disadvantaged populations in some countries where the baseline prevalence is low, such as Slovenia and Cyprus. Third, it highlights the compounded problem that exists in countries that present a high level of inequality in conjunction with a high prevalence of lack of a flush toilet in the home, as in Latvia and Hungary. Although the data presented here are restricted to EU members and Iceland, Norway and Switzerland, similar – or even stronger – income-related inequalities appear outside the EU, as shown in data on the prevalence of lack of a flush toilet stratified by wealth status, urban/rural residence and region in Georgia (see Annex 1).

Fig. 5. Prevalence of lack of a flush toilet in the dwelling by relative poverty level (2009)



Source: data from EU-SILC, 2011.

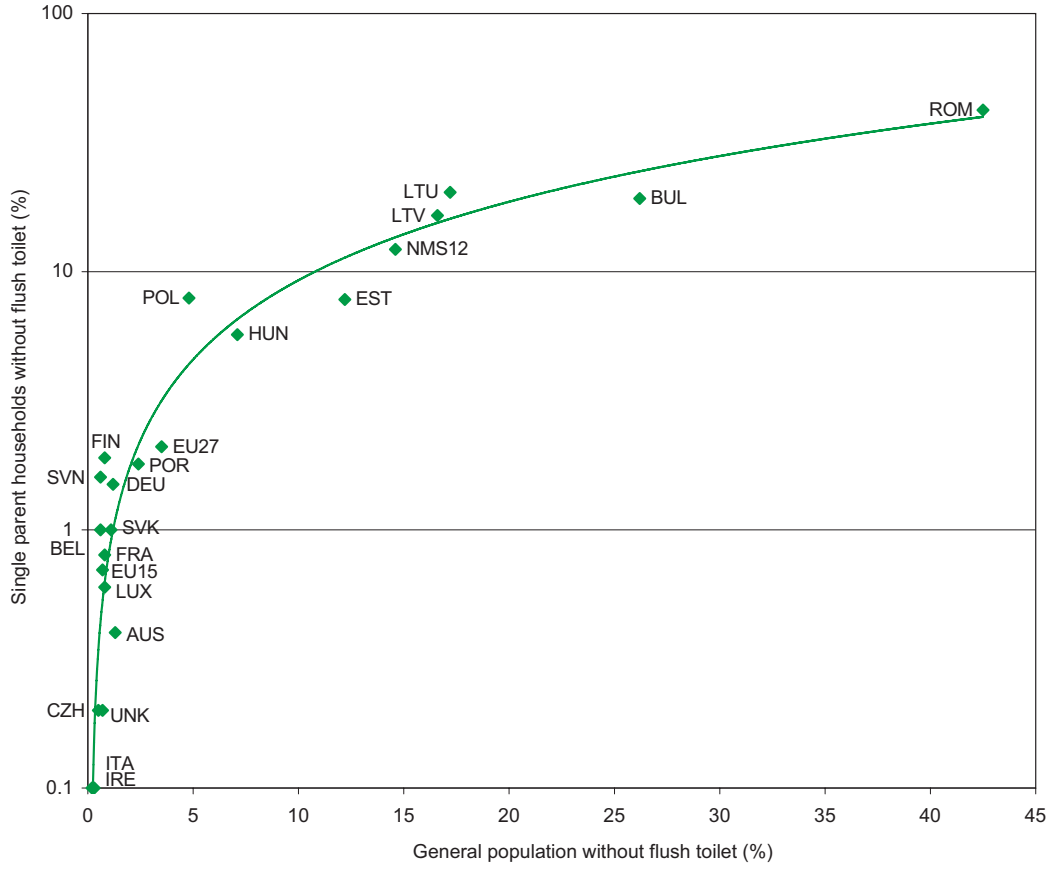
Notes: [a] countries reporting full population coverage; [b] countries reporting 0.1% for both above and below relative poverty level.

The relationship between lack of a flush toilet in the dwelling among single-parent households and among the general population was plotted on a logarithmic scale (see Fig. 6). The analysis excludes countries where the entire population has a flush toilet inside the home. The linear model explains about 96% of the variability, signifying that one variable could predict the second one with very good precision. The regression coefficient is equal to 0.93, showing that, on average, the percentage of single-parent households living in a home without a flush toilet is slightly lower than that in the general population. Several exceptions appear on the scatter plot: countries on the left of the line have a higher prevalence of lack of a flush toilet among single-parent households than in the general population. The highest levels of inequality faced by single-parent households exist in Poland (4.8% of the general population reported lack of a flush toilet at home compared to 7.9% of single-parent households), Finland (0.8% versus 1.9%), Slovenia (0.6% versus 1.6%) and Lithuania (17.2% versus 20.3%).

The subgroup of single-parent households lacking a flush toilet in the dwelling was explored in more detail to assess whether those below the poverty threshold constituted a particularly exposed group. Using a linear model (data not shown), it was found that, on average, the percentage of single-parent households below the poverty threshold without a flush toilet increases by about 2% when the prevalence among all single-parent households increases by 1%. In other words, the prevalence of lack of a flush toilet in the dwelling is twice as high among single-parent households in relative poverty than among all single-parent households. The situation represented by several NMS12 countries appears especially worrying. For example, in Bulgaria the prevalence of living in a dwelling without a flush toilet is 19.2% among all single-parent households and 53.6% among those in relative poverty. In Romania, the prevalence is 42% among all single-parent households but almost double that figure (78%) among those in relative poverty. The examples for Romania and Bulgaria show how the combination of two sociodemographic determinants – namely poverty and single-parent household situation – enables the identification of a particularly exposed group.

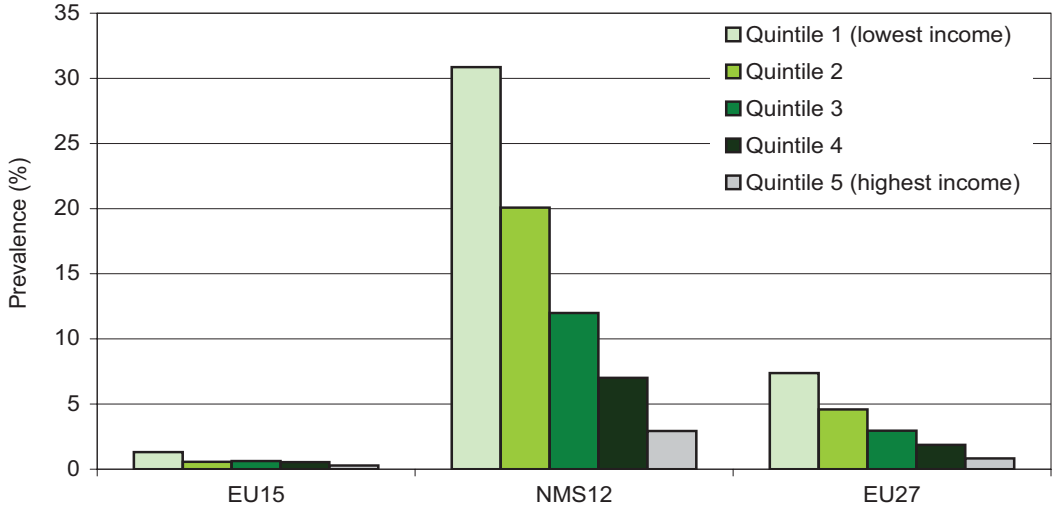
Finally, the income-related inequality of lacking a flush toilet in the dwelling was analysed (see Fig. 7), indicating that low income is associated with increased prevalence of lack of a flush toilet. As already shown, the NMS12 countries are by far the most affected in quantitative terms, but they also exhibit the largest inequality levels, with 31% of the population lacking a flush toilet in the dwelling among the lowest income quintile and 3% in the highest income quintile.

Fig. 6. Prevalence of lack of a flush toilet for single-parent households versus general population (2009)



Source: data from EU-SILC, 2011.
Note: see list of country abbreviations in Annex 4.

Fig. 7. Prevalence of lack of a flush toilet in the dwelling by income quintile (2009)



Source: data from EU-SILC, 2011.

Target groups for action

The analysis demonstrates that households in the NMS12 countries are the most exposed to lack of a flush toilet in the dwelling and most vulnerable in income-related terms. Moreover, it reveals greater inequalities between the socioeconomically advantaged and disadvantaged population groups in this

region; this corroborates the wealth of knowledge from the existing literature which identifies low-SES populations as having the poorest access to good sanitation conditions. Inequalities can also be observed among the EU15 countries, but to a lesser extent.

The income gradient analysis per region gives additional information underlining a strong linear decrease in prevalence of lack of a flush toilet in the dwelling from the lowest to the highest quintile. This reveals that inequalities exist not only between the poorest and the richest but also as a continuum across all income categories. The analysis also demonstrates that although when compared with the general population single-parent households are not disadvantaged by default, single-parent households in relative poverty have a prevalence of lack of a flush toilet almost double that for all single-parent households.

Health implications

The plethora of preventable health effects (such as acute diarrhoea – particularly among infants and children – hepatitis, typhoid and paratyphoid enteric fevers, intestinal parasitic worms and other parasitic diseases) related to lack of access to a flush toilet has been internationally recognized by the insertion of important water and sanitation targets in the Millennium Development Goals (United Nations, 2010). WHO has reiterated that progress towards these targets "will contribute significantly to the reduction of child mortality, major infectious diseases, maternal health and quality of life of slum populations" (Hutton and Bartram, 2008). Sanitation interventions have been shown to reduce illness and to have a substantial impact on the epidemiology of child diarrhoea: directly by reducing exposure to disease determinants, and indirectly by altering the pathways by which socioeconomic factors act on the outcome (Fewtrell et al., 2005; Genser et al., 2008).

Conclusions and suggestions

Lack of a flush toilet in the dwelling is still an issue in many countries within the WHO European Region. The proportion of households with no flush toilet varies between subpopulations, with those in relative poverty – and particularly single-parent households in relative poverty – more exposed.

A few suggestions for action stem from this analysis and concern permanent individual and collective housing. Specific recommendations could also be formulated for temporary housing – such as that built for transitory workers or students' residences – or any other provisional or emergency type of accommodation. The analysis does not take into account this particular category of housing.

Suggested mitigation actions are:

- ensuring that all new residential buildings have at least one inside flush toilet per dwelling;
- rehabilitation of existing dwellings to install a flush toilet where one is lacking;
- offering financial support to disadvantaged populations to encourage installation of a flush toilet in their housing;
- better reporting of data for non-EU Member States, especially in relation to income and household types not covered by WHO/UNICEF JMP data.

Evidently, the two first recommendations are only practical if households have access to an adequate water supply and if this supply is affordable for the poorest segments of the population.

INEQUALITIES IN LACK OF A BATH OR SHOWER IN THE DWELLING

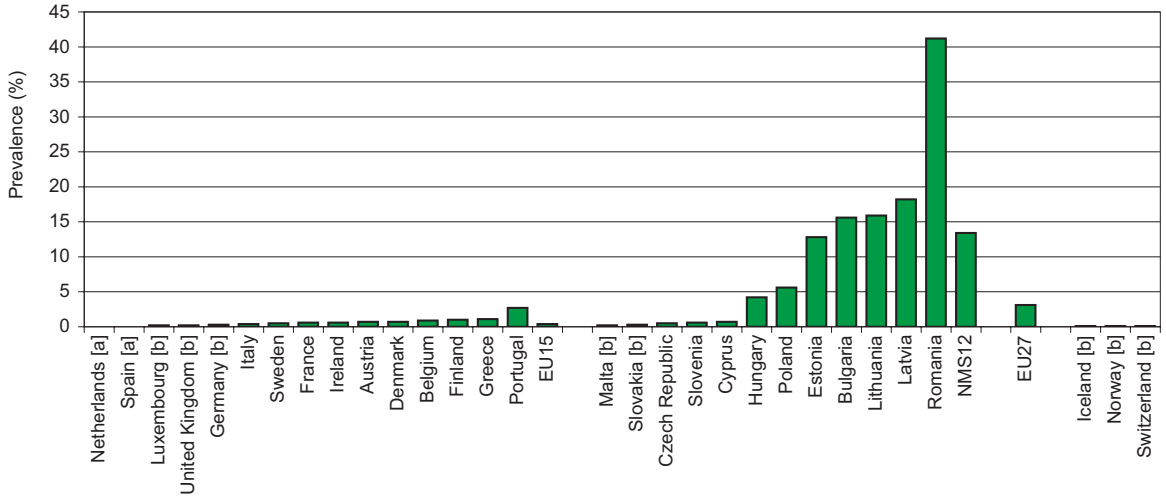
Introduction

The absence of a bath or shower in the dwelling is associated with an inadequate supply of water and impairs personal and domestic hygiene. The Office of the High Commissioner for Human Rights (OHCHR) has stated that the right to water is intrinsically connected to the right to an adequate standard of living because it greatly influences human health and quality of life (OHCHR, 2011). Lack of a bath or shower in the dwelling severely undermines the capacity of individuals to use the required amount of water necessary to meet their most basic hygiene needs and to promote good health (Howard and Bartram, 2003; WHO, 2011c). Washing may not occur as often as necessary to maintain good hygiene and bathing cannot be assured unless it is carried out at an open water source outside the household, such as a nearby river, lake or stream. The water quality at these sources may even be contaminated and unsafe for human use. Moreover, if household members have to collect water to be used in the dwelling from outside, the distances and time involved may prevent the household from securing the volumes necessary to support optimal basic personal and domestic hygiene; this may also result in storage of the water at home, making it prone to contamination, even if it is initially clean (Howard and Bartram, 2003). Populations lacking a bath or shower in the dwelling, and consequently most at risk of contracting diseases related to suboptimal hygiene, are in addition those who are most socioeconomically disadvantaged and living in poverty. Even if they have access to minimum volumes of water from a source outside the dwelling, marginalized populations are unlikely to benefit from the protective effect of higher volumes of water per day, gained from water piped into the home (Luna et al., 1992; Prüss and Mariotti, 2000).

Indicator analysis: inequalities by income and household type

As with the absence of a toilet in the dwelling indicator, the inequalities related to a lack of bath or shower in the dwelling are predominantly intercountry inequalities (see Fig. 8).

Fig. 8. Prevalence of lack of a bath or shower in the dwelling by country (2009)



Source: data from EU-SILC, 2011.

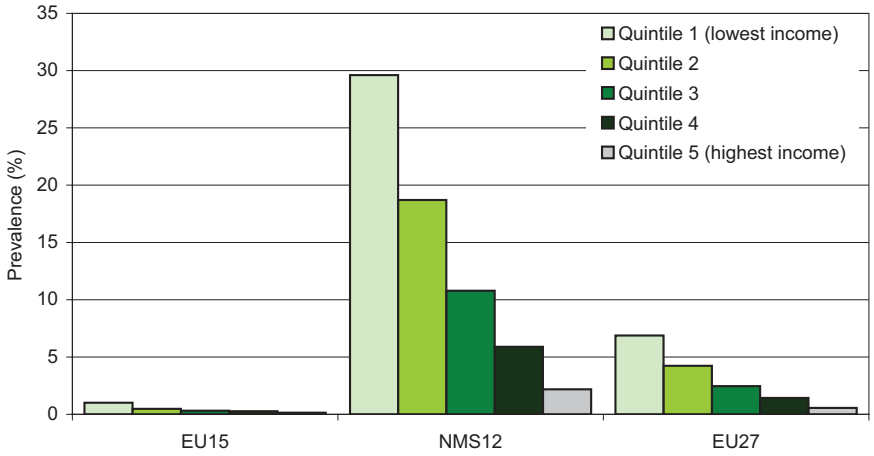
Notes: [a] countries reporting full coverage; [b] countries reporting prevalence lower than or equal to 0.3%.

Having no bath or shower at home is not an issue for the EU15 countries, where the average prevalence is 0.4%. Portugal (as in the case of lack of a toilet in the dwelling) has the highest prevalence at 2.7%. In the Netherlands and Spain, the entire population is reported to have a bath or a shower in the dwelling and low prevalence levels (up to 0.3%) were observed for Luxembourg, Germany and United Kingdom, as well as for Iceland, Norway and Switzerland. By contrast, as seen with the previous housing indicator,

large differences were observed between the NMS12 countries, with a high prevalence in Romania (41.2%), Latvia (18.2%), Lithuania (15.9%) and Bulgaria (15.6%) and a low prevalence in Malta (0.2%), Slovakia (0.3%), the Czech Republic (0.5%) and Cyprus (0.7%).

The Eurostat data indicate strong inequalities in access to a bath or shower at home between populations in the lowest income quintile and those in the highest. Prevalence levels for income quintiles show a steep gradient in the NMS12 countries, especially in the lowest income quintile where 29.6% of the population report a lack of bath or shower, which is 11% higher than the second-lowest quintile (see Fig. 9). In the EU15 countries, despite the low prevalence of the problem overall, a social gradient also clearly exists (ranging from 1% in the lowest-income population to 0.1% in the highest). In summary terms, the data indicate that within the lowest-income population group, more than 7% of EU citizens do not have a bath or shower in their home. However, detailed data for Kyrgyzstan (see Annex 1) indicate that outside the EU the problems are much greater, but can only be identified through national databases.

Fig. 9. Prevalence of lack of a bath or shower by income quintile (2009)



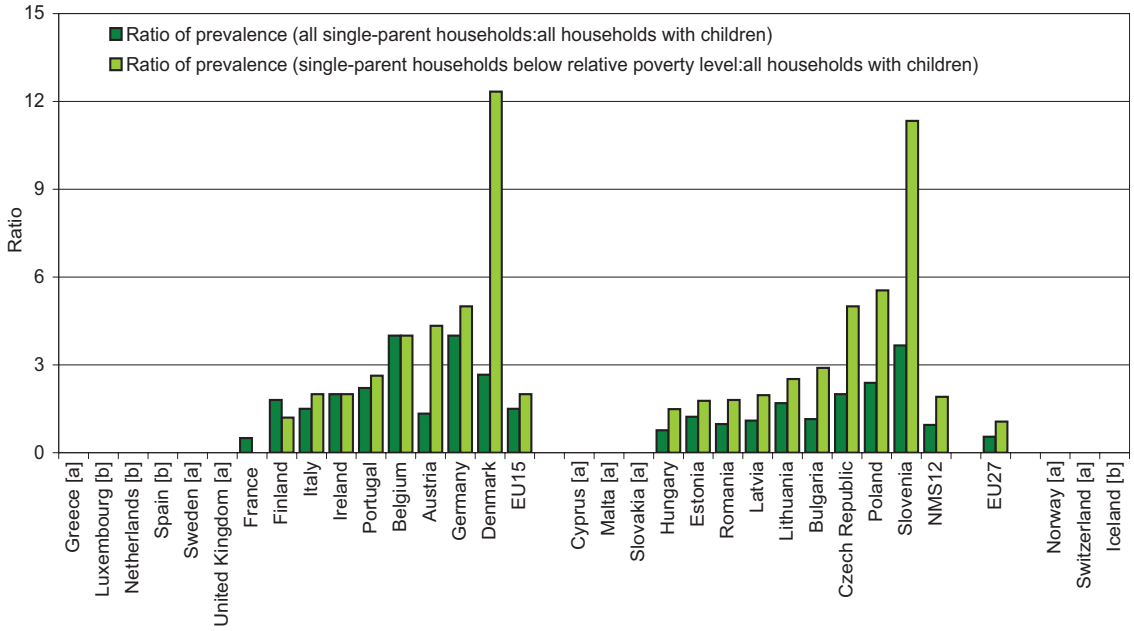
Source: data from EU-SILC, 2011.

In the majority of countries, prevalence of lacking a bath or shower in the dwelling is higher among single-parent households than among all households with dependent children (see Fig. 10), except in France and Hungary. The ratio varies between 0.5:1 for France and 4:1 for Belgium or Germany, but to ensure a complete interpretation of the figures the low prevalence of households with no bath or shower in these countries (0.2%, 0.2% and 0.1% in all households with dependent children and 0.1%, 0.8% and 0.4% among single-parent households, respectively) must be noted.

Larger inequalities can be found when figures for single-parent households in relative poverty and for all households with dependent children are contrasted, with ratios ranging from 1.2:1 in Finland and about 12:1 in Denmark (see Fig. 10). This comparison does not reveal differences in the extent of inequalities between EU15 countries and NMS12 countries: the prevalence of living in a house without a bath or shower among low-income single-parent households is about twice greater than among households with dependent children across both regions.

In several countries, taking relative poverty into account only slightly increases the difference between figures for single-parent households and for all households with dependent children (see Fig. 10). This means that the issue concerns all single-parent households equally, irrespective of income. For instance, in Belgium both ratios are 4:1 and in Ireland both are 2:1. In contrast, Denmark and Slovenia exhibit a much larger difference when considering single-parent households in relative poverty: for both countries, the ratio is approximately 12:1. High ratios are also found for the Czech Republic and Poland.

Fig. 10. Ratio of prevalence of lack of a bath or shower for all households with children compared to single-parent households, by poverty level (2009)



Source: data from EU-SILC, 2011.

Notes: [a] countries reporting full coverage with bath/shower for all single-parent households; [b] countries reporting full coverage with bath/shower for all households with dependent children.

Target groups for action

The analysis confirms that prevalence of lack of a bath or shower in the dwelling is highest in a majority of NMS12 countries compared to EU15 countries: the average figures across each region are 13.4% and 0.4% respectively. Lower-income populations are also clearly identified as constituting a disproportionately highly exposed group. The current economic crisis with its serious social consequences might exacerbate existing environmental health risks, including those relating to lack of hygiene and sanitation equipment. On average among the EU15 countries, the prevalence of lacking a bath or shower among those below the relative poverty threshold is about four times higher than among those above it. The contrast is greater in the NMS12 countries, where the average ratio is 6:1. Finally, single-parent households – especially those on low incomes – are a particularly vulnerable group regarding lack of a bath or shower in the dwelling, compared to all households with dependent children.

Health implications

A lack of hygiene and sanitation equipment is still one of the most basic threats to health found in dwellings (Bonnefoy, 2007). It has long been established that a number of diseases are linked to poor hygiene, including those transmitted through the faecal-oral route, skin and eye diseases, and diseases propagated by infestations, including louse- and tick-borne typhus (Bradley, 1977; Cairncross and Feachem, 1993). A study conducted in the south of Tehran found that lack of a bath or shower constitutes a risk factor for persistent diarrhoea in children under five years old (Sakhaie et al., 2001).

The main purpose of personal hygiene is to prevent such health-threatening conditions, but it is also relevant to improve appearance. This plays an important role in social acceptance and inclusiveness, since poor hygiene can hinder a person's reputation, community integration and job capacity; factors that, in turn, are determinants of self-esteem and revenue.

Conclusions and suggestions

Lack of a bath or shower is an issue in several countries, mainly among the NMS12 countries, and probably also among the countries in the eastern part of the WHO European Region, for which data were not available. Several subpopulations were identified as more frequently vulnerable to the absence of a bath or shower in the dwelling: socioeconomically disadvantaged groups, single-parent households and households combining these two sociodemographic determinants.

Suggested mitigation actions are:

- ensuring that all new residential buildings have a bath or shower in each dwelling;
- rehabilitation of existing buildings to install a bath or shower where one is lacking;
- offering financial support to disadvantaged populations to encourage installation of a bath or shower in their housing;
- better reporting of data for non-EU member states, especially in relation to income and household types not covered by WHO/UNICEF JMP data.

Evidently, the two first recommendations are only practical if households have access to an adequate water supply and if the cost of energy to heat the water is affordable for the poorest segments of the population.

INEQUALITIES IN OVERCROWDING

Introduction

An overcrowded house is recognized as an important contributor to ill health (Maani, Vaithianathan and Wolfe, 2006), a burden affecting several population subgroups. The 2008 annual report of the European Federation of National Organisations working with the Homeless (FEANTSA) advanced that among the population groups at greatest risk of overcrowded living are immigrants, refugees and ethnic minority groups; this is partly because overcrowded homes may be accepted as temporary accommodation by new arrivals to a city, particularly ethnic minorities (FEANTSA, 2008). For example, black and minority ethnic households in England are about six times as likely as white households to be overcrowded, and around half of the registered migrants in Austria live in an overcrowded home with at least two people per room. However, no data were identified that would enable an international inequality assessment of overcrowding in relation to migrant status or ethnicity.

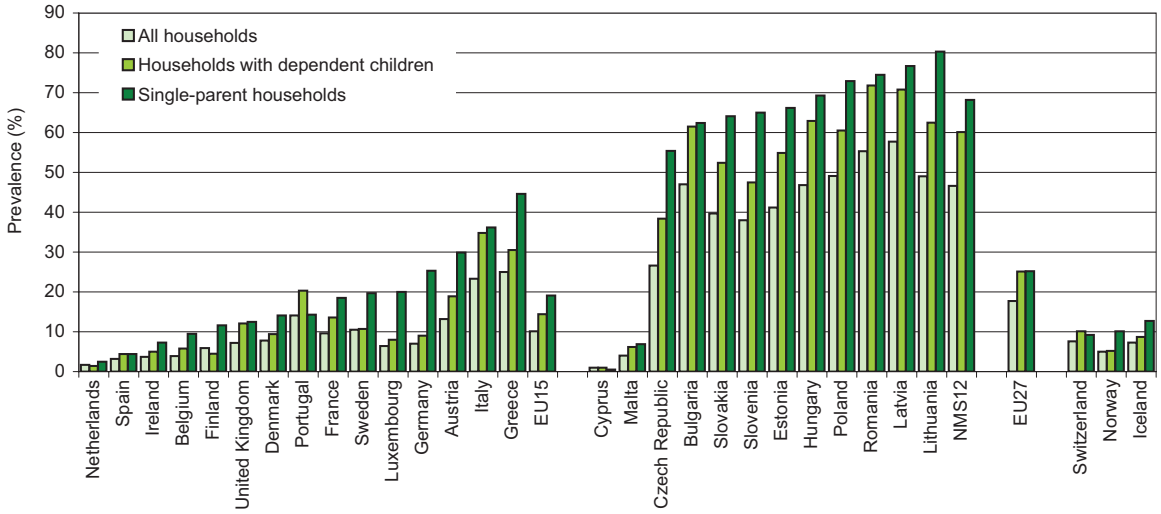
The authors of a New Zealand study found that unemployed people are more likely to live in overcrowded households than people with full-time jobs, with respective proportions of 20% and 7% (Ministry of Social Development, 2010), and highlighted a clear relationship between income levels and overcrowding. Multigenerational households also logically constitute a group at particular risk of overcrowded living; for example, 83% and 67% of overcrowded households in Wales and in Scotland respectively include dependent children (FEANTSA, 2008). Moreover, it must be noted that there are also issues where elderly people cohabit with their children's families – a situation more often seen in southern European countries.

Indicator analysis: inequalities by income and household type

The problem of overcrowding is a particularly significant housing threat as it is suffered by 10.1% of the general population in the EU15 countries and 46.6% in the NMS12 countries, indicating strong subregional differences (see Fig. 11). It is unsurprising that overcrowding among households with

dependent children, which tend to be larger than the average household size, has a higher prevalence (14.4%) in the EU15 countries and a markedly higher prevalence (60.1%) in the NMS12 countries. Even higher prevalence levels are observed among single-parent households (EU15: 19.1%, NMS12: 68.2%).

Fig. 11. Prevalence of overcrowding by household type (2009)



Source: data from EU-SILC, 2011.

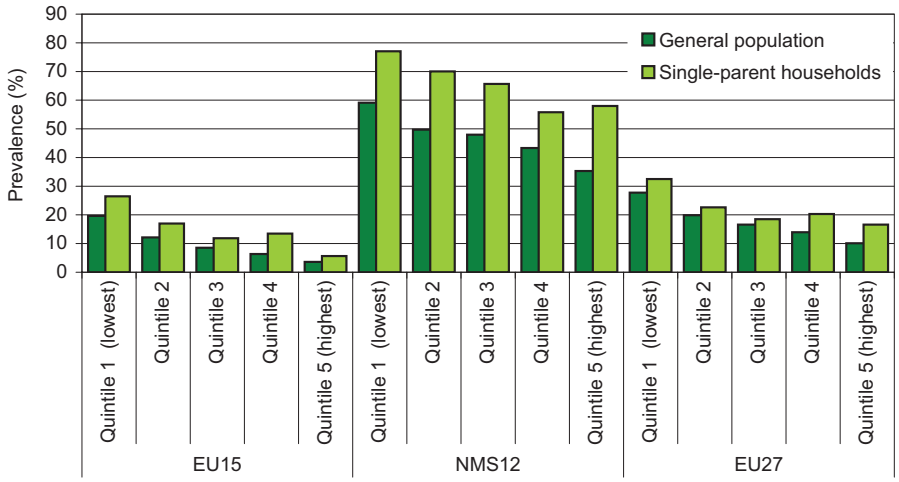
Larger disparities in levels of inequality between household types can be observed among the EU15 countries than the NMS12 countries. In Austria and Belgium, the prevalence of living in an overcrowded house among single-parent households is at least double that among all households, while in Germany it is 3.5 times higher. Inequalities between household types are less apparent in the NMS12 countries, where overcrowding is more frequent – only the Czech Republic has a prevalence among single-parent households double that among all households. Nevertheless, protecting vulnerable groups in the NMS12 countries from overcrowding is a significant challenge, since for four countries the overcrowding prevalence among single-parent families exceeds 70%.

Fig. 11 also demonstrates an inverse correlation between the relative inequality and the absolute prevalence of overcrowding among households: the relative differences between household types are globally higher in the EU15 countries where total prevalence is lower, while the reverse is observed in the NMS12 countries.

In addition, a clear gradient of the prevalence of overcrowding appears in the general population according to income (see Fig. 12). For the EU15 countries, 20% of the lowest-income population are exposed to overcrowding versus less than 4% of the highest-income. For the NMS12 countries, a sharp decrease in prevalence was also found across the income quintiles, ranging from almost 60% to 35% between the first and the fifth quintiles. The data also indicate that the prevalence of overcrowding is much higher among single-parent households than the general population across all income quintiles, although it does not exactly follow the linear pattern observed in the general population: in the EU15 countries, overcrowding among single-parent households in the fourth income quintile (the second highest income category), is slightly greater than in the middle quintile, and there is also an inverse trend between the two highest income categories in the NMS12 countries.

Overall, the data confirm that the poorest quintile of the population suffers greater exposure to overcrowding than the richest quintile. This is confirmed by more detailed data from Great Britain (see Annex 1) showing that the overall risk of overcrowding also differs by dwelling tenure, but that household income remains associated with overcrowding in all types of tenure.

Fig. 12. Prevalence of overcrowding by income quintile and household type (2009)



Source: data from EU-SILC, 2011.

Target groups for action

The majority of NMS12 countries show high overcrowding figures compared to the EU15 countries. More detailed data show that several population subgroups are particularly exposed to overcrowding in both regions. Having dependent children in the household is a strong indicator for increased exposure to overcrowded living conditions, and single-parent households are at even greater risk.

Furthermore, a low income increases the risk of living in overcrowded homes. The prevalence of overcrowding is higher among low-income single-parent households (77%) than among all single-parent households (60%) in the NMS12 countries. These observations are in accord with the existing literature, which highlights the fact that low-income populations, and particularly single-parent households, are more susceptible to this form of discomfort and health risk. Analysis of the income gradient by subregion presents additional information underlining the gradual decrease in the prevalence of overcrowding from the lowest to the highest income quintile. This reveals that inequalities exist not only between the poorest and the richest households but also as a continuum across all income categories.

Health implications

Household overcrowding is often associated with social deprivation, which in turn leads to an increased risk of infectious diseases (Maani, Vaithianathan and Wolfe, 2006). Numerous epidemiological studies have demonstrated the existence of a significant association between overcrowding and the prevalence of certain infectious diseases. Overcrowding may have a direct effect by facilitating the spread of infectious diseases such as tuberculosis, rheumatic fever and meningococcal disease (Baker et al., 2000). More specifically, tuberculosis associated with household overcrowding in the eastern part of the WHO European Region results in 0.8 deaths and 617.6 disability-adjusted life years (DALYs) per 100 000 population, corresponding to a total of 15 351 tuberculosis cases and 3518 deaths (Braubach, Jacobs and Ormandy, 2011).

Housing space adequate to the needs and desires of a family is also a core component of quality of life. Overcrowding has been associated with mental health problems (Braubach, Jacobs and Ormandy, 2011). A study conducted in north-west England found an association between overcrowding and the prevalence of psychiatric morbidity in the adult population (Harrison, Barrow and Creed, 1998). Several studies have also demonstrated that housing quality constitutes a good predictor of psychological issues and that overcrowding in particular is significantly associated with children's mental health (Evans, Saegert and Harris, 2001; Evans, Saltzman and Cooperman, 2001; Evans and English, 2002).

Conclusions and suggestions

Overcrowding is an issue in the majority of NMS12 countries and, to a lesser extent, in the EU15 countries. Several subgroups were identified as more frequently exposed to overcrowding in the dwelling, although by far the greatest overcrowding risk is found for socioeconomically disadvantaged households. Households with children in general and specifically single-parent households also show higher prevalence rates. Those accumulating both sociodemographic determinants have the highest exposure levels: low-income single-parent households in the NMS12 countries have a prevalence of overcrowding of more than 75%.

Suggested mitigation actions are:

- making regulatory provisions so that all new residential building projects, private or public, plan a minimum proportion of dwellings for large households – this should take into account the demographic characteristics and future trends of each country and, where appropriate, of different regions within a country;
- ensuring a significant proportion of large dwellings when renovating existing housing stock;
- providing targeted financial support to disadvantaged populations to facilitate access to dwellings of sufficient size;
- increasing public housing programmes which provide dwellings with an adequate number of rooms as a way to improve the overcrowding situation of low-income populations and those groups most vulnerable to overcrowding.

INEQUALITIES IN DAMPNESS IN THE HOME

Introduction

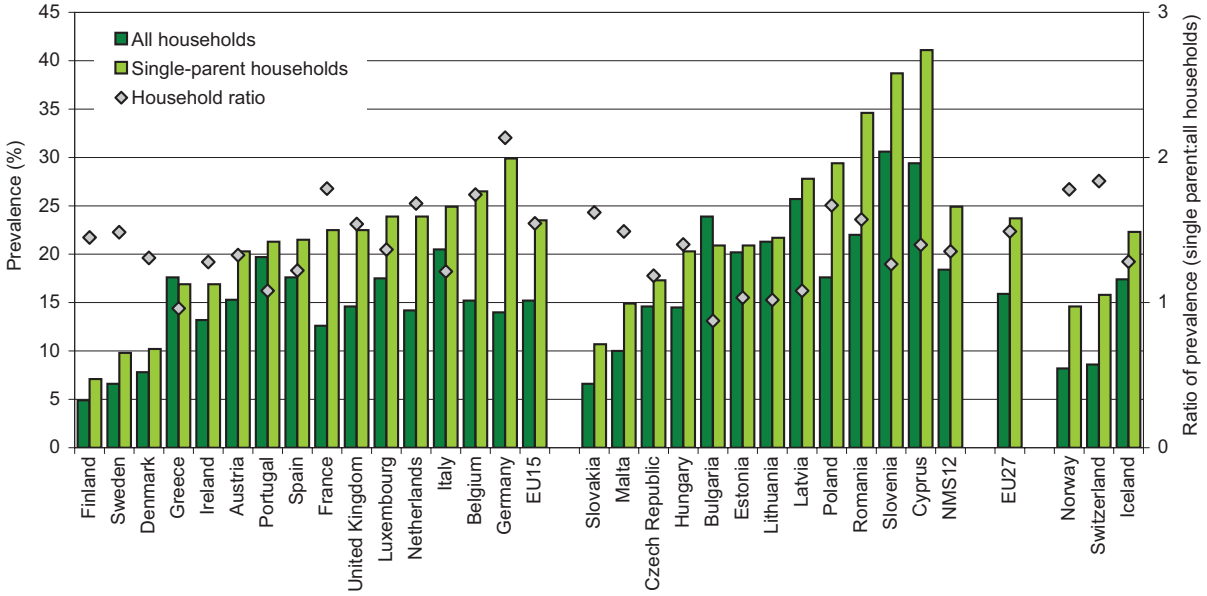
Dampness in the dwelling constitutes a substandard living condition that indicates the presence of water damage, a leaking roof, rot in window frames and floors, visible mould or condensation (Social Care Institute for Excellence, 2005). Dampness is associated with a broad array of detrimental health effects in adults and children (Fisk, Lei-Gomez and Mendell, 2007). Mould growth is also facilitated when dampness is present indoors, a condition often encountered in poor social conditions associated with large family size that gives rise to humidity (Butler et al., 2003). Individuals with lower SES are highly exposed to the effects of substandard housing conditions: studies have shown that ethnic minorities and individuals with low income tend to suffer disproportionately from the adverse health effects related to exposure to dampness and mould (Kohlhuber et al., 2006; Bolte and Mielck, 2004; Mielck and Heinrich, 2002). A WHO report on guidelines for indoor air pollution concludes that dampness should be given greater priority as it contributes to the deterioration in health of disadvantaged and low-income populations who are already overburdened by disease (WHO, 2009).

Indicator analysis: inequalities by income and household type

A comparable level of prevalence of dampness in the dwelling exists in both the EU15 and the NMS12 countries (see Fig. 13).

On average, 15% of the general population is affected by dampness in the home in the EU15 versus 18% in the NMS12 countries. However, within these regional averages, strong national variations are observed. The lowest prevalence is found in Finland, where only 5% of the population live in damp homes; similarly low levels were found in Sweden and Slovakia. Slovenia has the highest prevalence at 30%, followed by Cyprus at 29%.

Fig. 13. Prevalence of dampness in the dwelling by household type (2009)

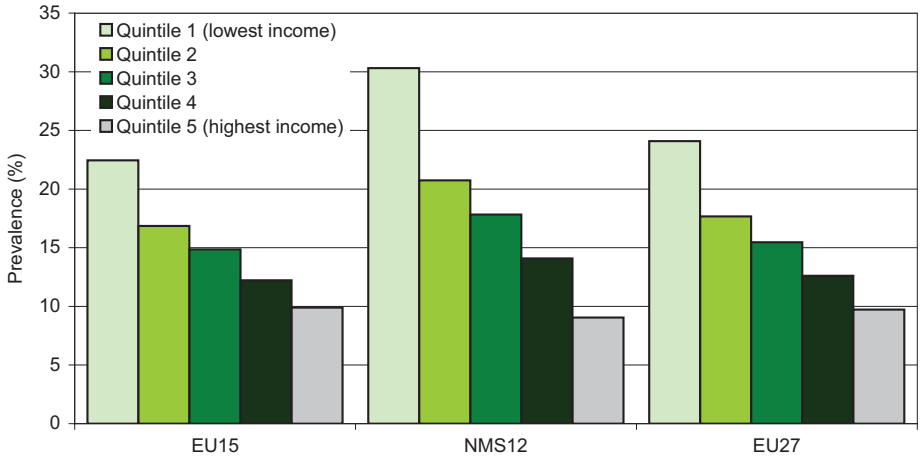


Source: data from EU-SILC, 2011.

Moreover, in the majority of countries the prevalence of dampness in housing is higher among single-parent households than the general population (household ratio of 1.5:1 for EU27, with national household ratios ranging from 0.9:1 to 2.1:1). The prevalence of dampness in single-parent households across regions is 24% in the EU15 and 25% in the NMS12 countries, but again there are wide national variations, with the highest prevalence of 41% in Cyprus, followed by 39% in Slovenia, and the lowest once again in Finland at 7%. The prevalence of dampness among single-parent households in Germany is double that among the general population at 29% and 14% respectively – the largest difference measured. However, differences of 10% or more are also found between the general population and single-parent households in Belgium, Cyprus, France, the Netherlands, Poland and Romania. In contrast, Greece and Bulgaria report the opposite situation, with a slightly higher prevalence of damp homes in the general population than among single-parent households. More details on the association of household types with dampness can be found in data from Norway (see Annex 1).

There is a clear gradient in the prevalence of dampness in homes from the lowest income quintile to the highest (see Fig. 14). The trend is steeper among the NMS12 than the EU15 countries, a result partly explained by the high average prevalence in the lowest income quintile among the NMS12 countries (30%).

Fig. 14. Prevalence of damp dwellings by income quintile (2009)



Source: data from EU-SILC, 2011.

A more in-depth analysis by country (data not shown) highlights wide income-related variations, particularly among EU15 countries. Southern European countries such as Portugal, Greece and Italy show the highest prevalences in the lowest income quintiles (between 25% and 28%) while in Nordic countries (such as Denmark, Finland, Norway and Sweden), the prevalence levels are much lower for these groups (between 7% and 12%), leading to lower levels of inequality. Among the NMS12 countries, the steepest gradient of dampness across the income quintiles is found in Romania and Poland, with 35.5% and 30.1% prevalence in the lowest income group and 8.7% and 7.4% in the highest, respectively. Compared to this, countries such as Slovenia (40.3% versus 21.4%) and Cyprus (35.0% versus 21.2%) show a lower level of inequality, but this is mostly because problems with damp are also common for high-income households.

Target groups for action

In contrast to the other housing inequality indicators considered above, living in a damp dwelling is a housing issue in both the EU15 and the NMS12 countries. Lower-income populations in both regions (especially in the lowest income quintile) constitute more exposed groups. This is particularly marked among the NMS12 countries, where a large gap exists between the lowest income quintile and the others, giving a three-fold difference in exposure to dampness in the home between poor and rich. Single-parent households are also a group at higher risk: in all countries bar two, the risk of living in a damp dwelling is higher for single-parent households than among the general population.

Health implications

Dampness is associated with a broad array of detrimental health effects; the most common of these are related to the deterioration of the respiratory system (Mudarri and Fisk, 2007), including a higher prevalence of respiratory symptoms, increased risk of asthma, wheezing cough (Pirastu et al., 2009) bronchitis, common cold and rhinitis (Pirhonen et al., 1996). Some studies showed a clear relation between dampness and mould and objective measures of lung function. Children's respiratory health is particularly damaged by living in a damp or mouldy home (Tischer et al., 2011). Results based on the analysis of data collected from 45 countries of the WHO European Region estimate that a considerable proportion of childhood asthma cases are attributable to exposure to indoor dampness and mould (Braubach, Jacobs and Ormandy, 2011). More precisely, it has been estimated that 0.07 asthma-related deaths and 50 asthma-related DALYs per 100 000 children per year are associated with exposure to dampness in dwellings, and that 0.06 asthma-related deaths and 40 asthma-related DALYs per 100 000 children per year are associated with exposure to mould. Irritations of the throat and eyes, allergies, rhino-conjunctivitis and eczema have also been observed repeatedly (Bonnefoy, 2007; Zacharasiewicz et al., 2000; Simoni et al., 2005; McNally, Williams and Phillips, 2001).

Conclusions and suggestions

Dampness in the home is an issue in all 27 European countries for which data were available. A large proportion of the general population lives in homes where dampness is an issue. As with many other risk factors, socioeconomically disadvantaged households (particularly those in the two lowest income quartiles) are most affected, as are single-parent households.

One reason for dampness and associated mould is related to the design and construction of buildings; good design and proper construction can help to prevent problems from occurring (WHO, 2010b). Maintenance and use of buildings can also be considered key factors to preserve healthy housing; for example, a speedy response to water damage will help to keep the dwelling in sound condition.

Suggested mitigation actions are:

- making regulatory provisions so that all new residential building projects, private or public, provide adequate protection of building structures against excess dampness and humidity – adequate levels of ventilation should be maintained in all buildings, irrespective of their use and ownership;
- ensuring that the problems of dampness, humidity and ventilation are considered when renovating existing and especially low-cost housing stock;
- providing targeted financial support to disadvantaged populations and those groups most exposed to damp homes due to specific housing circumstances;
- providing adequate housing conditions and affordable heating to economically disadvantaged and vulnerable larger households, since overcrowded living conditions and indoor cold both contribute to dampness.

The last recommendation links the problem of dampness to other housing inequality indicators discussed in this chapter: policies and actions to reduce overcrowding and increase thermal comfort will have an indirect impact on the prevalence of dampness in the homes of disadvantaged populations groups.

INEQUALITIES IN KEEPING THE HOME ADEQUATELY WARM

Introduction

In colder climates, living in a comfortably heated home is commonly viewed as protective of human health. WHO recommends a minimum temperature of 21°C in living rooms, and 18°C in all other rooms (WHO, 2007). Households unable to maintain this standard comfortable temperature, or that require more than 10% of their income to attain the WHO standards, are described as living in fuel poverty (European fuel poverty and energy efficiency: Epee Project, 2008). Many countries have policies that protect their most vulnerable population from cold-related health risks; the United Kingdom Fuel Poverty Strategy (BERR, 2001), for example, aims to reduce fuel poverty by focusing on people over 60 years old, people living with disabilities or long-term illnesses, and households with dependent children, and subsequently to eradicate fuel poverty by 2018 (Liddell and Morris, 2010).

Fuel poverty disproportionately affects low-income households, which must economize across all areas of the household budget and choose the most important expenses for their family. This economic disadvantage is exacerbated by the poor energy efficiency standards of many of their homes. In Europe, between 50 and 125 million people are estimated to suffer from fuel poverty and the Epee Project reveals that this number will inevitably rise in the future as global energy prices increase. Approximately one-third of households in Northern Ireland and Wales live in fuel poverty, whereas 13% in Scotland and 9% in England are affected by this problem (Shortt and Rugkåsa, 2007).

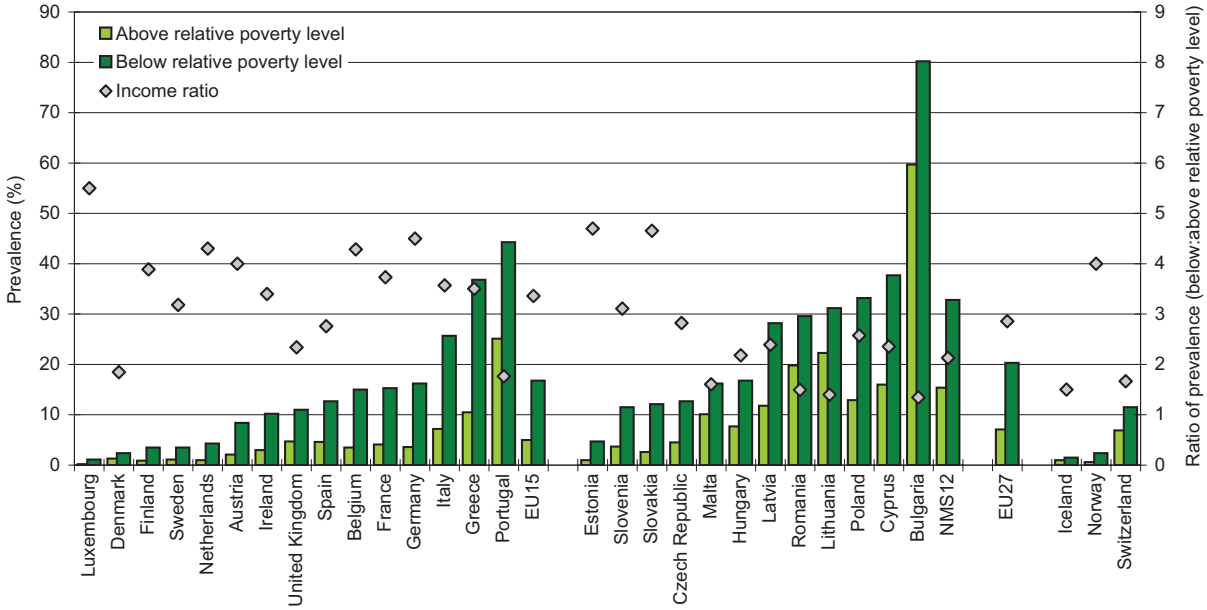
It is important to recognize that a household's inability to keep the home adequately warm has serious health consequences. Extreme winter temperatures have been demonstrated to cause the premature deaths of tens of thousands of EU citizens each year. In a European cross-country analysis (Healy, 2003) a significant association between poor housing – in terms of thermal efficiency – and high levels of winter mortality was found. Further evidence suggests that the excess of winter mortality in the United Kingdom is related to fuel poverty and is highest among the most disadvantaged population groups (Braubach and Fairburn, 2010).

Indicator analysis: inequalities by income, Gini index and household type

Inability to keep the home warm constitutes a housing issue among both the NMS12 countries (18.4% prevalence among the general population) and – although to a lesser extent – the EU15 countries (6.9% prevalence). Of the NMS12 countries, Bulgaria has by far the highest prevalence at 64.2%, while Estonia has the lowest at 1.7%; of the EU15 countries, Portugal has the highest prevalence and Luxembourg the lowest, at 28% and 0.3% respectively.

Income levels influence the risk of exposure to cold homes across both subregions, and for many countries, households below the poverty threshold are particularly strongly affected. The magnitude of income-related inequalities is in fact greater among the EU15 than among the NMS12 countries: on average, the prevalence of inability to keep the home warm is 3.4 times higher for those in relative poverty in the EU15 countries, but only 2.1 times higher in the NMS12 countries (see Fig. 15).

Fig. 15. Prevalence of inability to keep the home warm by relative poverty level (2009)



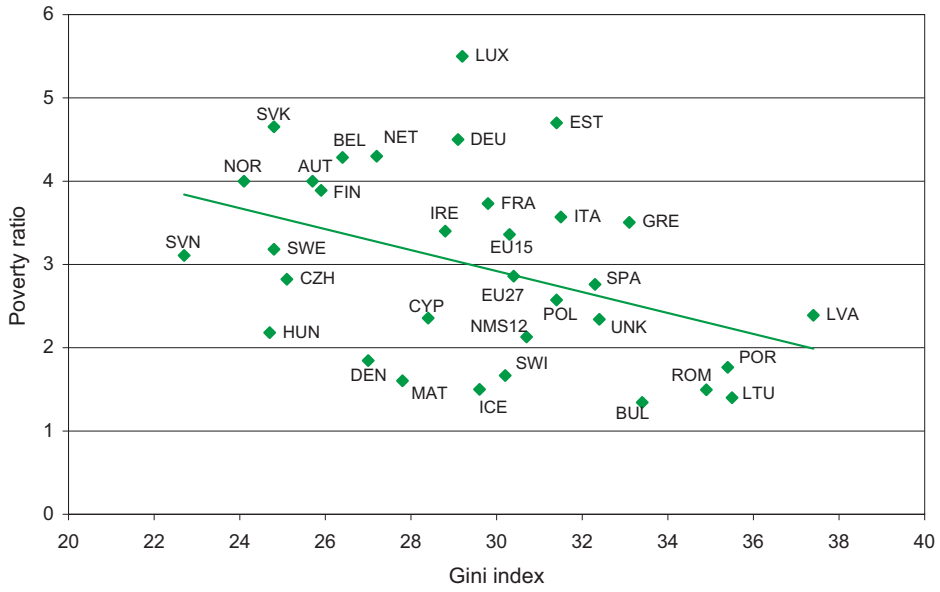
Source: data from EU-SILC, 2011.

There is a general trend that countries with high prevalence rates of inability to keep the home warm have lower income-related inequalities. The inequality ratio of 1.3:1 in Bulgaria is the lowest among the NMS12 countries, which, combined with the country's high prevalence rate, shows that keeping the home warm represents a widespread housing problem. The highest ratio is found in Luxembourg, at 5.5:1, but evaluation of this relative metric must take two facts into account: only a small proportion of the general population (about 0.3%) reported the problem, while prevalence among households below the poverty threshold is 1.1%. Similar findings are seen for Austria, the Netherlands, Estonia, Slovakia and Norway, all of which present a high level of inequality between populations above and below the poverty threshold (with a ratio of about 4:1 or higher), but a very low prevalence in the general population, at less than 4%. In comparison, countries such as Cyprus, Greece, Latvia and Poland may need to pay particular attention to this indicator, since their inequality ratios are at least 2:1 and high prevalence rates (above 15%) are observed in the general population.

There is also a clear linear association between the Gini index indicating national income-related inequalities and reported inability to keep the home warm (see Fig. 16): about 16% of the variability of the inequalities between the population above and below the poverty threshold is explained by the Gini index (R2=0.16). When the index increases by 1%, income inequalities related to thermal comfort in winter decrease by 0.12. In other words, a lower Gini value, indicating a lower general income inequality,

goes with a higher income inequality related to thermal comfort. For example, comparing Norway with Portugal, income inequalities are higher in Portugal (Gini index of 24.1 in Norway and 35.4 in Portugal) whereas inequalities between populations above and below the poverty threshold are higher in Norway (ratios of 4:1 in Norway and 1.8:1 in Portugal).

Fig. 16. Ratio of prevalence of inability to keep the home warm (households below:households above relative poverty level, 2009) in relation to the Gini index (2009)



Source: data from EU-SILC, 2011.
Note: see list of country abbreviations in Annex 4.

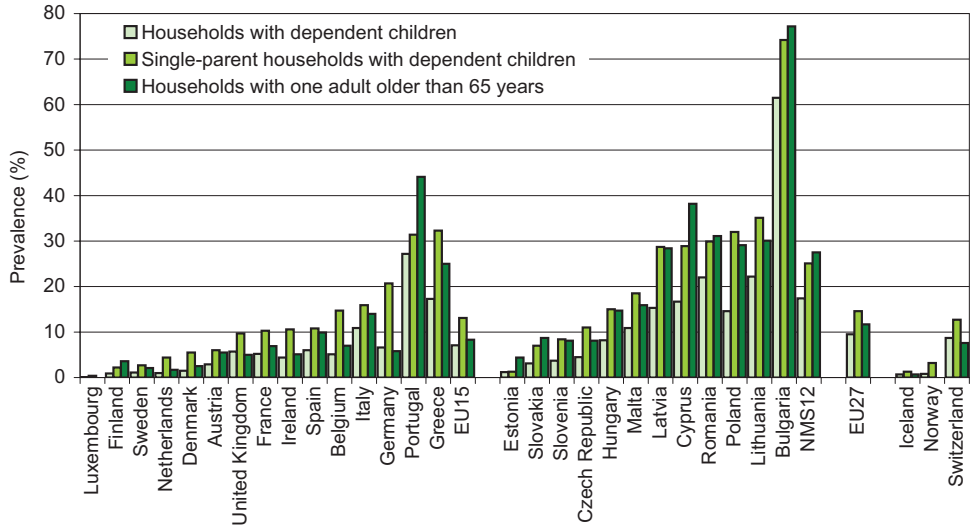
This means that inability to keep the home warm is inversely related to the general level of income inequality within countries, indicating that inequalities in thermal comfort in winter are not directly associated with national income inequality patterns. This effect may result from the fact that in some countries the difference of prevalence between income groups is rather low (see Fig. 15).

The demographic groups most exposed to the problem of inability to keep the home warm are not the same across European countries (see Fig. 17). One common point is that households with dependent children seem less affected by the problem (7.1% in the EU15 and 17.4% in the NMS12 countries) than single households with one adult older than 65 years (8.3% in the EU15 and 27.5% in the NMS12 countries) and single-parent households (13.1% in the EU15 and 25.1% in the NMS12 countries). By contrast, single-parent households have greater difficulty keeping the home warm among the EU15 countries, while among the NMS12 countries, the overall prevalence is higher for single households with one adult older than 65 years. Among the EU15 countries, Portugal is an exception: the prevalence of inability to keep the home warm is much higher among single households with one adult older than 65 years (44%) than among single-parent households (31%).

Target groups for action

Most of the NMS12 countries present a high prevalence of problems with keeping the home warm in the general population, with Bulgaria showing by far the highest level. Within countries, socioeconomically deprived populations report more problems with thermal comfort in winter in both the EU15 and the NMS12 countries, although the magnitude of this inequality is greater in western Europe. This result is consistent with results obtained for the five other housing indicators and corroborates the wealth of knowledge in the existing literature reporting that socioeconomically disadvantaged groups are more susceptible to environmental exposures.

Fig. 17. Prevalence of inability to keep the home warm by household type (2009)



Source: data from EU-SILC, 2011.

In the majority of countries, single-parent households are most frequently unable to keep the home warm and should be considered a group at high risk. Households with one adult older than 65 also constitute a group prone to the problem in a few countries, including Bulgaria, Cyprus and Portugal. Further detailed information on potentially vulnerable groups is available from Serbia and Montenegro, showing, for example, that education level may also have a strong impact on ability to heat the home (see Annex 1).

Health implications

According to the recent Marmot Review Team report (2011) on the health impacts of cold housing and fuel poverty, excess winter deaths (EWDs) are associated with thermal efficiency of housing and low indoor temperatures. About 40% and 33% of EWDs are attributable to cardiovascular and respiratory diseases respectively, the risk of EWD being almost three times higher in the quartile of houses with coldest indoor temperatures than in the warmest quartile. A WHO report on the burden of disease of inadequate housing quantified as 30% the proportion of EWDs attributable to cold housing (Braubach, Jacobs and Ormandy, 2011).

A BMJ editorial commenting on the Marmot Review Team report concludes that "although the extra deaths in elderly people are caused mainly by cardiovascular and respiratory disease, far greater numbers have minor ailments that lead to a huge burden of disease, costs to the health system, and misery" (Dear and McMichael, 2011). Non-fatal cardiovascular and respiratory diseases are also linked to low indoor temperature, which exacerbates existing conditions such as arthritis and rheumatism, increased blood pressure and risk of stroke, social isolation and adverse effects on children's education and nutrition (Shortt and Rugkåsa, 2007). Children are especially at risk, in particular for respiratory problems that are, in part, due to the development of moulds in the humid environments of cold houses. The Marmot Review Team (2011) also reports that mental health is negatively affected by fuel poverty and cold housing in all age groups, with a fivefold increase in risk of poor mental health among adolescents living in cold housing than those in warmer houses.

Conclusions and suggestions

Inability to keep the home warm is an important housing issue in most European countries, and a high level of inequality is also apparent. Population subgroups living in relative poverty are significantly more affected, with several countries showing three or four times higher prevalence rates for households below than those above the poverty threshold. Inequalities in exposure to cold homes are also identified for single-parent households and, to a lesser extent, households with one adult older than 65 years.

Suggested mitigation actions are:

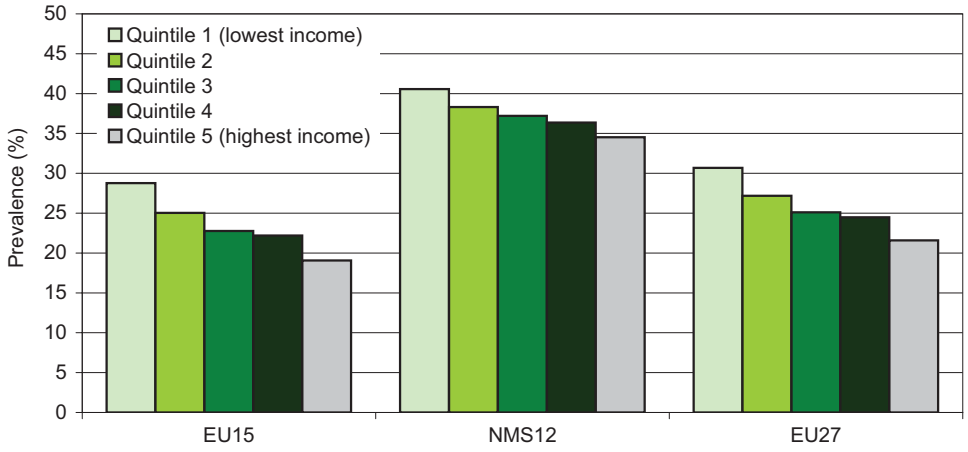
- offering special energy prices or financial support to the most vulnerable households (especially those in relative poverty and households with children), allowing them to pay for the energy needed to maintain an appropriate temperature inside the home;
- ensuring efficient insulation to reduce energy consumption and related expenses – poorer households often live in the least energy-efficient homes, and will thus need financial support to afford thermal insulation;
- building and rehabilitation of social housing to meet energy standards and reduce households' energy expenses;
- giving consideration at a local scale, in accordance with general energy-saving policies, to the availability of low-cost energy sources such as wood, residual agricultural biomass, wind and geothermal sources, depending on the local situation and opportunities;
- providing measures and information from a health perspective to avoid an extreme focus on saving energy leading to reduced air exchange and a deterioration of indoor air quality: a good balance is required between ventilation and insulation.

INEQUALITIES IN KEEPING THE HOME ADEQUATELY COOL

Although it falls outside the environmental health inequality indicator set, the EU-SILC database also offers data on dwellings that cannot be kept cool in summer, enabling comparison with the opposite thermal comfort indicator discussed above. Globally, the proportion of the general population unable to keep the dwelling comfortably cool in summer is higher than the proportion unable to keep the home warm in winter, showing that summer temperatures may be a rising problem. Much higher prevalence levels can be found among the NMS12 countries (average 37.7%) than among the EU15 countries (average 24.2%).

Moreover, there is a clear gradient in the proportion of the population not comfortably cool in the dwelling during the summer from the lowest income quintile to the highest (see Fig. 18). The trend appears steeper among the EU15 countries than among the NMS12 countries, where the highest income quintile is much more affected than the lowest in the EU15.

Fig. 18. Prevalence of inability to keep the home adequately cool in summer by income quintile (2007)

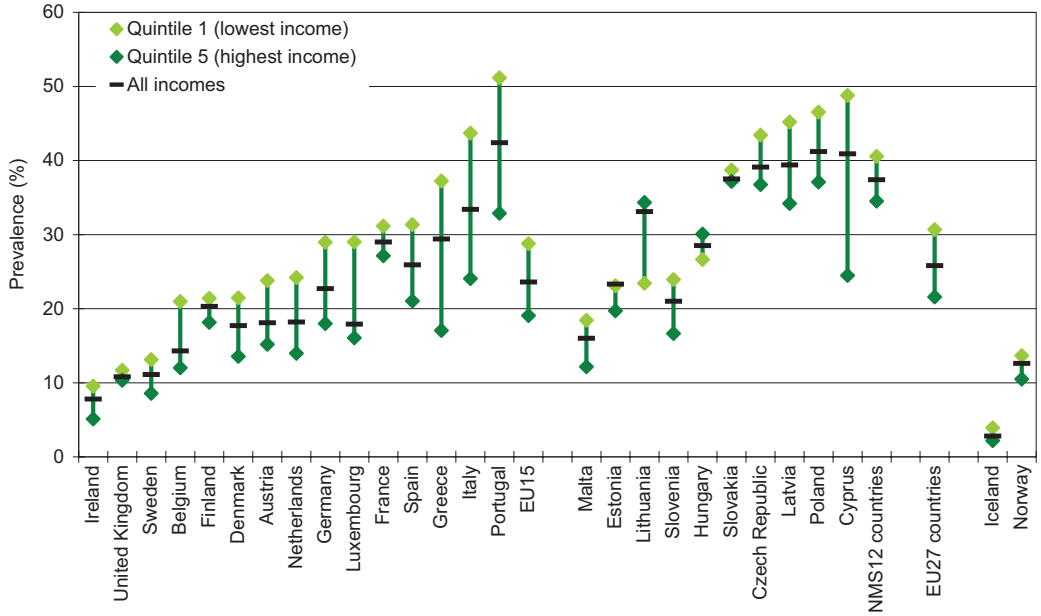


Source: data from EU-SILC, 2011.

There are strong variations within both the EU15 and the NMS12 countries, with the overall prevalence of not being comfortably cool in summer largely affected by geographical location and climate (see Fig. 19). However, the data also indicate that the impact of income on problems with indoor temperatures in summer is very diverse, depending on the country.

The inequalities across the income quintiles seem most strongly expressed in hot climates such as Greece, Italy, Portugal and Cyprus, which show a prevalence difference of around or even beyond 20%, with Greece and Cyprus indicating an income ratio of 2:1 between the lowest- and highest-income population quintiles. Of further note is the finding in Lithuania and Hungary, where further exploration is needed to explain the reverse finding that high-income households are more affected. Finally, the data also indicate that the problem of keeping the home cool in summer is less clearly related to income levels than was the case for keeping the home warm in winter (where income ratios were higher than 3:1 for many EU15 and several NMS12 countries: see Fig. 15).

Fig. 19. Prevalence of inability to keep the home adequately cool in summer by income (2007)



Source: data from EU-SILC, 2011.

CONCLUSION ON HOUSING-RELATED INEQUALITIES

From a public health perspective, two aspects of housing inequality can be distinguished: inequalities relating to the basic needs of water and equipment availability for drinking, cooking and hygiene on the one hand, and inequalities relating to overcrowding, dampness and the capacity to keep the home warm or cool on the other. The main health effects associated with water and sanitation indicators are infectious diseases, while those associated with the latter indicators are allergic and respiratory or cardiovascular diseases. This analysis reflects the distinction between these two different aspects, showing that the former is of particular concern in the NMS12 countries, whereas the latter affects both the NMS12 and the EU15 countries.

The analysis also clearly demonstrates that a high proportion of the population living in the NMS12 countries has no flush toilet and no bath or shower in the dwelling. Because absence of sanitation equipment inside the home has such considerable health consequences, housing policies should ensure that all new residences in public buildings or private houses offer such basic commodities. This requires that no construction should be allowed without a permit from local authorities that will check that not only the building plans but also the reality conform to this obligation. Regarding pre-existing premises, the data clearly show that poverty is the key risk factor for absence of a toilet and shower or bath.

Housing and public health policies should therefore target low-income household groups including single-parent families – a particularly vulnerable category – for the delivery of social aid and funds to help reduce the prevalence of this problem. Indeed, the study reveals that the combination of these two socioeconomic characteristics of poverty and single parenthood gives rise to a particularly exposed and vulnerable group that could be considered a priority for targeted action in many countries.

Accessibility (and affordability) of drinking-water has also been shown to be a serious issue in many countries of the eastern part of the WHO European Region – particularly, but not solely, in rural areas. Moreover, the analysis reveals that although the prevalence of inadequate water supply has tended to decrease for all countries since 1995, it remains very high for the Euro 3 countries. Taking the significant health consequences into account once again, the same rationale for the necessity for installing sanitation equipment should apply to the obligation to connect water networks to all new and old dwellings in urban areas. In addition, provision should be made at national and regional levels to help investments in rural areas that would develop community water systems in small towns and villages.

The data provide strong evidence that the non-sanitary housing inequalities – overcrowding, dampness and thermal comfort related to cool and warm homes – exist in almost every country. Once again, low-income populations, and especially low-income single-parent households, are most affected across all indicators. This requires particular attention because this combination of disadvantages has been identified as the group most exposed to substandard housing in many countries.

Progress in the areas of overcrowding, dampness and thermal comfort can be made through a combination of housing and social policies and should be regulated by national laws to ensure their effective implementation throughout the country. All new building programmes should be obliged to provide a minimum proportion of dwellings with a large number of rooms in order to host large families, with low-cost homes for rent or for purchase, the figures depending on national demographic and sociocultural characteristics. Rehabilitation programmes for existing buildings should aim to achieve the same goal. Dedicated financial support should also be targeted to economically disadvantaged groups to cope with the costs of energy (for heating or cooling) and to help them improve insulation and ventilation of the dwelling.

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CHAPTER 3

INJURY-RELATED INEQUALITIES

CHAPTER 3. INJURY-RELATED INEQUALITIES

Ingrid Fast, Matthias Braubach, Francesco Mitis, Lucie Laflamme

Key messages

In general terms, unintentional injuries related to or influenced by environmental conditions are a major challenge for public health.

- Unintentional injuries are the third leading cause of death in Europe and the associated morbidity puts a high level of demand on health systems.
- Unintentional injuries are one of the causes of mortality and morbidity with the steepest socioeconomic gradient, affecting lower-income people and areas to a greater extent.
- Unintentional injuries can be prevented through a range of evidence-based measures.

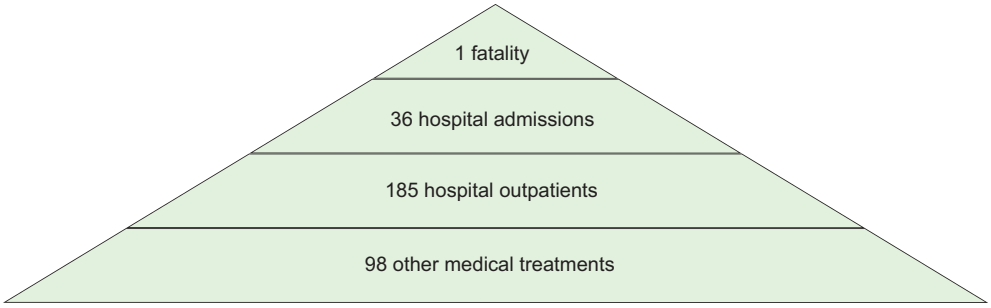
This chapter specifically reports on sex- and age-related inequalities, as well as on differences by national income levels, for four injury-related inequality indicators, highlighting the following factors.

- Males sustain far more fatal road traffic injuries (RTIs), falls, and poisonings than females, and the same applies to non-fatal work-related injuries.
- The strongest sex-related inequality is found for RTIs, where incidence among males is four times greater than among females.
- Age-related inequalities exist but are not systematic; they differ in magnitude and in direction across indicators.
- The highest age-related disparities are found for fatal falls, where rates among the elderly are extremely high. By contrast, work-related injury rates do not vary remarkably with age in many countries.
- At country level, low- and middle-income countries have generally higher RTI and poisoning mortality rates than high-income countries.
- Country variations in injury-related inequalities can be very significant, with differences between lowest and highest inequality levels often fivefold or more. However, these differences strongly depend on the respective inequality indicator.

INTRODUCTION

Injuries are a leading cause of mortality worldwide, responsible for 9% of all deaths globally and 7% in the WHO European Region (WHO, 2011). They are also responsible for a great deal of morbidity; injured people are frequently admitted to hospital and, even more frequently, receive care through outpatient visits and medical consultations and treatments (see Fig. 20). Although their consequences are often minor, some injuries may have long-lasting and permanent negative consequences – not only physical (such as life-long disability) but also psychological (such as post-traumatic stress disorder (PTSD)) or social. Superficial or open wounds, contusions, dislocations and fractures are among the most common types of injuries sustained (Sethi et al., 2006a).

Fig. 20. Pyramid of unintentional injuries



Source: data from Bauer and Steiner, 2009, adapted.

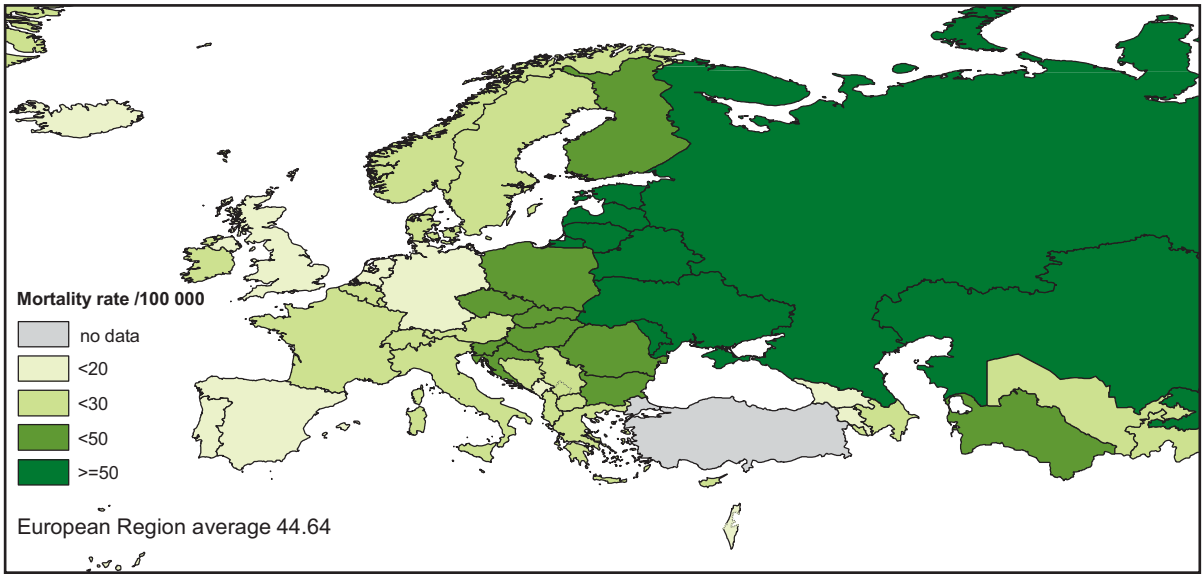
Although injury rates have fallen slightly in Europe during the past decade, there is broad scope for improvement: both global injury rates and the unequal distribution of injuries within and between countries can be tackled and reduced (Laflamme, Burrows and Hasselberg, 2009; Laflamme et al., 2009). There is accumulated and convincing evidence that unintentional injuries are highly preventable (WHO, 2007a), and there is a growing body of knowledge suggesting that inequalities in injury rates can be prevented and reversed (Laflamme, Burrows and Hasselberg, 2009; Laflamme et al., 2009).

This is of the utmost importance, since injuries have become one of the causes of mortality with the steepest social gradient. Map 2 below shows that this is also reflected in the stark mortality rate differences between countries.

There is also increasing evidence from several European countries that inequality-related differences in injury morbidity can be just as stark. These inequalities arise for different reasons, including differences in exposure, in access to means of prevention (and protection) and in injury consequences (Laflamme, Hasselberg and Burrows, 2010). Inequalities have been observed between different sociodemographic groups – based on individual age, sex, and SES – as well as between locations such as country, region and area of residence. Such wide disparities in injuries have been highlighted in the WHO European Region when comparing low- and middle-income countries to high-income ones (Sethi, Mitis and Racioppi, 2010). If all countries' data were at the level of the lowest national injury-related mortality rate, 508 313 lives could be saved each year within the WHO European Region (accounting for 68% of all injury-related death cases) (Sethi et al., 2006a).

To better contextualize and highlight the inequalities in injuries occurring in Europe, this chapter presents data on inequalities related to the incidence of non-fatal work-related injuries, fatal RTIs, fatal poisonings and fatal falls, stratified by age and sex, and – for RTIs, poisonings and falls – by national income levels. Additional information is also provided concerning the state of knowledge of sociodemographic parameters that – unlike other inequality indicators covered in this report – could not be addressed with the available data.

Map 2. Standardized mortality rates for unintentional injuries and poisonings/100 000 population (last year of reporting)



Source: data from European Health for All database (variable 7060), 2011

DATA AND METHODS

The data used in this chapter were extracted in spring 2011 from a range of international databases provided by Eurostat and WHO (Eurostat, 2011; European detailed mortality database (DMDB), 2011; European mortality database (MDB), 2011; European Health for All database, 2011). In addition, data from the updated global burden of disease (GBD) (WHO, 2011) were used to supplement the RTI, poisoning and fall information, enabling a closer look at inequalities between high-income and low- and middle-income countries, stratified by sex and age group. No further information on income-related inequalities was available.

Throughout the chapter, sex ratios (SRs) are used to represent the relative difference in incidence or mortality rates between males and females; for example, a value of 3:1 indicates that incidence among males is three times higher than among females.

For the inequality indicators on RTIs, poisonings and falls, it proved very difficult – and sometimes impossible – to generate representative subregional results because of a lack of adequate data. Therefore, the subregional data reported often represent the average of the national rates of the countries covered by the respective region, and this restriction is clearly marked in each affected figure. Subregional data that give accurately representative aggregated results (often provided by Eurostat databases, as in the case of work-related injuries) do not include this indication.

Work-related injuries

Eurostat provided all data on work-related injuries, defined as "accidents at work resulting in more than 3 days' absence from work" (Eurostat, 2011). An accident at work is defined as "a discrete occurrence in the course of work which leads to physical or mental harm". This definition includes work-related injuries that occur both inside and outside the work premises (even if caused by a third party or during transport) and cases of acute poisoning. Injuries caused by accidents on the way to or from work (commuting accidents), occurrences with a purely medical origin (such as a heart attack at work), occupational diseases and general work-associated conditions such as overexertion and musculoskeletal effects were excluded.

Work-related injuries are the only indicator based on non-fatal injury data. Injury incidence rates for males and females (Eurostat code hsw_aw_inasx) were calculated, along with the development of injury incidence for males and females from 1998 to 2006 (Eurostat code tsiem 090). In addition, injury incidence was determined for three age groups: younger (up to 24 years), middle (25–54 years) and older (55 years and above) (based on Eurostat code hsw_aw_inaag). To extend the evidence base, data on occupational death rates from the European Commission and the European Health for All database were also included.

Fatal RTIs

Data from the DMDB on the number of RTI-related deaths/100 000 population were used to display inequalities in RTI rates by four age groups and to assess differences by sex. The database, further information and definitions are available online on the WHO Regional Office for Europe web site (http://data.euro.who.int/dmdb/) and cover up to 47 of the WHO European Member States.

Data from the DMDB – WHO International Statistical Classification of Diseases and Related Health Problems, tenth revision (ICD-10) codes V01–V79 and V82–V89 (WHO, 2010a) – were compiled to reflect cases of road traffic-related death, excluding mortality related to train or air transport but including cases of death among cyclists and pedestrians. However, if the necessary information was not available, DMDB data on overall transport mortality were used, based on mortality tabulation list 1 (MTL1) of ICD-10 and integrating data from countries still reporting through the ICD-9 system (MTL1 code 1096).

For an assessment of intracountry variations of transport-related mortality, data from the MDB on deaths from transport accidents (code 7120) – available for few European Member States – were used.

Fatal poisoning

Data from the DMDB on the number of fatal poisonings/100 000 population were used to show inequalities by sex and the related ratios for all poisonings, as well as for alcohol-related poisonings specifically. Age group-specific poisoning death rates were calculated for the most relevant poisonings.

Data were taken from the DMDB (ICD-10 codes X40–X49 and MTL1 code 1100). The database, further information and definitions are available online on the WHO Regional Office for Europe web site (http://data.euro.who.int/dmdb/) and cover up to 46 of the WHO European Member States.

For an assessment of intracountry variations of poisoning mortality, MDB data on the standardized death rates from accidental poisoning (code 7420) – available for few European Member States – were used.

Fatal falls

Data from the DMDB on the number of fatal falls/100 000 population were used to calculate inequalities by sex and the related ratios for the full population, as well as for age group categories. Age-specific data show the trend of fall mortality over the life course.

The data were taken from the DMDB (MTL1 code 1097). The database, further information and definitions are available online on the WHO Regional Office for Europe web site (http://data.euro.who.int/hfamdb/) and cover up to 46 of the WHO European Member States.

RESTRICTIONS AND DATA LIMITATIONS

There were four major restrictions on the treatment of the data.

Lack of data and data coverage

Age- and sex-stratified data on work-related injuries and mortality could only be obtained from Eurostat, which has data from a limited number of WHO European Member States. In the data provided by Eurostat on work-related injuries, stratification by sex was only available at country level for 17 EU countries.

For some countries, the latest reported data are several years old and current injury rates are unknown. This hampered an accurate comparison of trends over time and made comparative assessments difficult.

Quality of data

Data from the MDB and DMDB must be used with caution for intercountry comparisons because for some countries mortality rates may be biased due to the underreporting of death cases, particularly in the central Asian republics, the Caucasus countries and some countries in the Balkan region (MDB, 2011; DMDB, 2011).

Lack of country data on individual socioeconomic determinants

Country-specific information on injuries stratified by SES variables (income, education, and so on) or other relevant dimensions such as ethnicity is not available from the databases used, and would have provided additional information on inequalities in injury rates. Wherever possible, existing empirical evidence and country-level income data were used to cover the socioeconomic dimension of injury-related inequality.

Outcome heterogeneity

The four injury-related inequality indicators studied are heterogeneous groups. Within each of them there are different health outcomes caused by a variety of mechanisms; for example, different categories of road users are associated with different levels of injury risk, and some population groups are particularly affected by alcohol poisoning rather than by other types of poisoning. Variations and differences related to the injury types can be large, implying that there might be underestimations of differences between groups, and that some existing inequalities are possibly not reflected by the data.

INEQUALITIES IN WORK-RELATED INJURIES

Introduction

In Europe alone there are as many as 300 000 work-related deaths every year, and work-related injuries have been defined as the biggest health risk in the working environment, before exposure to noise and carcinogens (WHO, 2002). There is ample evidence from the scientific literature – European and international – that there are substantial inequalities in work-related injury rates, varying especially but not exclusively by occupation. Since occupation and SES are strongly correlated, differences in work-related injury rates can also be found based on individual SES measures such as education and income level (WHO, 2010b; Siegrist et al., 2010; Costa and D'errico, 2006).

Another source of inequality in work-related injury rates is sex: males have higher injury rates than females. This can be explained by differences both in type and amount of occupational exposure and in individual behaviour and vulnerability (WHO, 2010b). Even individual age can come into play as a

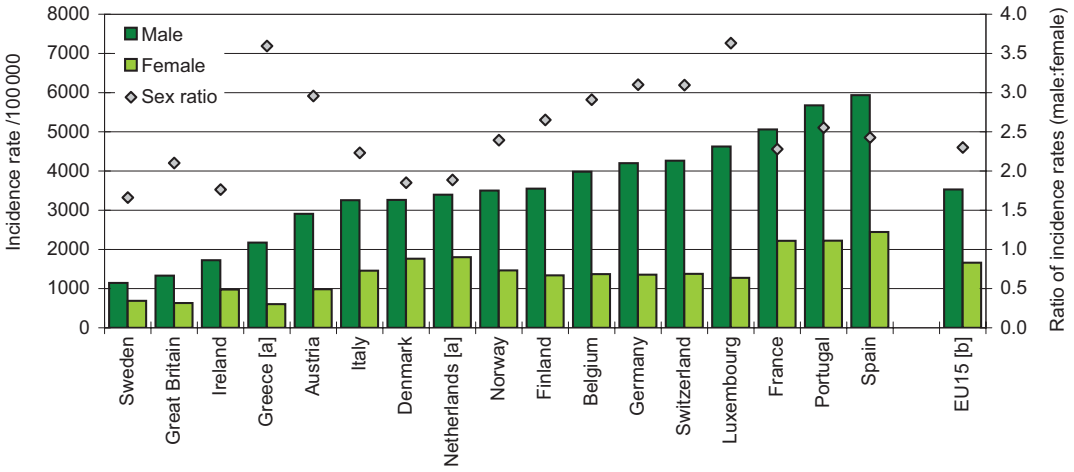
source of inequality, with younger and older workers identified as risk groups for their expected lack of experience in the former case (European Agency for Safety and Health at Work, 2011) or their age-related impairment in the latter (European Commission, 2009). But reviews indicate that it is in rather specific circumstances and for specific types of injuries that age can be expected to play a role (Laflamme and Menckel, 1995). Age can, in fact, be not only an aggravating but also a preventive factor.

Work-related injuries are highly preventable through modification of the work environment itself, of prevailing working conditions and also, to some extent, of the working climate and work culture (Council Directive, 1989; WHO, 2010b). Because occupational exposure varies greatly across occupational groups and sectors, some occupations are at far greater risk than others and so are some sectors of activity.

Indicator analysis: inequalities by sex, age and occupation

Using country-based Eurostat data, it can be observed that males have higher work-related injury incidence rates than females in all countries, with an average male–female SR of 2.3:1 for the EU15. The highest ratios are 3.6:1 and 3.5:1 in Luxembourg and Greece, and the lowest is found in Sweden at 1.7:1. For males, the incidence rate of injuries/100 000 ranges from 1145 (Sweden) to 5935 (Spain), and for females from 605 (Greece) to 2446 (Spain) (see Fig. 21).

Fig. 21. Work-related injury incidence rate/100 000 population in employment by sex (2007)



Source: data from Eurostat, 2011.

Notes: [a] data for Greece and Netherlands from 2006; [b] EU15 data based on value for Great Britain replacing unknown value for United Kingdom.

Sex-related differences are also reproduced at economic sector level (see Table 4). Risk of injury to males outweighs that to females by the highest proportion in the construction sector (SR 3.6:1); this is also the sector with the highest injury incidence globally. The SR is lower in sectors such as transport and communication (1.4:1) and hotel and catering (1.3:1). A national example of work-related injury SR differences by sector is provided for Croatia in Annex 1.

Fig. 22 shows the development of the incidence of work-related injuries from 1998 to 2006, the last year of reporting to Eurostat. The bars show the incidence changes for males and females, based on an index value of 100 for the baseline year of 1998. In most EU countries, the occurrence of work-related injuries decreased strongly for both sexes, although with a sharper decline for males than for females. In 2006, the work-related injury index for females was at 83 for EU27, whereas for males the index dropped to 77. This corresponds to injury rate reductions by 17% and 23% since 1998, respectively. In a few countries the rate actually increased for one sex (Ireland, Cyprus, France and Lithuania) and thus indicates an increasing sex-related inequality during the time period covered, while in Estonia, the

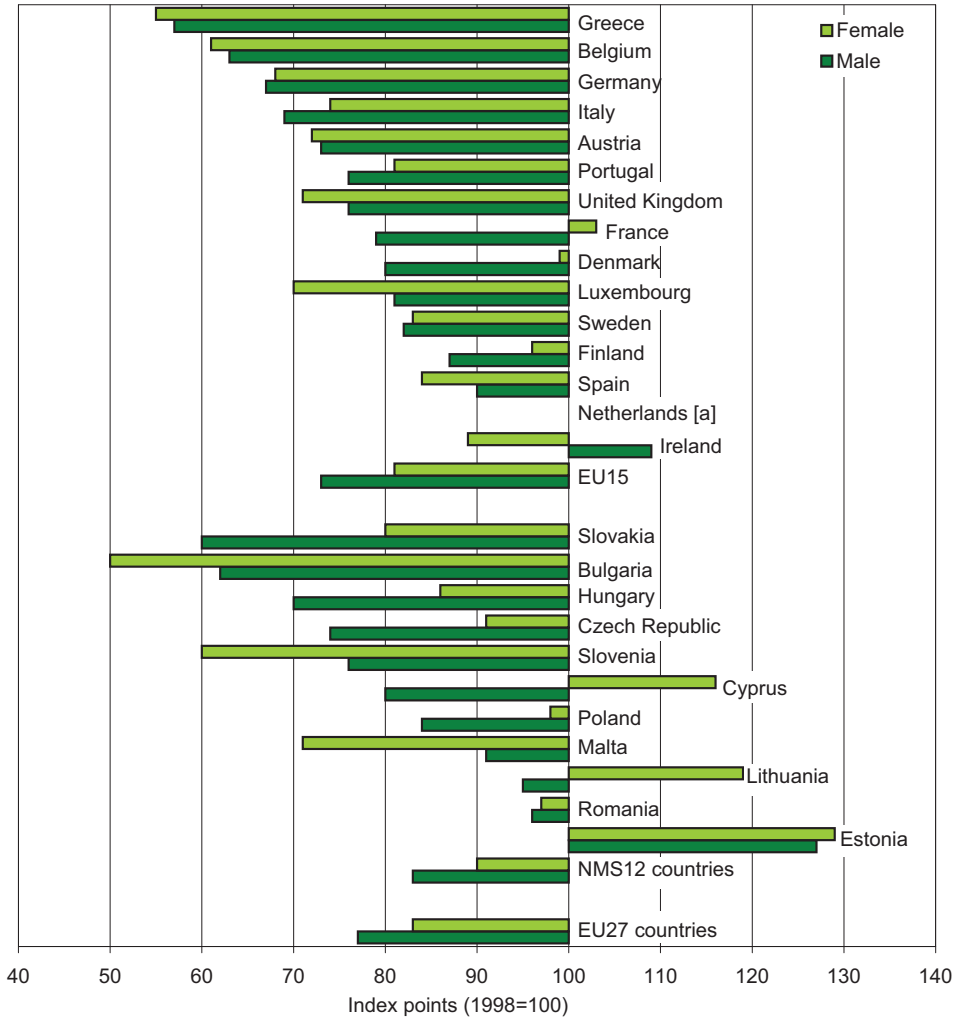
rate strongly increased for both sexes. However, there are various countries where, although rates are declining for males and females, there is a strong sex-related difference in the relative reduction (such as Denmark, Czech Republic and Poland).

Table 4. Standardized incidence rate of accidents at work by economic sector and sex (average for 2005–2007)

Economic sector	Incidence/100 000 population in employment		Ratio of incidence rates
	Male	Female	(male:female)
Construction	6172	1723	3.6:1
Electricity, gas & water supply	2046	715	2.9:1
Manufacturing	4003	1855	2.2:1
Financial intermediation; real estate	1972	934	2.1:1
Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	2811	1440	2:1
Agriculture, hunting and forestry	4847	2963	1.6:1
Transport, storage and communication	2882	2013	1.4:1
Hotel and catering	3238	2585	1.3:1

Source: data from Eurostat, 2011.

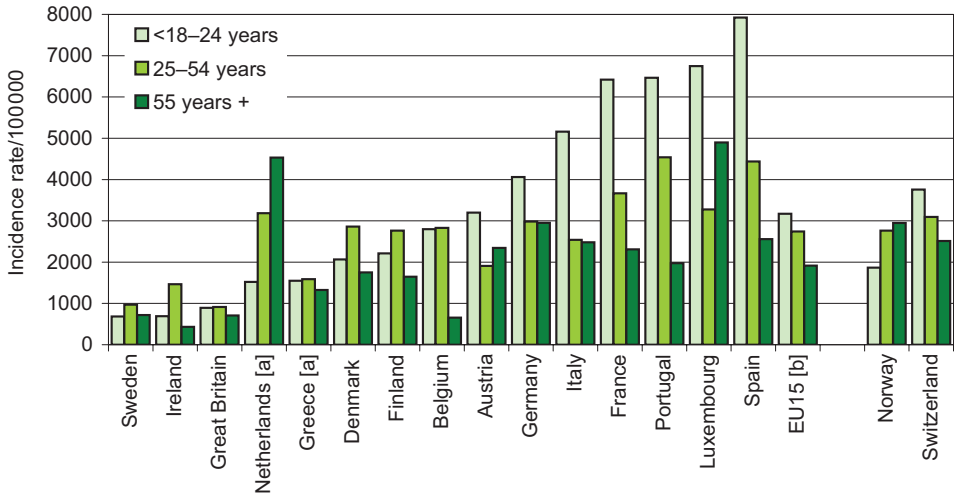
Fig. 22. Work-related injury incidence rate/100 000 population in employment by sex (2006) in index points



Source: data from Eurostat, 2011.
Note: [a] Netherlands: value = 100 (2005).

Fig. 23 illustrates age-related inequalities in work-related injury rates. In many instances, at country level, workers from the highest age group experience the lowest incidence of work-related injuries (EU15 average: 1917/100 000). Noteworthy exceptions are the Netherlands (4533/100 000), Luxembourg (4897/100 000) and Norway (2947/100 000) where incidences among the highest age group exceed those among younger workers.

Fig. 23. Work-related injury incidence rate/100 000 population in employment by age group (2007)



Source: data from Eurostat, 2011.
Notes: [a] data from 2006; [b] EU15 data based on value for Great Britain replacing unknown value for United Kingdom.

Workers in the middle age group rank second (average EU15 incidence: 2743/100 000); the highest incidence rate is found in Portugal (4539/100 000) and the lowest in Great Britain (914/100 000). Workers in the youngest age group for their part have the highest incidence rates of work-related injuries (average EU15 incidence: 3172/100 000), with the highest rate in Spain (7923/100 000) and the lowest in Sweden (686/100 000). Compared to sex-related inequalities, age-related inequalities in work-related injury rates are not very pronounced in general, but for individual countries (such as France, Italy, Luxembourg, Portugal and Spain) the incidence differences are remarkably high.

However, looking at fatal work-related injuries within the EU, the age-related inequality pattern changes, and the sex-related inequality pattern is enhanced. Age-stratified mortality data for the year 2000 indicate that fatal work-related injuries are far more likely to affect older workers than their younger counterparts (Eurostat, 2011). Fatal injury data stratified by sex show that in sectors with the highest mortality rates (agriculture, manufacturing, construction and transport), 95% of all fatal injuries occurred among males (European Commission, 2009).

The data presented in this chapter are limited to EU countries and it remains unclear whether the patterns observed herein apply to the same extent to other countries of the WHO European Region. However, the European Health for All database (parameter 4070) presents general data on work-related mortality rates for 50 countries which range from 0.2/100 000 to 10.7/100 000. The data indicate strong regional differences in work-related mortality rates (Euro 1 countries showing the lowest mortality rates while the highest are found in Euro 3 countries), but cannot be stratified by age or sex.

Target groups for action

Among the countries contributing data, males sustain more work-related injuries than females and thus represent a target group for action. This is true for data within each sector and aggregated from all economic sectors, but is mostly relevant in manual labour-intensive sectors (see Table 4). However, without data on occupational exposure, it is not possible to determine the specific occupations at higher risk or indeed the sources of the hazards.

It is important to note that some health problems that are more common among females are missing from the material under consideration: this is because the definition of work-related injuries includes only those occurring during the course of work. Within the health sector, for instance, where females make up a greater proportion of employees than males, musculoskeletal problems are highly prevalent among nurses and aides but are not considered to be direct work-related injuries.

A closer look at data stratified by occupation and economic sector would also help to broaden understanding of age-related inequalities, which are less clearly expressed when looking at the total number of work-related injuries.

Although inequality dimensions other than age and sex could not be considered in the analyses conducted, it is important to note that workers with low SES and migrant workers are known vulnerable groups that suffer traumatic injuries more often, a fact that has been attributed to their generally worse health status. But poorer working conditions and work environments may also contribute to their higher risk of work-related injury (European Agency for Safety and Health at Work, 2011).

Health implications

Work-related injuries most often result in sick leave, and there are more injuries that result in sick leave among older than younger workers. Longer durations of sick leave in general are more prevalent among males and the elderly working population (European Commission, 2009). However, work-related injuries can also lead to long-lasting disabilities and, as mentioned above, even have fatal outcomes. Disability is a threat for workers of all age groups: among adults, around 6% of disabilities are a consequence of work-related injuries (Tüchsen et al., 2009).

Regarding the types of injuries sustained, from 1997 to 2005 a decrease has been observed in the incidence of wounds and superficial injuries as burns, scalds and frostbite. By contrast, occurrences of dislocations, sprains and strains are on the increase, as well as multiple and internal injuries resulting in death (European Commission, 2009).

Work-related injuries also affect a worker's social life and future prospects; for instance, disabilities that reduce work performance or capacity to remain in an occupation lead not only to loss of employment but also to an impoverished quality of life. The long-term absence from work or long-term unemployment of a breadwinner might even put an entire family in a precarious situation.

Conclusions and suggestions

Although the available data are representative of only a limited number of countries, some trends and patterns are noteworthy. One is that there are clear sex-related inequalities in the incidence of work-related injuries, to the disadvantage of male workers. However, in recent years, decreases in work-related injuries have been more remarkable among male workers than female workers.

Also striking is the heightened risk of occupational injuries among younger workers, which is strongly expressed in several countries. By contrast, older workers are over-represented when analysing occurrences of fatal work-related injuries.

The risk of work-related injury can be significantly reduced by the design and layout of safer working environments, methods, and instruments. Work to build up and promote these factors is likely not only to reduce the probability of injury but also to narrow down the level of inequality between males and females employed in similar occupations (Eurostat, 2011). However, more reliable reporting of work-related injuries in non-EU countries would extend the available information on the incidence of work-related injuries and their distribution among different segments of the workforce within the WHO European Region, as well as helping to identify target groups for action.

Suggested mitigation actions are:

- implementation of national programmes on occupational safety and health as suggested by ILO Conventions 155 (ILO, 1981) and 161 (ILO, 1985) and the Workers' health: global plan of action (WHO, 2007b), aiming at universal coverage of prevention-oriented occupational health services for all workers;
- further implementation and enforcement of the Community strategy 2007–2012 on health and safety at work (European Commission, 2007) and similar relevant policies applying outside the EU;
- thorough induction training of younger and new workers on workplace hazards and respective safety measures;
- wherever possible, adapting job demands and conditions to the physical and mental capacity of workers;
- provision of basic occupational health services to workers from vulnerable groups (younger, elderly, disabled, migrant, pregnant, and so on) and those in high-risk sectors (such as small enterprises, construction, manufacturing, health care, agriculture, mining and informal);
- better reporting on work-related injuries through occupational health surveillance programmes, including their distribution by age, sex and occupation.

INEQUALITIES IN FATAL ROAD TRAFFIC INJURIES (RTIs)

Introduction

An increasingly mobile society with growing traffic volume bears a rising risk of RTIs, including injuries related to both motorized and non-motorized means of transport. As the leading cause of deaths among adolescents and young adults, and an increasingly important cause of injury and death among children, RTIs have among the most serious consequences of all injuries (Sethi et al., 2006b). In 2010 alone RTIs resulted in 107 850 deaths in the WHO European Region (WHO, 2009). In western Europe an estimated 25% (12–59%) of RTIs are caused by environmental factors such as urban structure and road design (Prüss-Üstün and Corvalán, 2006). Alongside environmental risks, alcohol consumption and speeding rank highly as factors associated with both crash occurrence and crash severity. It has been estimated that around one in four injuries is caused by drink–driving (Directorate General for Health and Consumer Protection, 2006).

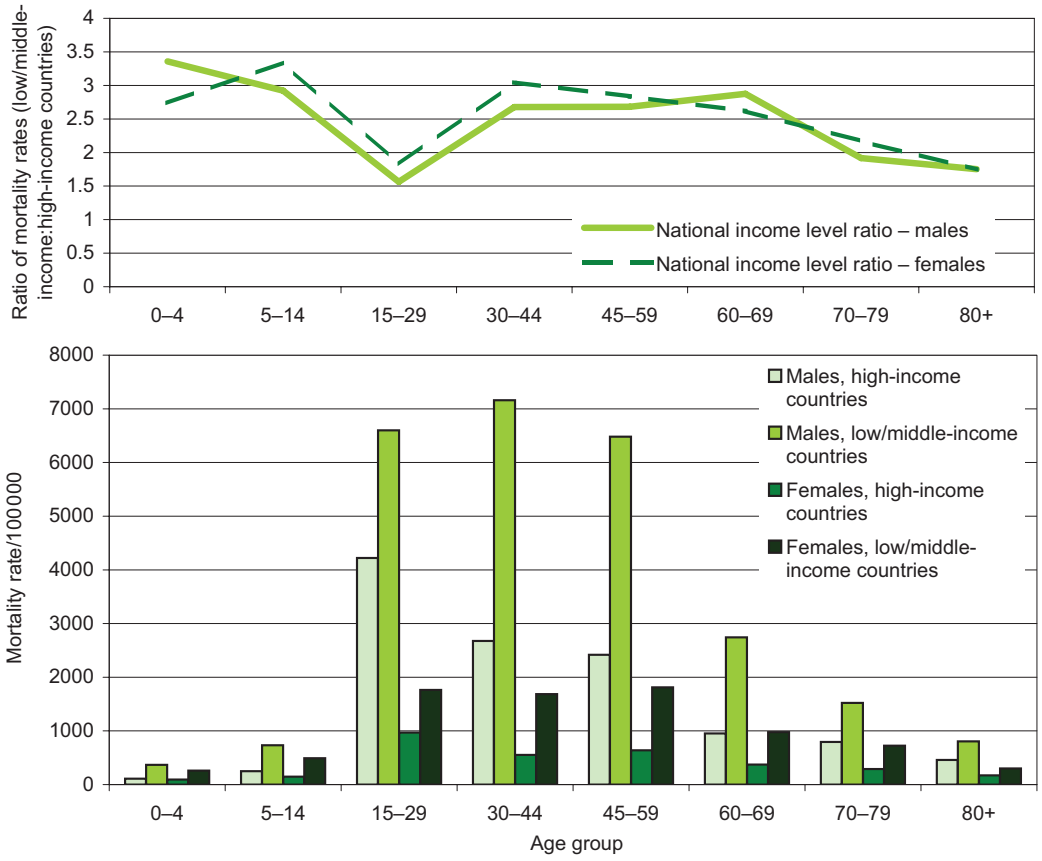
RTIs are not randomly distributed among areas and groups in society (Laflamme and Diderichsen, 2000; Laflamme, Hasselberg and Burrows, 2010). In Europe, residents of the Euro 3 countries are more at risk than those of other regions: as a result of these states' late transition to market economies and a resulting increase in motorization without the matching infrastructure, road safety tends to be low (Racioppi et al., 2004). Alongside well-known differences between, for example, urban and rural areas, there are also remarkable inequalities between socioeconomic groups, to the detriment of disadvantaged ones (WHO, 2009; Laflamme, Hasselberg and Burrows, 2010). Within countries, a high proportion of the RTI-related burden of injury is carried by those with low SES, in part because they may not have equal access to safe transport options (Kay et al., 2011).

In addition, males are at far greater risk of RTI than females and so are people in the younger and middle age categories. These inequalities may, however, vary depending on the category of road user (Laflamme, Hasselberg and Burrows, 2010).

Indicator analysis: inequalities by country income, age and sex

Based on recent GBD data (WHO, 2011), Fig. 24 shows the inequalities of RTI mortality rates between high-income countries and low- and middle-income countries in the WHO European Region. Among all age groups and both sexes there is much higher RTI-related mortality in low- and middle-income countries. The relative inequality between countries with high national income levels versus those with low and middle national income levels is lowest in the 15–29 year age group in both males (low- and middle-income country to high-income country ratio of 1.6:1) and females (ratio of 1.8:1). The highest inequalities are found for children, with country income ratios of 3.4:1 (males, 0–4 years) and 3.3:1 (females, 5–14 years). Despite the much higher mortality rates in males, the ratio of high-income to low- and middle-income countries is on a similar level for males and females, showing that both sexes are, in relative terms, similarly disadvantaged by national income levels.

Fig. 24. RTI mortality rate/100 000 population by national income level, sex and age in the WHO European Region (2008)

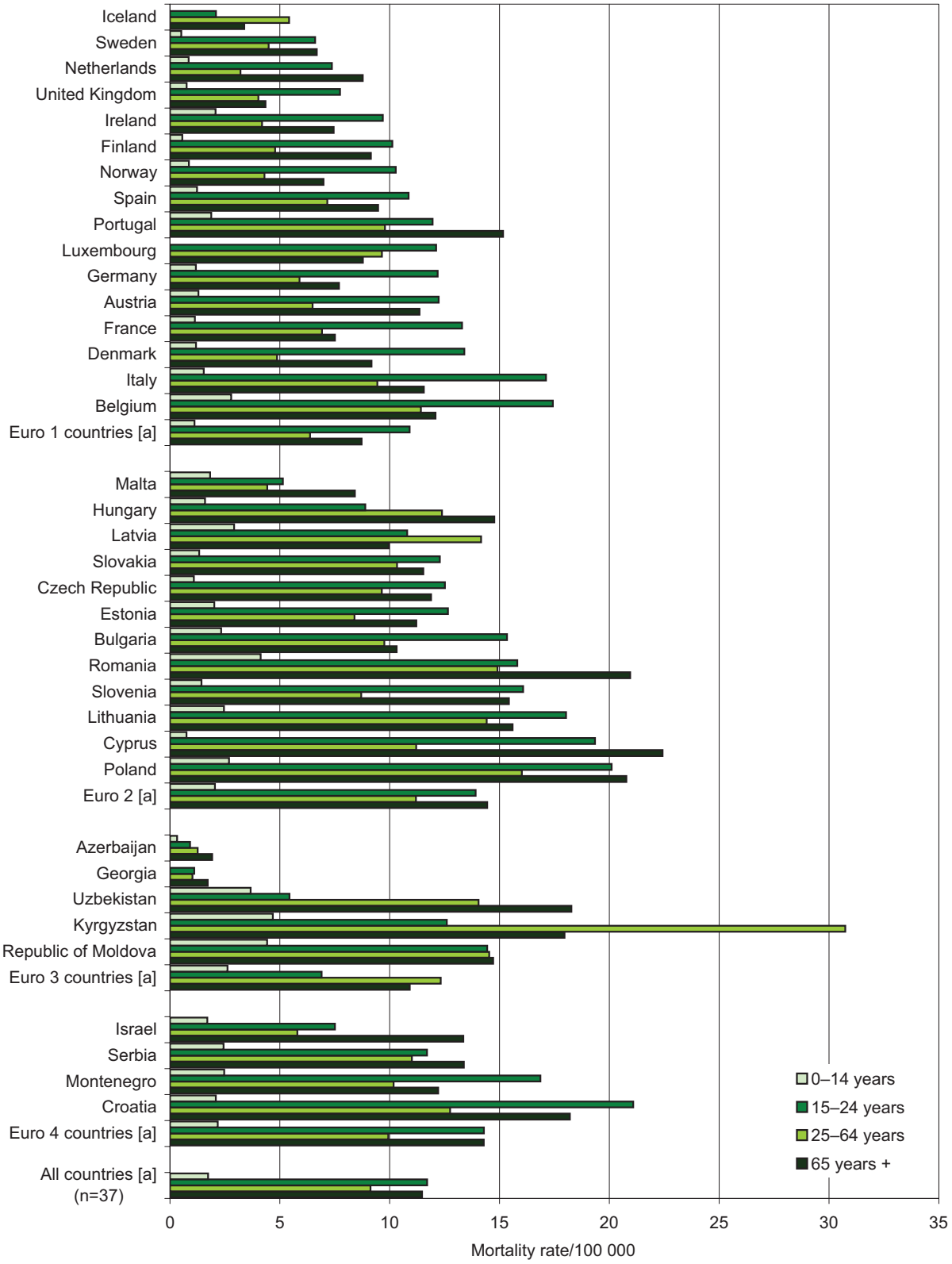


Source: calculated from GBD 2008 data (WHO, 2011).

A compilation of standardized mortality rates/100 000 by age group (0–14, 15–24, 25–64, 65+ years) is shown in Fig. 25a and the same calculation is shown in Fig. 25b using data on all transport-related mortality rates for those areas where RTI-specific data were not available.[7]

7 RTI data used for Fig. 25a are based on the DMDB (ICD-10 codes V01–V79 and V82–V89) and refer to all fatal injuries occurring on the roads, including those to pedestrians and cyclists. Fatal injuries to passengers of trains, aircraft and ships are excluded. Fig. 25b uses data on "Transport mortality" from the DMDB (MTL1 code 1096) for countries where detailed data on RTIs were not available.

Fig. 25a. Age-standardized mortality rate/100 000 population from RTIs by age group (last year of reporting)

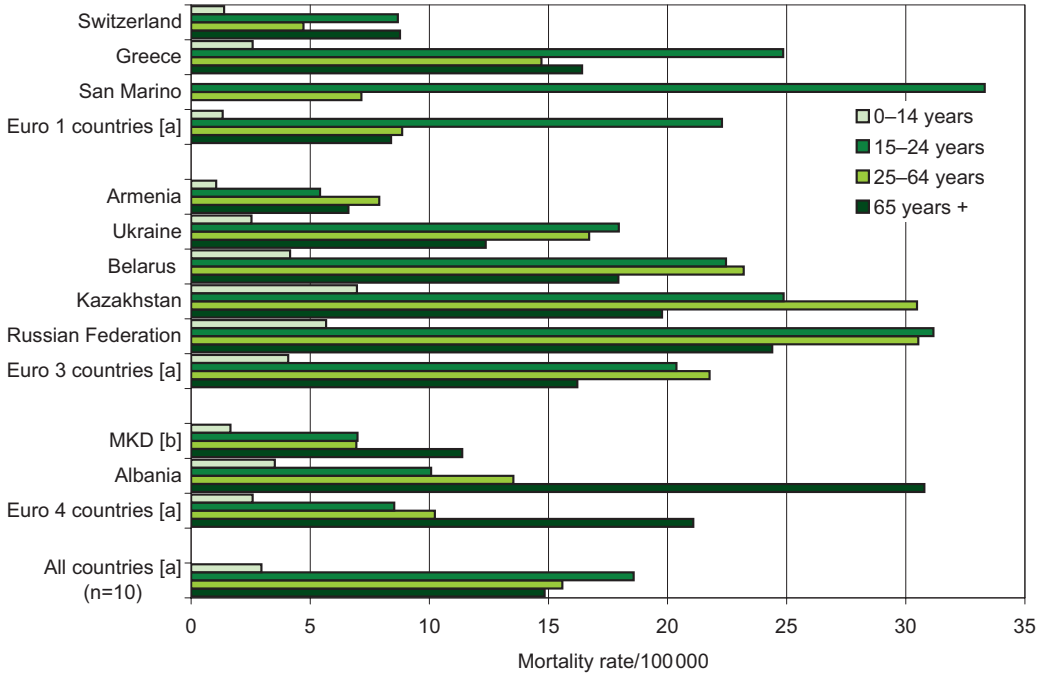


Source: data from DMDB, 2011.

Note: [a] average of national rates.

The aggregated data for all countries show that the lowest RTI mortality rate is among children, with an average of 1.7 deaths/100 000, while the mortality rates for all other age groups are much higher (see Fig. 25a). In 20 out of 37 countries the highest mortality rate falls in the 15–24 year age group (total average of 11.7/100 000), which is also the highest total average rate, followed by the highest age group (65 and older), at 11.5/100 000. Those aged over 65 years have the highest RTI mortality rates in 14 countries.

Fig. 25b. Age-standardized mortality rate/100 000 population from all transport injuries by age group (last year of reporting)



Source: data from DMDB, 2011.
Notes: [a] average of national rates; [b] MKD: ISO code for the former Yugoslav Republic of Macedonia.

Fig. 25b indicates a roughly similar situation for all transport mortality. All age groups have somewhat higher mortality rates than in the RTI-specific data, but – as with the RTI mortality data – child mortality rates are much lower (at an average of 2.9 deaths/100 000) than the rates for other age groups. The highest average mortality rate is found for the 15–24 year age group (18.6/100 000), but it is only a little lower for the 25–64 year age group (15.6/100 000) and the oldest age group (14.8/100 000).

Although the average aggregated data for all countries show no large differences between the three oldest age groups, Figs. 25a and 25b indicate that age variations can be rather different within countries. In fact, the relatively low mortality rate among children aged up to 14 years is the only commonality for all countries. In addition, countries show strong variations in the national level of transport-related mortality, with Albania, Kazakhstan, Kyrgyzstan, the Russian Federation and San Marino showing very high rates, exceeding 25/100 000 for at least one age group.

More detailed data for some countries show that intracountry variations in RTIs exist and can be quite diverse. Table 5 presents selected examples of countries with wide regional variations in RTI mortality (Spain: factor 3.7, Russian Federation: factor 3.8) and countries with lower regional disparities (Finland: factor 2.1, Hungary: factor 1.3).

Fig. 26 presents the differences by sex in road traffic-related mortality, showing the SR of fatal RTIs for different age groups. The mortality from RTIs is higher in males throughout all age groups, indicated by median values higher than 1.

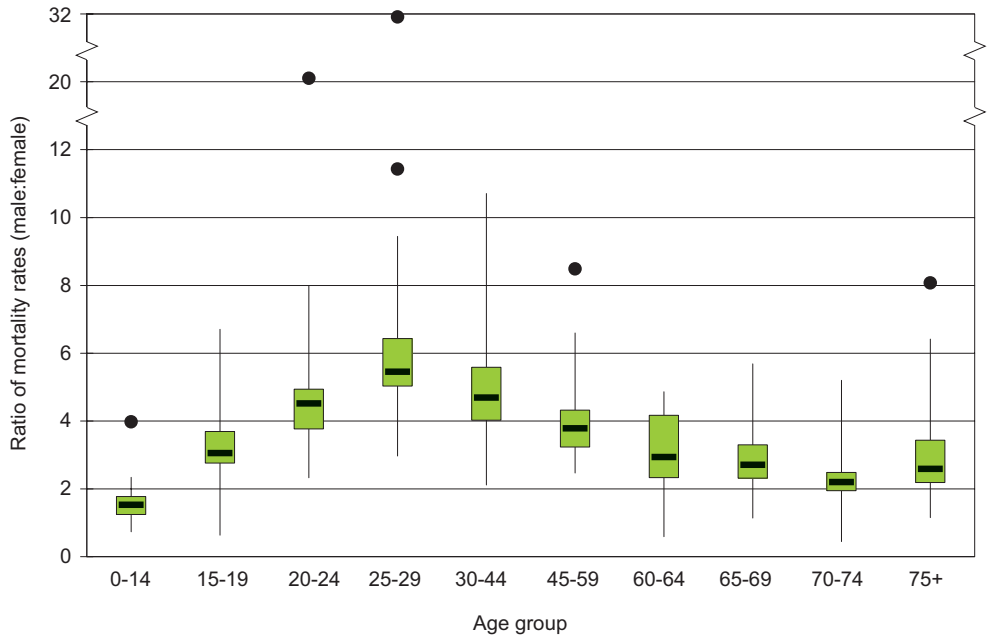
Table 5. Intracountry differences in transport-related standardized death rates/100 000 population for selected countries (last year of reporting)

	Finland (2009)	Hungary (2009)	Russian Federation (2001)	Spain (2008)
Minimum mortality rate	3.7	8.2	13.0	2.6
Average mortality rate	6.1	9.7	25.8	7.1
Maximum mortality rate	7.9	10.7	49.1	9.5
Factor between minimum and maximum rate	2.1	1.3	3.8	3.7

Source: data from MDB, 2011.

The inequality in RTI mortality levels between males and females is greatest for young adults, reaching a more than fivefold difference in those aged 25–29 years. After the age of 29 the inequality between the sexes decreases moderately to a SR between 2:1 and 3:1 in the older age groups. Analysis of the overall transport injury data from 47 countries shows that the average transport-related mortality is 15.7/100 000 for males and 4.2/100 000 for females, indicating that the male mortality rate is almost four times higher (DMDB, 2011).

Fig. 26. SRs by age group for RTI mortality (last three reporting years)



Source: data from DMDB, 2011.
Note: country coverage as for Fig. 25a.

Reversed sex-related inequalities with higher mortality rates in females can be observed in only three countries, but the difference is much smaller. Such inequality is found in the youngest age groups (0–14 years and 15–19 years) in Azerbaijan and Denmark; in the older age groups higher mortality rates in females are reported by Azerbaijan and Montenegro.

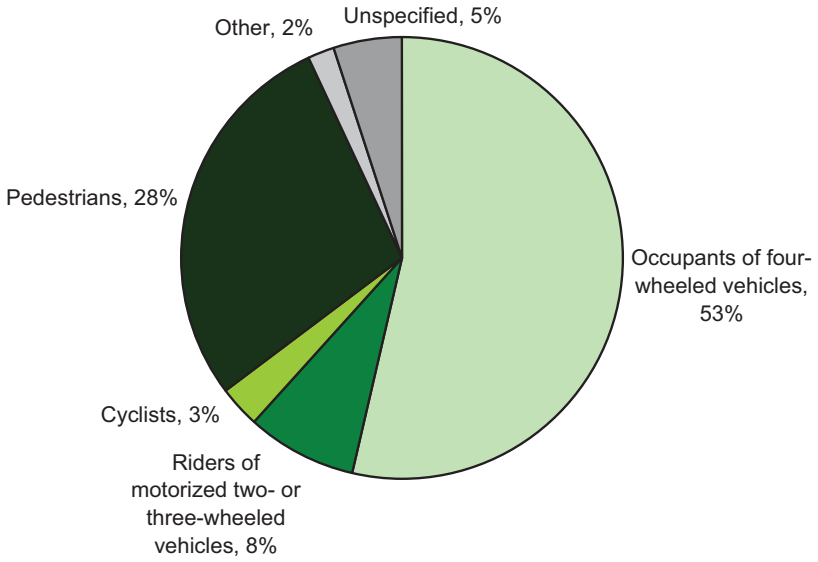
Target groups for action

Personal characteristics which influence vulnerability to RTIs are sex (males have a far higher incidence rate than females) and age (young adults and older road users have the highest incidence rates). Young adults also have higher rates of mortality from RTIs as car drivers. The age- and gender-associated lifestyle factors for this group, such as speeding or overconfidence in males, or driving under the influence of alcohol and drugs, raise the incidence of RTIs (Peden et al., 2004; European Commission, 2011).

In old age (65+ years), incidence of RTIs is determined by functional limitations (increased crash risk) and physical vulnerability (increased injury severity), which result in a higher risk of fatality than injury (European Commission, 2011).

Fig. 27 shows the distribution of RTI mortality by road user category, indicating that about one-half of all RTI mortality in the WHO European Region is suffered by car occupants. However, pedestrians account for 28% of all deaths from road traffic. A national example of transport mortality for different road users stratified by sex and age is provided for Malta in Annex 1.

Fig. 27. Distribution of RTI fatalities by road user category for the WHO European Region



Source: data from WHO, 2009, adapted. Data have been reported by countries for different years.

In urban areas, pedestrians are the most vulnerable road users, because they are usually not or scarcely protected. Unprotected road users are vulnerable to the greater mass and speed of motorized vehicles (European Commission, 2011). Among pedestrians, people aged below 10 and over 65 years are at especially high risk. Pedestrians have the highest fatality rate in urban areas and account for 33% of fatal RTIs. Pedestrians with low SES are at especially high risk because they have least access to safer modes of transport (Kay et al., 2011). In rural areas, however, car drivers have the highest incidence of fatal accidents (43%), while pedestrians account for only 9% of fatal RTIs in rural settings (European Commission, 2011).

Health implications

The health consequences of RTIs vary in severity. The most severe outcomes are fatal injuries, but the fatality rate is relatively low (2% in 2005) in comparison to other outcomes (European Transport and Safety Council, 2007). The recently decreasing fatality rates from RTIs are partially counteracted by an increased number of severe injuries with long-term consequences. More serious health implications can result in long-term or permanent disability such as spinal cord injuries (1.4% of all RTIs), a fractured thighbone (1.3%) and long-term intracranial injuries (1.2%). RTIs often result in short-term disability, such as short-term intracranial injuries (24.6%); open wounds (10.3%), various fractures and internal injuries (<6.3%) are less severe consequences of RTI (Peden et al., 2004). As an overall result of RTIs, 17% of all DALYs are lost (Racioppi et al., 2004).

Psychological effects of RTI include PTSD in all age groups, and the intangible costs and economic strains on affected families are high (Sethi et al., 2006a).

Conclusions and suggestions

There are inequalities in RTI-related death rates within and between all countries of the WHO European Region. Both age and sex play an important role but affect RTI rates differently: age differences appear to be rather country-specific, while males suffer more road deaths than females in all countries. The higher rate of mortality among males is partly because of greater exposure (they are more likely to be on the roads than females) and partly because of risk-taking behaviour on the roads. Income levels affect the magnitude of RTIs both in relation to country income levels – as indicated by Fig. 24 – and in relation to individual income and SES, as shown in literature on the subject (see Kay et al., 2011; Laflamme et al., 2009; Laflamme, Hasselberg and Burrows, 2010).

In order to tackle inequalities of fatal RTI rates and RTI-related adverse health outcomes, more detailed understanding about the causes of inequalities in the WHO European Region is required. The large national variations of inequality patterns mean that only broad guidelines or recommendations can be made (see, for example, Mock et al., 2004). A good starting point would be to decrease the overall incidence of RTIs, as suggested by the *World report on road traffic injury prevention* (Peden et al., 2004), the EU's *Policy orientations on road safety 2011–2020* (European Commission, 2010) and the *Global plan for the decade of action for road safety 2011–2020* (WHO, 2010c). This includes action on the environmental causes of RTIs, which are determined by, for example, urban structure, road design and land use patterns (Prüss-Üstün and Corvalán, 2006). Changes to the environment such as better urban and street planning, street maintenance, installation of adequate street lighting and general traffic calming have already been shown to be effective interventions (Bunn et al., 2003; Beyer and Ker, 2009).

Nevertheless, targeted and specific approaches are necessary to reduce RTIs in the main risk groups. There is a need to decrease the occurrence of RTIs in young adults – specifically males – and also to reduce the vulnerability of older road users.

Suggested mitigation actions are:

- separating motorized vehicles from unprotected and less protected road users such as pedestrians and cyclists;
- implementation of traffic-calming measures to decrease vehicle speed in urban areas;
- promoting the use of individual safety measures (such as seatbelt, child car seat and helmet use);
- legislation and enforcement of laws that control speed, drink–driving and ensure safety equipment use;
- promotion of safe driving behaviours in general and consideration given to specific campaigns targeted at main risk groups such as male drivers;
- better reporting on RTIs, including their distribution by sociodemographic groups;
- implementation of the EU's *Policy orientations on road safety 2011–2020* (European Commission, 2010) and the *Global plan for the decade of action for road safety 2011–2020* (WHO, 2010c).

INEQUALITIES IN FATAL POISONING

Introduction

Unintentional poisoning is the third leading cause of death from injury in Europe (Bauer and Steiner, 2009). In 2008, 84 059 people died in the WHO European Region from unintentional poisoning, corresponding to a mortality rate of 9.5/100 000 (WHO, 2011). Poisonings have a wide variety of causes, ranging from chemicals and medicine in the home to alcohol intoxication.

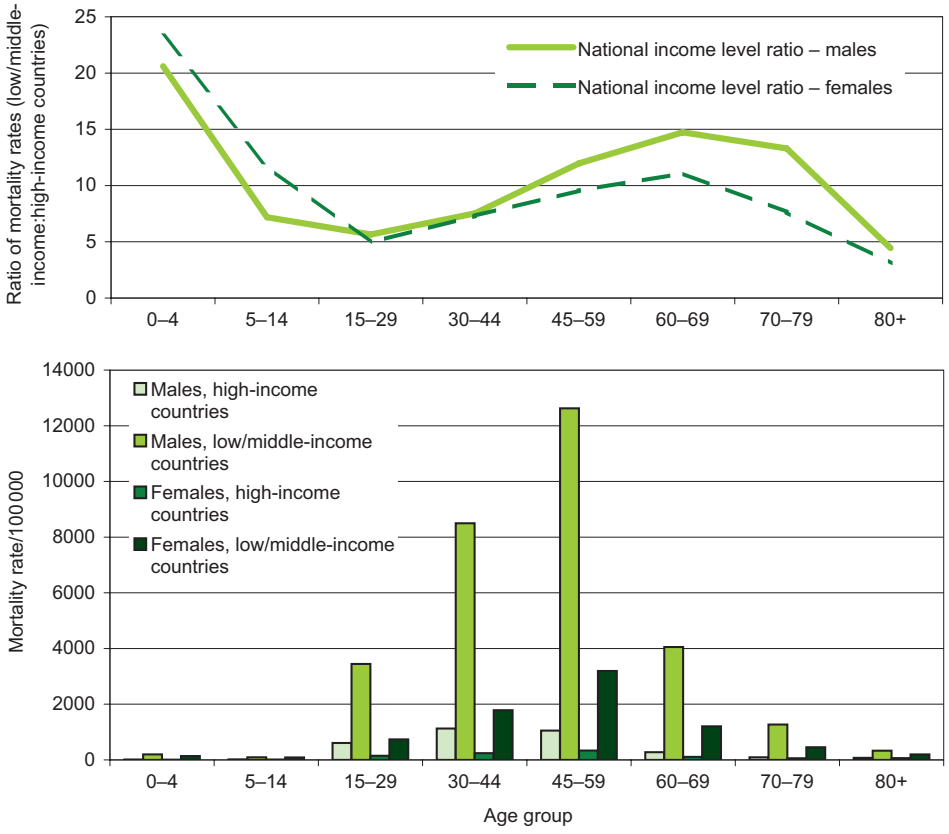
Recent research has identified an association between age and type of poisoning. Among the elderly, the main causes of poisoning are smoke from fire or other gases, and chemicals, pharmaceuticals and food (Centre for Research and Prevention of Injuries, 2011). Among adults in the middle age categories alcohol is the main cause of poisoning. Additional causes lie in a variety of exposures, most – but not all – of which are occupational ones. In young adults, substance abuse (including alcohol) is the main cause of poisoning; this type of poisoning is on the increase. The associated health effects of such poisoning are dependent on the substance (Sethi et al., 2006b). As many as 90% of poisonings among children occur at home: substances involved in childhood poisoning are often pharmaceuticals, cleaning fluids, cosmetics and other chemicals found in and around the home, as well as certain plants which cause poisoning (European Child Safety Alliance, 2011). Carbon monoxide exposure in the home and lead exposure in the general environment are additional sources of poisoning.

Factors associated with higher rates – or consequences – of poisonings are household poverty, living in deprived communities, single parenthood and overall low SES (Sethi et al., 2006a). Among children in particular, socioeconomic inequalities in unintentional poisoning risk can be strong (Laflamme, Hasselberg and Burrows, 2010). It is noteworthy that the risk of injury from poisoning can be particularly high in migrant populations as shown, for instance, in the Netherlands (Stirbu et al., 2006).

Indicator analysis: inequalities by country income, age and sex

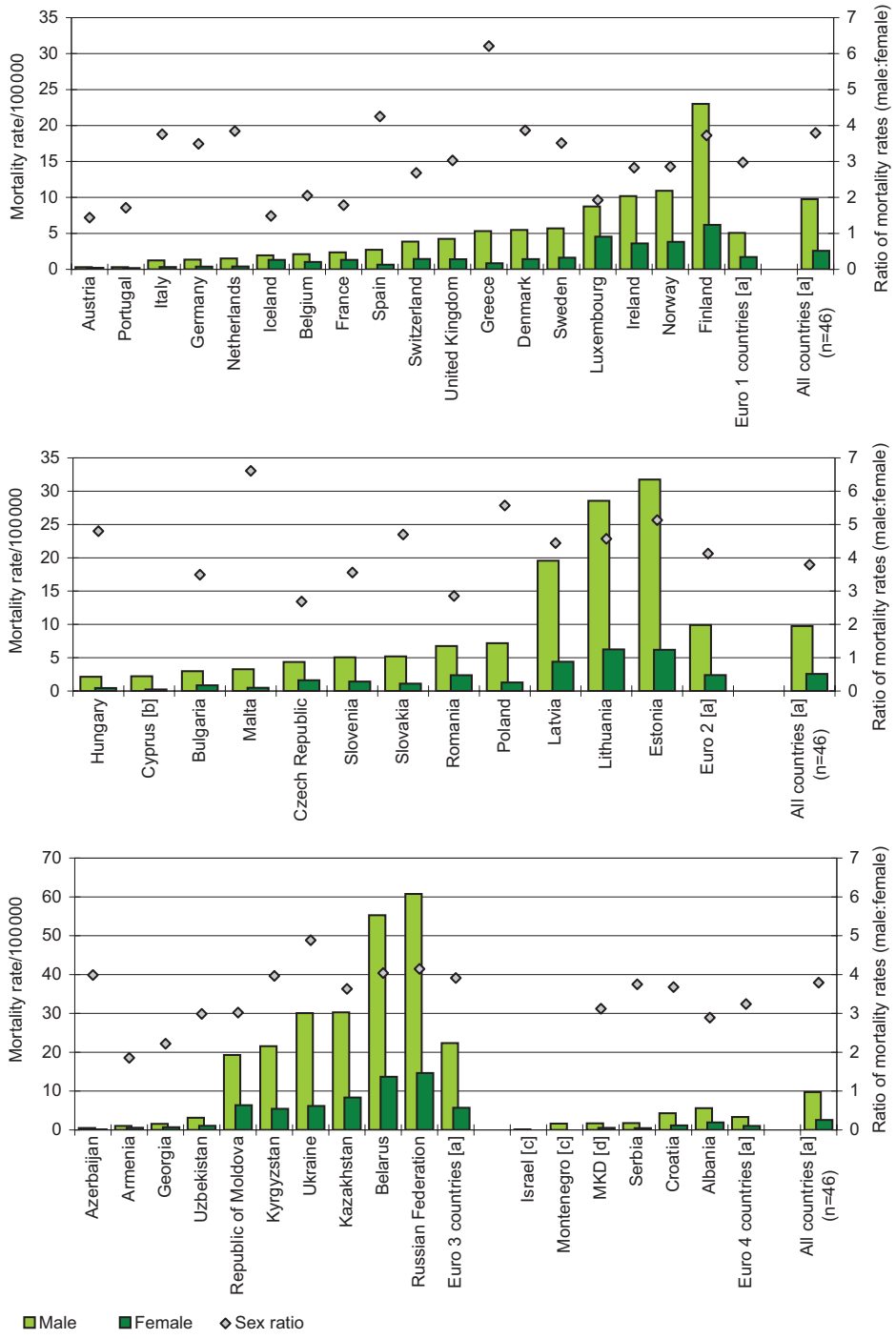
Recent GBD data (WHO, 2011) indicate that inequalities in mortality rates from poisoning between high-income and low- and middle-income countries are strongly to the disadvantage of the poorer countries (see Fig. 28). The differences are even greater than those found for RTIs (see Fig. 24). Small children (0–4 years) in low- and middle-income countries are especially affected, with a mortality rate more than 20 times higher than those in high-income countries (both males and females).

Fig. 28. Poisoning mortality rate/100 000 population by national income level, sex and age in the WHO European Region (2008)



Source: calculated from GBD 2008 data (WHO, 2011).

Fig. 29. Poisoning mortality rate/100 000 population by sex (last year of reporting)



Source: data from DMDB, 2011.

Notes: [a] average of national rates; [b] Cyprus: SR=11.0; [c] data reported for fatalities in males only; [d] MKD: ISO code for the former Yugoslav Republic of Macedonia.

Mortality rates for males are much higher, as with the RTI data (Fig. 24), but the mortality rate ratios of low- and middle-income to high-income countries are very similar, indicating that the impact of national income levels is similar for both males and females.

Data from the DMDB reveal that the average mortality rate from poisoning is 9.8 and 2.6/100 000 for males and females respectively – a SR of 3.8:1 to the disadvantage of males. Fig. 29 shows that this increased risk in males is reflected in all countries but expressed at very different levels of magnitude: the SR is lowest in Austria at 1.4:1 and exceeds 6:1 in Cyprus, Greece and Malta. However, the data also

indicate that the intercountry variability of poisoning rates – with the highest occurrences in the Euro 3 subregion – is more remarkable than the general sex-specific variability, which does not differ much between the Euro regions (ranging from an SR of 3:1 in Euro 1 to an SR of 4.1:1 in Euro 2). A national example of poisoning mortality stratified by age, sex and urban versus rural residence is provided for Poland in Annex 1.

Table 6 shows the proportion of alcohol poisoning among all poisonings for those countries reporting such data. Alcohol causes one-third (33.9%) of all poisonings on average, but there are extreme intercountry variations, with the contribution ranging from 3.6% (Belgium) to 78.6% (Poland). The SR of 3.7:1, however, is similar to the SR for all poisonings (3.8:1).

Table 6. Alcohol-related poisoning mortality rate/100 000 population by sex (last year of reporting)

Country	Alcohol-related poisoning			Ratio of mortality rate (male:female)	Percentage of all poisonings related to alcohol
	Total	Male	Female		
Belgium	0.1	0.1	0.0	5.6:1	3.6
Denmark	0.3	0.4	0.2	2.2:1	7.8
Finland	8.0	13.3	2.7	4.9:1	54.8
France	0.3	0.5	0.1	4.5:1	17.3
Germany	0.2	0.3	0.1	3.0:1	19.5
Ireland	2.1	2.8	1.4	2.0:1	30.4
Italy	0.0	0.0	0.0	1.5:1	4.0
Luxembourg	3.8	4.8	2.8	1.7:1	56.4
Netherlands	0.1	0.1	0.1	0.9:1	7.5
Norway	1.0	1.3	0.7	1.9:1	13.2
Portugal	0.0	0.0	0.0	2.1:1	11.2
Spain	0.1	0.1	0.1	2.6:1	5.9
Sweden	1.1	1.5	0.6	2.6:1	28.6
United Kingdom	0.4	0.6	0.3	2.3:1	15.1
Euro 1 countries [a]	1.2	1.8	0.6	2.9:1	19.7
Bulgaria	0.5	0.8	0.3	2.2:1	29.0
Czech Republic	1.7	2.6	0.8	3.4:1	56.4
Estonia	8.2	13.6	3.7	3.7:1	44.3
Latvia	7.0	12.5	2.5	4.9:1	62.6
Lithuania	10.0	16.9	4.2	4.1:1	60.5
Poland	3.2	5.9	0.8	7.4:1	78.6
Romania	1.9	3.1	0.8	3.8:1	42.3
Slovakia	2.3	3.9	0.7	5.2:1	74.5
Slovenia	0.9	1.7	0.2	6.7:1	28.9
Euro 2 countries [a]	4.0	6.8	1.6	4.3:1	53.0
Georgia	0.7	1.0	0.4	2.6:1	58.5
Kyrgyzstan	8.0	13.3	3.4	3.9:1	62.0
Republic of Moldova	5.3	8.3	2.8	3.0:1	43.4
Uzbekistan	0.3	0.6	0.1	4.7:1	15.8
Euro 3 countries [a]	3.6	5.8	1.7	3.4:1	44.9
Croatia	0.5	0.8	0.1	6.5:1	16.7
Euro 4 countries [a]	0.5	0.8	0.1	6.5:1	16.7
All countries (n=28) [a]	2.4	4.0	1.1	3.7:1	33.9

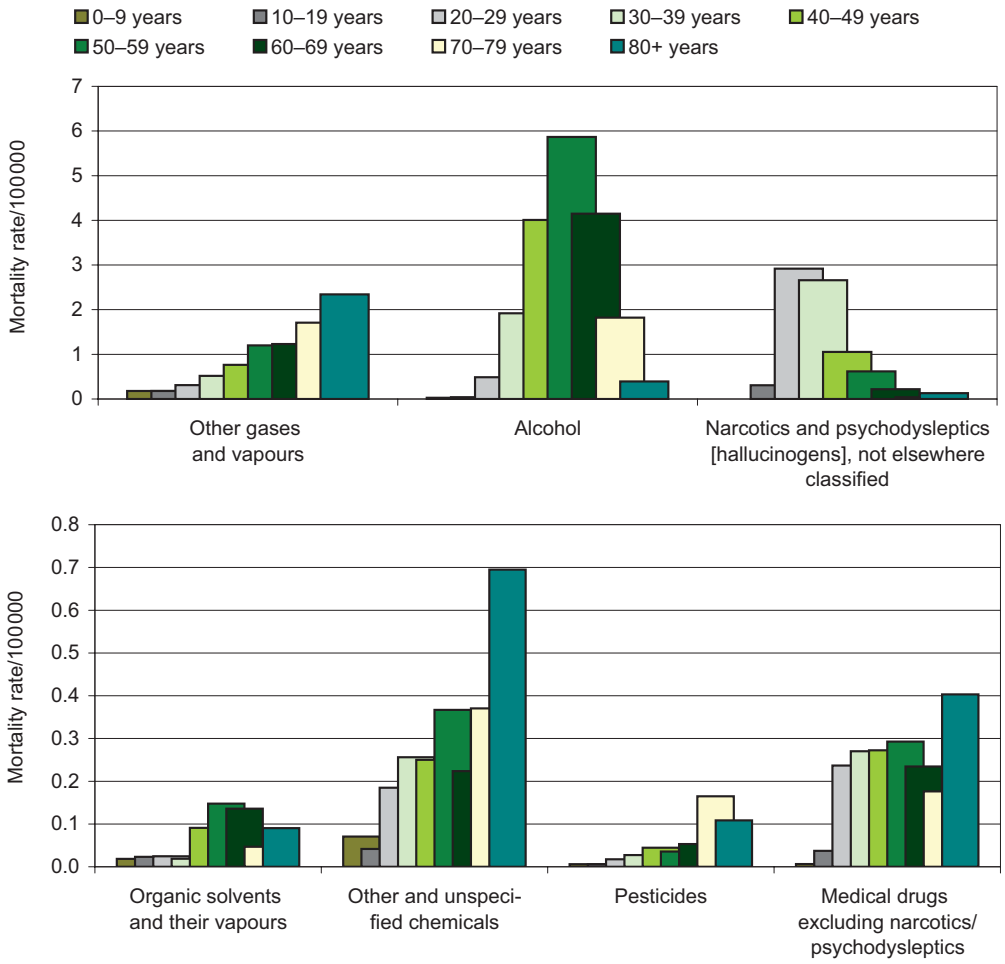
Source: data from DMDB, 2011.

Note: [a] average of national rates.

An analysis of intracountry regional variation for a subset of 12 countries reporting subnational data shows that the poisoning mortality rates reveal smaller intra- than intercountry differences, with the exception of the Russian Federation where regional rates range from 1.2–130.3/100 000 (MDB, code 7420).

Regarding age-related inequalities, Fig. 30 confirms that there is a specific age profile for each of the various causes of poisoning reported in the DMDB. Generally, rather low mortality rates are found in the youngest age group (0–19 years), followed by increased mortality rates with rising age up to 39 years. The starkest increase is identified for narcotics and psychodysleptics, representing illegal drugs. Thereafter, mortality trends in the different age groups vary by poisoning cause. The elderly are the main risk group for gases and vapours, pesticides and unspecified chemicals, while the rates for narcotics decrease again after the age of 39. Older adults are the main risk group for alcohol, organic solvents and vapours.

Fig. 30. Poisoning mortality rate/100 000 population by age group and cause (last year of reporting)



Source: data from DMDB, 2011.

Furthermore, Fig. 30 shows that the total magnitude of age-related inequalities varies by cause of poisoning. The overall highest mortality rates are alcohol-related, characterized by strongly increasing mortality rates with increasing age, to a maximum mortality rate of 5.9/100 000 for the 50–59 year age group. Narcotic substances cause the second highest mortality rates. The rates of fatal poisoning by pesticides are the lowest ones.

Analysis of all poisoning causes by sex (data not shown) indicates that, in general, there is a higher prevalence of poisoning among males than females for almost all substances. The largest differences by sex are seen for alcohol – as shown above – as well as for narcotic substances and non-organic gases and vapours. On the other hand, several countries indicated a higher level of pesticide poisoning among females, including Croatia and Bulgaria (where mortality among females is double that among males) and Portugal (where mortality among females is six times higher).

Target groups for action

Males have higher mortality rates from poisoning than females. People in their fifties (50–59 years) constitute the age group with the highest overall mortality rates, but this is strongly related to alcohol poisoning, which is the most relevant single cause of fatal poisoning. However, seen from a cause-specific perspective, the older population is a key risk group for many poisonings.

By far the highest mortality rates are found in the countries of the Euro 3 region but the Baltic countries – together with Finland – represent another geographical poisoning hotspot.

Low national income levels strongly increase the overall risk of poisoning, but – in contrast to the higher proportions of mortality among adults and the elderly described above – especially affect poisoning rates among small children. However, the DMDB data do not provide information on poisonings by socioeconomic attributes of individual victims, and thus this dimension could not be studied.

Health implications

The health effects of poisonings can be wide-ranging in scope and duration because of the variety of poisonous agents. Symptoms of poisoning often include nausea, vomiting, stomach cramps, pain, diarrhoea and bloody stools. Fever, chills, headaches and weakness can also occur, and more severe cases can lead to shock or collapse (Winter Griffith, Moore and Yoder, 2006). Extreme poisoning can lead to death.

Besides acute poisoning related to CO, alcohol or consumption of hazardous items, for example, long-term poisoning such as lead poisoning can occur, which can cause fatigue or sleeping disorders, behaviour changes in adults and children, stomach discomfort, headache, vomiting and weight loss (Winter Griffith, Moore and Yoder, 2006).

Overall, poisoning is among the 15 leading causes of total DALYs lost. 2 156 438 DALYs were lost through poisoning in low- and middle-income countries in the WHO European Region in 2000 (Peden, McGee and Krug, 2002).

Conclusions and suggestions

Although injuries from poisoning are preventable to a high degree, they are an important cause of mortality and morbidity and time trends show that they persist. Those most affected by fatal poisonings are males in their fifties, where alcohol plays a major role. Alcohol is also a major concern, as is the use of drugs. However, other sources of poisoning to which people of all ages can be exposed at home, at work or in the general environment, also need close attention regarding their prevention.

For all vulnerable groups, the maintenance or establishment of a suitable network of poison control centres would enable fast and effective help in emergency situations.

Further information about the occurrence of poisonings, underlying causes and vulnerable groups should also be identified and analysed.

Suggested mitigation actions are:

- reducing alcohol poisoning by implementation of the Global Strategy to reduce the harmful use of alcohol (WHO, 2010d);
- reducing the risk of child poisoning through preventive measures, including safe packaging (manufacturers) and safe storing (home safety practice) of dangerous items and substances, as well as initiatives promoting increased parental supervision;
- a ban on production and availability of lethal substances;
- ensuring and promoting working and living conditions free from toxic or poisonous materials;
- establishment or maintenance of poison control centres and provision of information to the public on risks of intoxication from the main causes of poisoning;
- improving the surveillance systems monitoring the trends, causes and social context of poisoning cases.

INEQUALITIES IN FATAL FALLS

Introduction

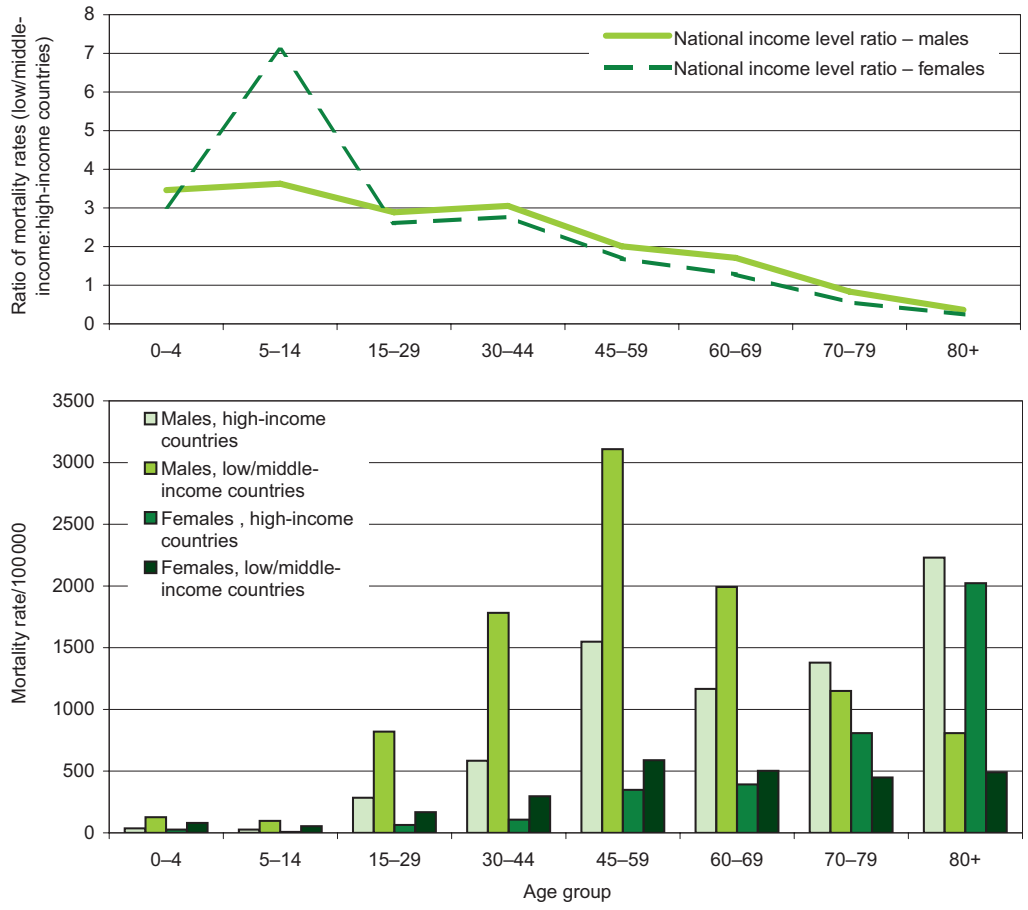
Falls are the second leading cause of unintentional injury deaths globally (WHO, 2010e). In the WHO European Region, 65 991 fall-related deaths occurred in 2008 (WHO, 2011). Falls are also the leading cause of non-fatal unintentional injuries in children (Sethi et al., 2008), although there is a strong association between age and type of fall, and the incidence and the health consequences of falls are by far the highest and most severe among the elderly. There is evidence that non-fatal fall injuries are in general more common among females and fatal ones more common among males (WHO, 2007a). There is also evidence that some types of falls are more representative of people in good physical condition whereas others falls are more typical for people in poorer physical condition, especially among older people (Kelsey et al., 2010). Falls occur in many different manners and circumstances – at work, at home, when commuting, during sports and leisure time, and so on.

Studies on the socioeconomic distribution of fall-related injuries indicate that high SES (measured in terms of education or income, for example) can be associated with a lower rate of falls in different age groups (among children and older people in particular), but the results are not consistent (WHO, 2007a; Sethi et al., 2008). Inequalities in fall-related injuries occur as a result not only of individual differences but also as a consequence of environmental disparities, including the built environment (such as the design and condition of stairs and balconies), and the products people make use of or are exposed to (WHO, 2007a). Unsafe and inadequate housing and living environments lead to higher rates of injury risk.

Indicator analysis: inequalities by country income, age and sex

Fig. 31 shows income-related inequalities in fatal falls/100 000 between males and females in high-income countries versus low- and middle-income countries. As with the other injury types (see Figs. 24 and 28), low- and middle-income countries have higher rates of fatal falls up to the 60–69 year age group. However, in the two oldest age groups the picture is reversed and the rate of fatal falls in high-income countries exceeds those in the low- and middle-income countries. Income ratios for males and females are very similar throughout all age groups, except for a peak in females in the age group 5–14 years. In all other age groups the rate ratio is slightly higher for males than females.

Fig. 31. Fall mortality rate/100 000 population by national income level, sex and age in the WHO European Region (2008)



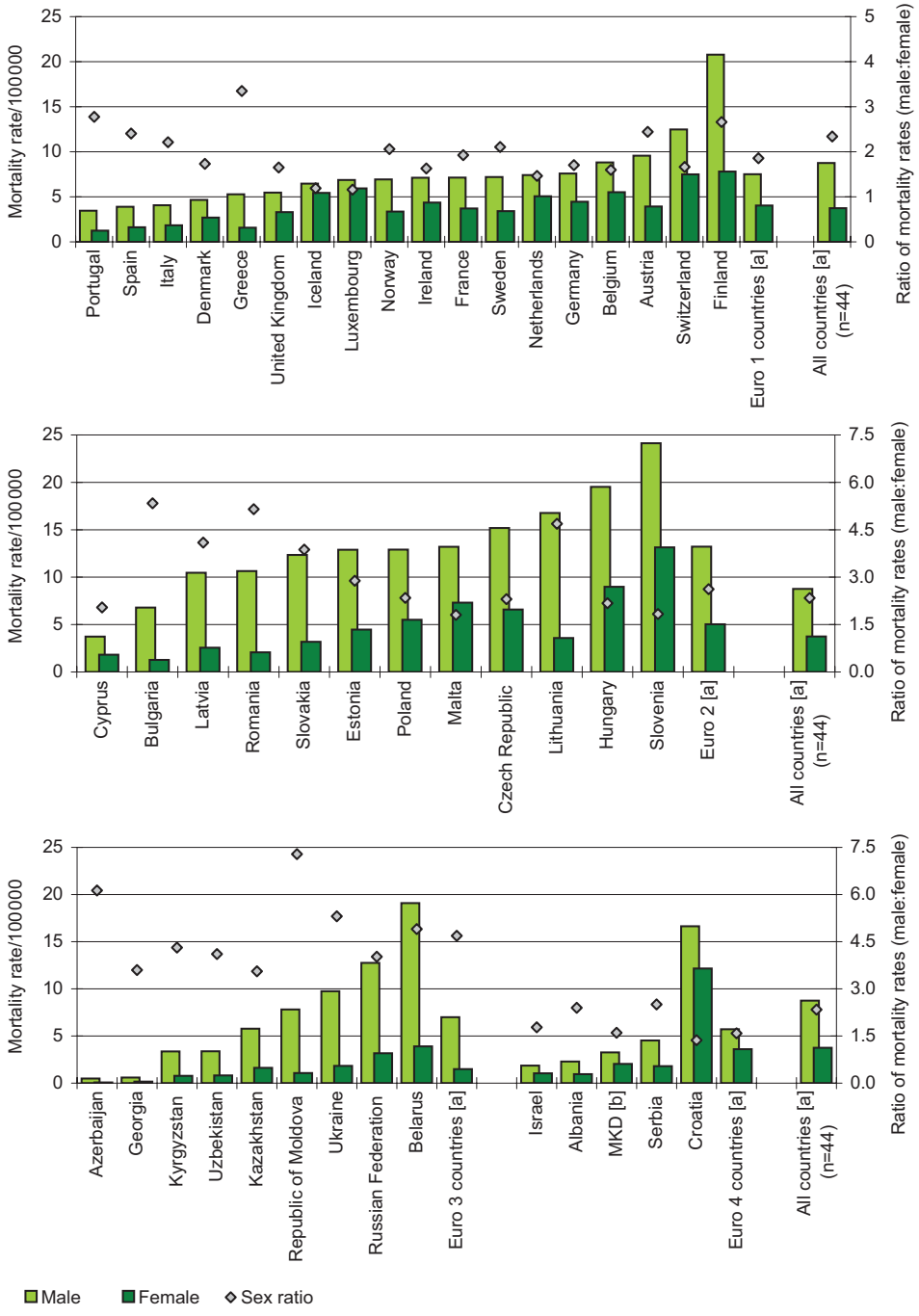
Source: calculated from GBD 2008 data (WHO, 2011).

The available data indicate that males have a higher level of mortality from falls than females in all countries of the WHO European Region (see Fig. 32). On average, the fall mortality rate/100 000 is 8.8 in males and 3.7 in females (SR 2.3:1) but as shown, intercountry differences are stark; the highest differences by sex are identified in the Euro 3 countries with an average SR of 4.7:1, along with the highest national SRs of 6:1 and higher (in Azerbaijan and the Republic of Moldova). High levels of sex-related inequality are also found for some Euro 2 countries such as Bulgaria and Romania, which show SRs of more than 5:1, while lower levels are identified for Euro 1 countries, with the lowest disparities in Iceland and Luxembourg (SR 1.2:1). In consequence, the SRs of fatal falls show a wide range from 1.2:1 to 7.3:1.

For both males and females, age-based differences reveal relatively low fall mortality rates – below 3/100 000 for both sexes – in the younger age groups (0–24 years), followed by a remarkable and quite steady increase thereafter (see Fig. 33). After the age of 64 years, a continued rise in incidence rates for both sexes occurs, the peak being reached in the oldest age group (85 years and over) with mortality rates of 130/100 000 females and 140/100 000 males. However, the data also show that the largest relative differences between males and females actually occur in the middle age range (20–59 years of age), and that this difference almost disappears with rising age.

A national example of fall mortality stratified by age and sex for Romania (see Annex 1) indicates that sex-related differences can be more strongly expressed within certain countries.

Fig. 32. Fall mortality rate/100 000 population by sex (last year of reporting)



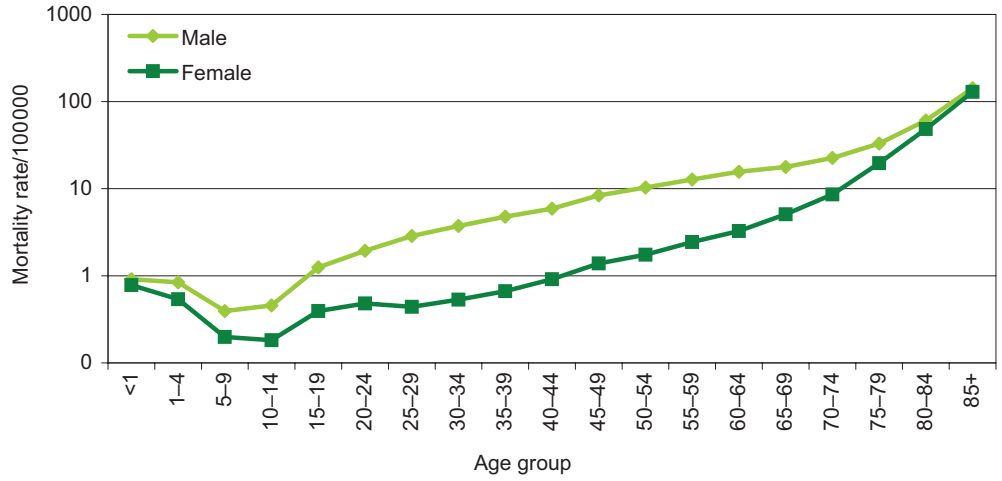
Source: data from DMDB, 2011.

Notes: [a] average of national rates; [b] MKD: ISO code for the former Yugoslav Republic of Macedonia.

Target groups for action

Fatal falls appear to affect males and older people to a greater extent. Globally, sex-related differences are more pronounced in the middle age categories (30–60 years) but remain smaller than age-related differences. Fall injuries among older people are, in fact, a major public health concern in Europe. A variety of individual factors contribute to explain the vulnerability of the older population, including frailty, impaired cognitive and visual capacity to handle certain situations and general health condition (OECD, 2001). In addition, the surrounding environment inside and outside the home can either aggravate or minimize the consequences of those individual vulnerability factors.

Fig. 33. Fall mortality rate/100 000 population by age (last year of reporting)



Source: data from DMDB, 2011.

Although the data do not provide evidence on the socioeconomic dimension of falls, some evidence from other studies and data sets can be referred to. In 2000 there were strong differences in fatal falls between high-income and low- and middle-income European countries, with 2.4 times more DALYs lost in low- and middle-income countries than high-income countries (Peden, McGee and Krug, 2002).

Some studies have indicated that high SES is associated with a lower rate of falls among children and older people, but the impact of SES does not seem to be consistent (WHO, 2007a; Laflamme, Burrows and Hasselberg, 2009; Sethi et al., 2008). The same applies to studies conducted at the area level, such as those comparing different neighbourhoods.

Health implications

77% of all home injuries among small children (up to five years) are due to falls (Bauer and Steiner, 2009), but in childhood, falls are seldom lethal and many children suffer only minor injuries and temporary disabilities due to falls. The most frequent injuries to children from falls are fractures (43%) followed by contusions and bruises (22%) (Kuratorium für Verkehrssicherheit, 2009). In adolescence and adulthood, falls frequently lead to hospitalization, and the effects include temporary as well as chronic functional constraints or other general limitations (Williams et al., 2011).

Among older people, falls have the most severe health outcomes, such as hip fractures, and show strongly increasing mortality rates from the age of 65 years. Fall-related injuries can impair autonomy and quality of life dramatically; as a result, a fear of falling is frequently observed among older people, restricting physical activity and mobility levels and possibly even increasing the risk of falls. In addition, such fear impacts social life negatively and can even lead to depression (WHO, 2007a).

Conclusions and suggestions

The available data indicate that age-related differences are more important than sex-related differences when it comes to fall injury mortality. However, sex-related inequalities exist and vary substantially with age: male mortality from falls surpasses that of females at all ages, although the highest difference between the sexes is found among the middle age categories.

In order to reduce the inequality in fall death rates, fatality as the most severe outcome in old age should be prevented and reduced. Efforts should be made to maintain or improve physical capacity through fitness programmes or to adapt dwellings to the needs and abilities of the elderly population through

home modification programmes. Regional inequality data reveal that the reported fall-related mortality rates for older people are surprisingly low in the Euro 3 countries. However, research shows that there were no governmental injury prevention programmes reported or in place in that region (Armour-Marshall et al., 2011), which may indicate a need for more research and monitoring.

Young children would benefit from higher safety standards at home (European Child Safety Alliance, 2009) as they suffer most from fatal falls within the age group below 25 years. Targeted action to protect children could therefore also help to close this gap.

Suggested mitigation actions are:

- safer building codes and especially adequate and adaptable homes for the elderly;
- a number of evidence-based safe practices to prevent the occurrence and consequences of children falling in the home (such as window guards and stair gates) (European Child Safety Alliance, 2009);
- creating and maintaining physical activity-friendly residential environments that support active living and especially active ageing;
- better research into the socioeconomic and sociodemographic determinants of fatal falls and the occurrence of falls in adults – especially adult males – to create targeted action to decrease inequalities and avoid an early onset of the risk of fatal falls.

CONCLUSION ON INJURY-RELATED INEQUALITIES

Injuries are an increasingly important source of concern both globally and within Europe, where they are a leading cause of mortality and disability. Injuries are, however, often preventable, whether sustained at home, at work, in the traffic environment or during leisure time: numerous evidence-based strategies have already been identified that can be implemented to reduce either the likelihood of their occurrence or the severity of their consequences (Sethi et al., 2006b; Peden et al., 2004; WHO, 2007c).

Sociodemographic inequalities in injury rates are also preventable: they can be avoided and they are reversible (Laflamme, 1998). Reaching and sustaining health targets in the WHO European Region requires not only safety-for-all policies and interventions but also equality-oriented ones (Whitehead and Dahlgren, 2006; Dahlgren and Whitehead, 2006). Equality-oriented measures may build on initiatives aimed at narrowing the safety divide between the worse- and better-off or focused solely on people or neighbourhoods in poverty (Laflamme, Burrows and Hasselberg, 2009; WHO, 2009b).

In the foregoing analysis, emphasis was placed on demographic differences within and between European countries and subregions. The differences between individual countries are much more strongly expressed than those between regions, making deductions on a subregional level difficult. Sex-related differences to the detriment of males were reconfirmed, although the magnitude of the differences by sex varied across health inequity indicators. For RTIs, for instance, the highest sex-related inequality arose among young adults (25–29 years), where the male mortality rate was more than five times higher than that of females. For fall-related mortality, rates were on average more than twice higher in males than females, but sex-related differences were most pronounced in the 20–59 year age range. Age-related differences varied too: the most striking ones were found for fall-related mortality, where rates were relatively low during the first decades of life, increasing somewhat thereafter, and rising remarkably after the age of 60, reaching a peak in the eighties. The analysis was based on severe (work-related) and fatal (RTI-, fall-, poisoning-related) injuries, but those represent "the tip of the iceberg". A set of analyses comparing high-income countries with low- and middle-income ones indicated that a high level of national income is associated with a lower risk of injury. Although this observation

was expected, the mechanisms lying behind it remain to be determined. It is also of note that wide differences exist between countries of similar economic levels, which is why a potential for improvement exists for all countries.

Recommendations include a set of diverse actions and involve resources from different sectors, including – but not limited to – the health sector. The experience accumulated from those sectors where extensive progress has been made, at least in some countries, demonstrates that environmental changes and so-called "passive" measures of prevention have the greatest and most long-lasting impact on injury rates (WHO, 2007c; WHO, 2009); they also have the advantage of being less stigmatizing. What such measures do, using Haddon's (1980) terminology, is "eliminate", "separate", "isolate", or "modify" the sources of danger. Similar strategies have been employed in various environments (for example, in traffic, at home and at work) with considerable success. Taking the traffic environment as an example, differential exposure to hazards may be addressed by countermeasures ranging from modifications of the environment itself (such as traffic separation or traffic calming) to improvements in the functioning of public transport systems (see Table 7).

Table 7. Haddon matrix applied to a road traffic crash

Phases	Factors			
	Human	Vehicle	Physical environment	Social environment
Pre-event	Attitudes Knowledge Use of alcohol Driver experience	Vehicle condition Speed	Roadway design Traffic calming Pedestrian facilities	Traffic laws Cultural norms
Event	Use of seat belts Wearing fastened helmet	Seat belts Helmets	Shoulders, medians Guardrails	Helmet and seat belt laws
Post-event	First aid Medical treatment	Fire risk	Availability of trauma care equipment Traffic congestion	Standards of trauma care in hospitals

Source: data from Hazen and Ehiri, 2006, adapted.

It must also be emphasized that prevention and control of injury risk are significantly aided by – and sometimes a pre-condition for – well-defined and enforced legislation and regulations (WHO, 2007c). Such legislation can be safety-oriented, determining minimum standards and conditions under which a number of activities or tasks can be performed (for example, during leisure time and sports or on the road). It can also impose safe behaviours and practices that would not be adopted by all on a voluntary basis only (such as the fitting of car restraints, bicycle helmet use and reducing alcohol consumption). Well-anchored legislation has a great potential not only to improve safety for all but also to narrow the safety divide and reduce injury-related inequality.

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CHAPTER 4

ENVIRONMENT-RELATED INEQUALITIES

CHAPTER 4. ENVIRONMENT-RELATED INEQUALITIES

Gabriele Bolte

Key messages

- In EU15 countries, prevalence of complaints about noise from neighbours or from the street is higher among individuals living in relative poverty. This inequality is not apparent in NMS12 countries.
- The direction and degree of social inequalities in complaints about lack of access to recreational or green areas depends on the local or regional situation in a given country or region, and on the socioeconomic indicator analysed. The expectation that disadvantaged groups might be more affected by a lack of access to recreational or green areas is mostly met in the EU15 region, while NMS12 and Euro 4 countries show more variation.
- Gender differences are relevant in sociodemographic inequalities in access to recreational or green areas.
- Among non-smokers, socioeconomic inequalities in second-hand smoke exposure at home exist with a higher exposure among disadvantaged groups, characterized by unemployment, difficulty paying bills most of the time, or low self-assessed social position.
- Among non-smokers in EU27 countries, prevalence of exposure to second-hand smoke indoors at work is higher among manual workers and among those individuals with difficulty paying bills most of the time.
- In the majority of countries, working non-smoking males were more often exposed to second-hand smoke at work than working non-smoking females.
- In accordance with the scientific literature, independent of the socioeconomic indicator used, socially disadvantaged individuals in EU15 countries mostly have a higher self-assessed exposure to noise, lack of access to recreational or green areas, and exposure to second-hand smoke at home or at work. In contrast, socially advantaged individuals in NMS12 countries appear to reside in urban neighbourhoods where environmental burdens such as noise or lack of access to recreational or green areas may occur more frequently.

INTRODUCTION

It has been estimated that approximately one-quarter of the global disease burden – and more than one-third of the burden among children – is caused by modifiable environmental factors, which include physical, chemical and biological hazards. Cardiovascular disease and cancer, as well as health-related behaviour – such as physical activity as a mediating factor – are the most relevant outcomes of noncommunicable disease within this estimation of the environmental disease burden in developed countries (Prüss-Üstün and Corvalán, 2006). A pilot project on the environmental burden of disease in Europe showed that 3–7% of the standard WHO discounted age-weighted burden of disease was associated with nine selected environmental stressors in the six participating countries. Among these nine stressors air pollution had the highest public health impact, followed by second-hand smoke and traffic noise (Hänninen and Knol, 2011).

There is growing evidence that socioeconomic inequalities in man-made environmental conditions contribute to health inequalities (Evans and Kantrowitz, 2002; Brulle and Pellow, 2006; Gee and Payne-Sturges, 2004). Exposure to environmental hazards as well as access to environmental benefits may differ according to socioeconomic position. The final report of the CSDH also emphasizes the relevance of poor and unequal living conditions for health inequalities, considering environmental factors in the physical form of the built environment, the quality of the natural environment in which people reside, and the nature of employment and working conditions for health (CSDH, 2008).

In addition, socioeconomic factors may modify health impacts by influencing an individual's vulnerability (WHO, 2010; Bolte, Pauli and Hornberg, 2011). Psychosocial stress has been suggested as a vulnerability factor linking social conditions with environmental hazards (Gee and Payne-Sturges, 2004).

Most research on socioeconomic disparities in environmental exposures has focused on environmental hazards and pollutants, showing, for example, that some disadvantaged urban subpopulations have a higher exposure to ambient air pollution, with motor vehicle traffic as one important source; that areas of high exposure often coincide with a lower socioeconomic position; and that socially disadvantaged people may be more responsive to air pollution (Kinney and O'Neill, 2006; Laurent et al., 2007). Studies within Europe indicate that less affluent population groups are most exposed to environmental risks in their place of residence and that waste facilities are often disproportionately located in areas with more deprived residents (Braubach and Fairburn, 2010; Martuzzi, Mitis and Forastiere, 2010). Recently, there have been more attempts to consider environmental resources – such as access to public green areas – and the distribution of these amenities in urban neighbourhoods, which may influence health-related behaviour, physical and mental health. Socioeconomic differences in exposure to ambient air pollution, noise, second-hand smoke and lack of access to green spaces have repeatedly been shown to exist especially among children in Europe (Bolte and Kohlhuber, 2005; Bolte, Tamburlini and Kohlhuber, 2010).

The aim of this chapter on environment-related inequalities is to illustrate socioeconomic differences in environmental exposures related to noise exposure at home, lack of access to recreational or green areas, and exposure to tobacco smoke at home and at work. Using available data from cross-national surveys of the WHO European Region, this chapter focuses on social indicators of material circumstances (such as income and poverty) according to the international debate on environmental inequalities and environmental justice (Brulle and Pellow, 2006; O'Neill et al., 2007).

DATA AND METHODS

Noise exposure at home

Data were retrieved from the EU-SILC database for the years 2004 to 2009. Data were available for between 15 (2004) and 30 countries (2009: 27 EU Member States, Iceland, Norway and Switzerland). Details of the sample size of the cross-sectional studies for each country are given on the EU-SILC web site.8 The reference population for EU-SILC includes all private households. Household members aged 16 or over were interviewed.

Noise from neighbours or from the street was assessed based on the EU-SILC question "Do you have any of the following problems related to the place where you live?" including answer category "Too much noise in your dwelling from neighbours or from outside (traffic, business, factory, etc.)" with answer options Yes and No. The self-reported complaints about noise from neighbours or from the street are given as percentage of the total study population of each country.

No stratification by sex was possible. Relative poverty was defined as a single-adult equivalent disposable income attributed to all household members below 60% of national median equivalized income, the variable obtained from the EU-SILC database. For equivalization of the total disposable household income the OECD modified scale of equivalization factors was used. Categories of household type "Households with dependent children" and "Households without dependent children" were used. The category "Single parent with dependent children" was also considered.

As the data provided cover the EU countries and Iceland, Norway and Switzerland only, EU15 and NMS12 were chosen as subregions, as with the other Eurostat-based inequality indicators in the injury- and housing-related inequality chapters. Data for Iceland, Norway and Switzerland are thus presented separately.

Lack of access to recreational or green areas

The second European Quality of Life Survey (EQLS) was conducted by Eurofound in 2007 with more than 35 000 adult interviewees from 31 countries: the 27 EU Member States, Norway, and three EU candidate countries (Croatia, the former Yugoslav Republic of Macedonia and Turkey). Data were obtained from the web site of the Economic and Social Data Service, via the UK Data Archive of the University of Essex. The dataset comprised data for 35 634 people (57% female).

EQLS participants were asked "Please think about the area where you live now – I mean the immediate neighbourhood of your home. Do you have very many reasons, many reasons, a few reasons, or no reason at all to complain about each of the following problems?" including answer category "Lack of access to recreational or green areas". For analysis, the answers to this question on reasons to complain were reduced to three categories: Yes ("Very many reasons", "Many reasons" and "A few reasons"), No ("No reason at all") and Don't know.

Data for several socioeconomic indicators were used for the inequality assessment.

- Income: the dataset comprised a variable of OECD income, with four categories – Lowest, Low, High, and Highest – indicating quartiles of income.
- Difficulty paying bills: participants were asked, "A household may have different sources of income and more than one household member may contribute to it. Thinking of your household's total monthly income: is your household able to make ends meet…?" The answer options were "Very easily", "Easily", "Fairly easily", "With some difficulty", "With difficulty", "With great difficulty", and "Don't know". For analysis, the answers were reduced to three categories:

8 See the Eurostat web site (http://epp.eurostat.ec.europa.eu/portal/page/portal/income_social_inclusion_living_conditions/documents/tab/Tab/EU-SILC%20sample%20size.pdf).

    - No difficulty paying bills ("Very easily", "Easily", "Fairly easily")
    - Difficulty paying bills from time to time ("With some difficulty")
    - Difficulty paying bills most of the time ("With difficulty", "With great difficulty").
- Employment: the available information was summarized into three categories – Employed (including self-employed), Unemployed and Other (including home-maker and retired).
- Level of education: participants were asked "What is the highest level of education you completed?" The answers were reduced to three categories:
    - Low ("no education completed")
    - Medium ("primary education", "lower secondary education", or "upper secondary education")
    - High ("post-secondary, including pre-vocational or vocational education but not tertiary", "tertiary education – first level", or "tertiary education – advanced level").
- Household type: this variable differentiates four categories – Single person, Single parent, Couple without children and Couple with children.

The socioeconomic indicators given above were only moderately correlated. All analyses were stratified by sex.

As the data provided cover the EU countries and Norway as well as the three candidate countries, subregions used to present results for geopolitical areas were EU15, NMS12, and Euro 4 countries; data for Norway are thus presented separately in the figures.

Second-hand smoke exposure at home or at work

Data on the second-hand smoke exposure at home and at work indicators were derived from *Special Eurobarometer 332: tobacco* (TNS Opinion and Social, 2010) and obtained through the WHO European Centre for Environment and Health. *Special Eurobarometer 332: tobacco* was part of wave 72.3 of the Eurobarometer and was conducted in 2009. It comprised 30 292 residents (56% female) aged 15 or over. The analysis was restricted to 29 792 participants (56% female) of 30 countries (27 EU Member States and three candidate countries: Croatia, the former Yugoslav Republic of Macedonia and Turkey).

To assess potential second-hand smoke exposure at home, the participants were asked "Which statement best describes smoking situation inside your house?" with answer options:

- "Smoking is not allowed at all inside the house"
- "Smoking is allowed only in certain rooms inside the house"
- "Smoking is allowed everywhere inside the house".

For analysis, potential second-hand smoke exposure at home was defined as "Smoking is allowed only in certain rooms or everywhere inside the house".

To assess exposure to second-hand smoke at work, only those participants currently working were asked "How often are you exposed to tobacco smoke indoors at your workplace?" with answer options:

- "Never or almost never"
- "Less than 1 hour a day"
- "1–5 hours a day"
- "More than 5 hours a day"
- "Not relevant (don't work or don't work indoors)".

Since the majority of participants answered "Never or almost never", exposure to second-hand smoke at work was defined as any exposure, combining categories "Less than 1 hour a day", "1–5 hours a day", and "More than 5 hours a day" for analysis. In most countries the proportion of individuals answering that they do not work indoors was below 10% of all non-smokers; exceptions were Turkey (19%) and Greece (12%).

To assess whether the lowest exposure category "Less than 1 hour a day" might cause artificial results, a sensitivity analysis was carried out defining exposure to second-hand smoke at work as at least 1 hour a day.

Several indicators of socioeconomic position were used for the inequality assessment.

- Self-assessed position on the social scale: participants were asked "On the following scale, step '1' corresponds to the lowest level in the society; step '10' corresponds to the highest level in the society. Could you tell me on which step you would place yourself?" This position was classified into Low (steps 1–4), Medium (steps 5–6), and High (steps 7–10) in the dataset.
- Difficulty paying bills: the question was "During the last twelve months, would you say you had difficulties to pay your bills at the end of the month?" Answer options were "Most of the time", "From time to time" and "Almost never or never". A fourth category comprised those participants who refused to answer this question.
- Employment (applied for exposure at home). The available information was summarized into three categories:
  - Employed (including self-employed, manager, other white collar worker and manual worker);
  - Unemployed;
  - Other (including home-maker, retired and student).
- Occupation (applied for exposure at work): data were stratified into two categories of Manual workers and Managers.

No information on household income or level of education was available in this dataset. All analyses were stratified by sex.

All analyses of second-hand smoke exposure were restricted to non-smokers. To assess their current smoking status, participants were asked: "Regarding smoking cigarettes, cigars or a pipe, which of the following applies to you?" with answer options "Smoke at the present time", "Used to smoke but have stopped" and "Never smoked". The smoking status of respondents was classified as current smoker or non-smoker ("Never smoked" or "Used to smoke but have stopped"). Depending on the country, 58% to 84% of the respondents were non-smokers (males: 49–88%, females: 62–85%). In total in EU27, 72% were non-smokers (males: 66%, females: 77%).

As the Eurobarometer data covered the EU countries as well as the three candidate countries, subregional groupings used were EU15, NMS12, and Euro 4 countries.

When considering social inequalities in second-hand smoke exposure, it must be borne in mind that current smokers mostly have a lower socioeconomic position (see Table 8), so restricting the analysis to non-smokers causes a disproportionate loss of socially disadvantaged individuals and may result in an underestimation of inequalities. Nevertheless, from a health point of view, second-hand smoke exposure is more relevant in non-smokers than in active smokers.

Among non-smokers, socioeconomic indicators of self-assessed social position, difficulty paying bills, and employment were only weakly correlated.

For the indicators on lack of access to green space and exposure to second-hand smoke, it proved to be very difficult – and sometimes impossible – to generate representative subregional results due to a lack of adequate data. Therefore, the subregional data often represent the average of the national rates of the countries covered by the respective region. In each figure, this restriction is clearly marked as the average of national rates for all reporting countries of the subregion. Subregional data that are representative (often provided by Eurostat databases, as in the case of noise exposure) do not include this indication and the aggregated results are representative of the respective subregion.

Table 8. Socioeconomic characteristics of smokers and non-smokers by sex (%)

	Male		Female	
	Smoker	Non-smoker	Smoker	Non-smoker
EU27				
Employment: unemployed	11.1	4.5	10.3	4.6
Self-assessed social position: low	24.3	17.4	22.2	20.3
Difficulty paying bills: most of the time	12.4	6.0	15.5	8.8
EU15				
Employment: unemployed	9.5	4.3	9.3	4.1
Self-assessed social position: low	19.0	12.1	17.2	13.5
Difficulty paying bills: most of the time	9.6	4.1	11.9	6.0
NMS12				
Employment: unemployed	13.4	4.8	11.5	5.3
Self-assessed social position: low	31.1	24.1	28.5	28.9
Difficulty paying bills: most of the time	15.9	8.4	20.0	12.2
Euro 4 countries				
Employment: unemployed	20.9	12.2	19.2	12.2
Self-assessed social position: low	35.0	32.6	32.9	32.2
Difficulty paying bills: most of the time	24.7	17.7	28.1	20.4

Source: data from *Special Eurobarometer 332: tobacco* (TNS Opinion and Social, 2010).

DATA RESTRICTIONS AND LIMITATIONS

Assessment of noise exposure using EU-SILC data was based on self-reported noise annoyance in terms of complaints about noise from neighbours or from the street. However, noise perception may differ by social position; for example, if less exposed individuals of a higher social position overrate their noise exposure, then the true relationship between social position and noise exposure could be underestimated. A further limitation is that there was no quantification of the self-reported noise exposure. EU-SILC data comprise only two income categories, and because of restricted data access no data on sex were available. Finally, different sources of noise (noise from neighbours and traffic noise) were combined into one question in EU-SILC. From a health perspective these sources should be assessed separately, because different exposure–response relationships may exist for different kinds of noise.

Complaints about lack of access to recreational or green areas is a rather vague exposure indicator. To assess potential health impacts of this characteristic of the built environment, information on the quality, dimension, ease and convenience of access, perception, and usage of the green space or recreational area is necessary (Mitchell, Astell-Burt and Richardson, 2011; Lee and Maheswaran, 2011; Richardson and Mitchell, 2010). Self-reported data should be combined with objective data on at least the location and dimension of green space or recreational area, and green spaces and recreational areas should be distinguished, because there might be different mechanisms linking these environmental characteristics to health. Furthermore, both the presence and the quality of such areas should be distinguished.

The analysis of second-hand smoke exposure at home was based on the survey answer "Smoking is allowed in certain rooms or everywhere inside the house". Permission to smoke only provides an indication of exposure; it does not enable a full determination of whether residents have actually been exposed to indoor smoke. Moreover, there was no supplementary information, such as the amount smoked at home by any person or the duration of smoking, in order to quantify exposure at home. The validity of self-reported data on active and passive smoking has been questioned. Public debate about smoke-free legislation in some countries may have contributed to a social preference bias towards reporting smoke-free homes, irrespective of actual smoking habits.

The analysis of second-hand smoke exposure at work was also based on self-reported data. Data were provided on duration of exposure, but do not allow any further quantification of exposure. There was no information on the validity of self-reported data on passive smoking at work.

Both analyses were restricted to non-smokers, since exposure to second-hand smoke was assessed to be more health-relevant in non-smokers. Thus, since smoking is more prevalent among socially disadvantaged individuals, this restriction will have caused a disproportionate loss of data on socially disadvantaged individuals.

INEQUALITIES IN NOISE EXPOSURE AT HOME

Introduction

Environmental noise (defined as noise emitted from all sources except industrial workplaces) is an important public health problem. The main exposure is road traffic noise. Sleep disturbance and annoyance, mostly related to road traffic noise, are the key health issues. At least one million healthy life years are lost every year from traffic-related noise in western European countries, including the EU Member States (WHO, 2011). The effects of neighbourhood noise and leisure noise are not addressed in this risk assessment because of a lack of data. Moreover, differences in exposure by sex and among varying socioeconomic groups, as well as additional burdens among potentially vulnerable subgroups are not considered.

Epidemiological studies show, in accordance with the fact that socially disadvantaged people are more likely to live near busy roads, that noise annoyance due to traffic is often higher in people with a lower socioeconomic position. In addition, social inequalities in objectively assessed noise exposure have been demonstrated (Bolte, Tamburlini and Kohlhuber, 2010). However, as the fact sheet on traffic noise exposure from the Netherlands shows, it must be borne in mind that different transport types (such as road, train and air) may have different inequality profiles (see Annex 1).

Indicator analysis: inequalities by income and household type

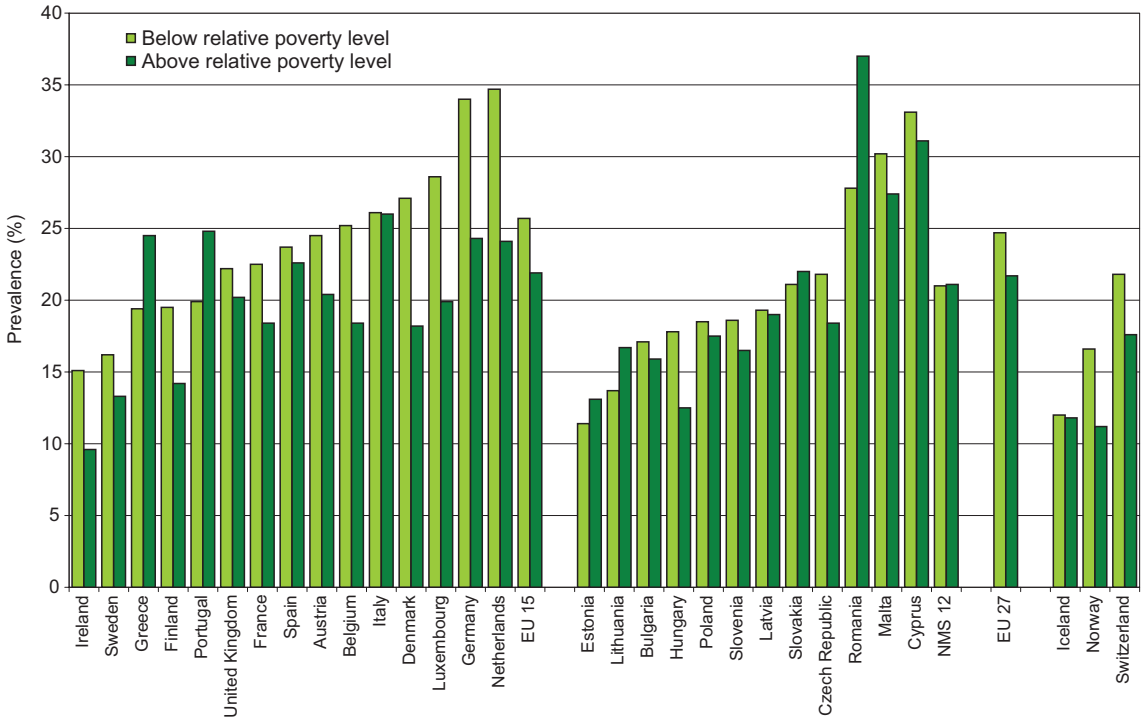
The overall prevalence of complaints about noise from neighbours or from the street varies by country between 10% and 35%, with an average of 22% across EU27 (2009 figures).

In the majority of the 30 reporting countries, self-reported noise exposure at home is higher among individuals living in relative poverty, although in six countries this pattern is reversed (see Fig. 34). Prevalence in EU27 is 25% among individuals below the relative poverty threshold and 22% among those above it. However, when the countries are grouped into subregions, the prevalence difference between the two income categories is present in EU15 countries (26% versus 22%) but disappears in NMS12 countries (21% for both income categories).

There is a small but constant difference of 3–4% between the income groups in EU15 countries from 2005 to 2009, showing no reduction in the existing inequality (see Fig. 35). In contrast, there are no clear and consistent differences between income groups in NMS12 countries. Prevalence of noise exposure at home is somewhat higher in EU15 countries, regardless of income. The highest prevalence is observed among individuals living in relative poverty in EU15 countries.

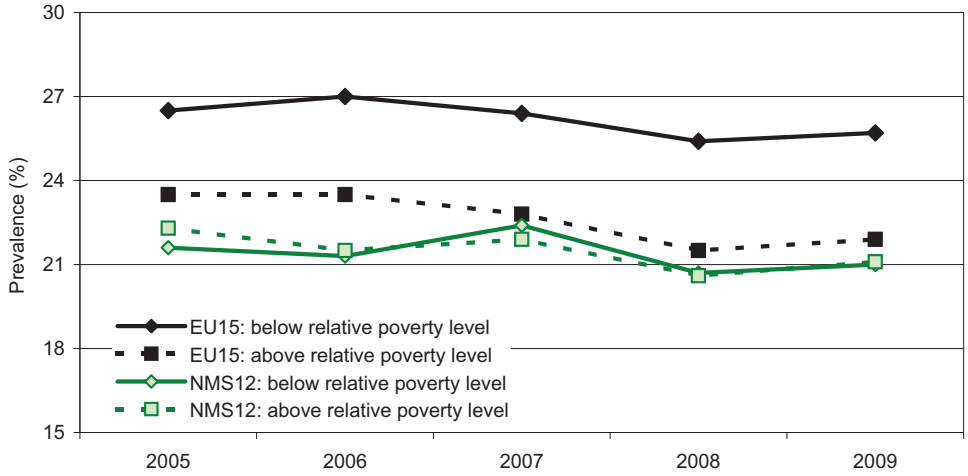
To assess the combined effect of several social dimensions, data on single parents living in relative poverty were contrasted with data on households without dependent children and with a household income above the relative poverty level. In the group of single parents in relative poverty, noise exposure at home varies between 9% and 41% by country, and in the latter group it varies between 11% and 38%. In the majority of countries (21 of 30) the prevalence of noise exposure at home is higher among single-parent households in relative poverty. Across EU27, the prevalence of noise exposure at home is 32% among single-parent households in relative poverty and 23% among households with no children and an income above the relative poverty level, and if the subregional groupings of EU15 and NMS12 are applied, the prevalence difference between the two types of household are more pronounced in the EU15 countries (33% versus 23%) than the NMS12 countries (24% versus 22%).

Fig. 34. Prevalence of complaints about noise from neighbours or from the street by relative poverty level (2009)



Source: data from EU-SILC, 2011.

Fig. 35. Time trend of prevalence of complaints about noise from neighbours or from the street by household income



Source: data from EU-SILC, 2011.
Note: NMS12 figures for 2005/2006 exclude Romania due to lack of data.

Target groups for action

Based on the limited available information, the most exposed groups in terms of the highest prevalence of complaints about noise from neighbours or from the street are low-income groups, especially single parents, mainly in EU15 countries.

Health implications

The environmental burden of disease due to environmental noise has been recently estimated for western European countries with a range of 1.0–1.6 million DALYs lost across all health outcomes (WHO, 2011). The estimates are 61 000 DALYs for ischaemic heart disease, 45 000 for cognitive impairment of children, 903 000 for sleep disturbance, 22 000 for tinnitus, and 587 000 for annoyance.

Data from EU-SILC show a consistent but rather small prevalence difference relating to income in noise exposure – defined as complaints about noise from neighbours or from the street – especially in Euro 1 countries. However, the given categorization of the two income groups (below and above 60% of median income) may mask the real extent of social differences across the entire income spectrum. Differences in exposure prevalence can rise to more than 10% when more specific social groups are identified by combining different socioeconomic characteristics (such as single parents with low income).

Since complaints about noise from neighbours or from the street may also be interpreted as a health effect in terms of annoyance, the EU-SILC data already show clear social inequalities in health related to noise exposure. However, from a health point of view it is important to recognize that there is considerable variation in exposure prevalence – or rather in prevalence of annoyance due to noise from external sources (neighbours or street) – between countries, affecting up to 35% of the population.

Conclusions and suggestions

Prevalence of self-reported noise annoyance varies considerably between countries. Irrespective of social differences, in many countries a relevant proportion of the population is affected by noise from neighbours or from the street. In Euro 1 but not Euro 2 countries, prevalence of complaints about noise from neighbours or from the street is higher among individuals with low income. If data were able to be stratified by more categories of income, the social differences seen would probably be greater.

It has been shown that health impacts such as annoyance and sleep disturbance are mostly related to traffic noise. Therefore, data on subjective noise exposure should be gathered separately for different sources of noise. Since more consistent data are available on social inequalities in exposure to traffic-related air pollution, a clearer picture of noise inequalities could be created if data were available for exposure to traffic-related noise only. Wherever possible, measured data on noise exposure should be used to support the results presented on social inequalities in self-reported noise exposure.

Suggested mitigation actions are:

- further enforcement of the EU Environmental Noise Directive (Directive, 2002) to tackle the important public health issue of traffic-related noise;
- ensuring that action plans to address noise issues on a regional level take potential social inequalities in noise exposure into account;
- better reporting of objective traffic-related noise exposure and subjective noise annoyance by sex and socioeconomic group;
- better research on combined exposure to noise and air pollutants, including their distribution by sex and sociodemographic group, for a comprehensive health risk assessment.

INEQUALITIES IN LACK OF ACCESS TO RECREATIONAL OR GREEN AREAS

Introduction

Green space may influence physical and mental health as well as well-being (Maas et al., 2006; Mitchell and Popham, 2008; Abraham, Sommerhalder and Abel, 2010). It has been proposed that green space – in terms of contact with nature – has an influence on health through restorative properties (Mitchell, Astell-Burt and Richardson, 2011). Both design of the built environment and accessibility of the natural environment have an impact on physical activity and active living (Edwards and Tsouros, 2006).

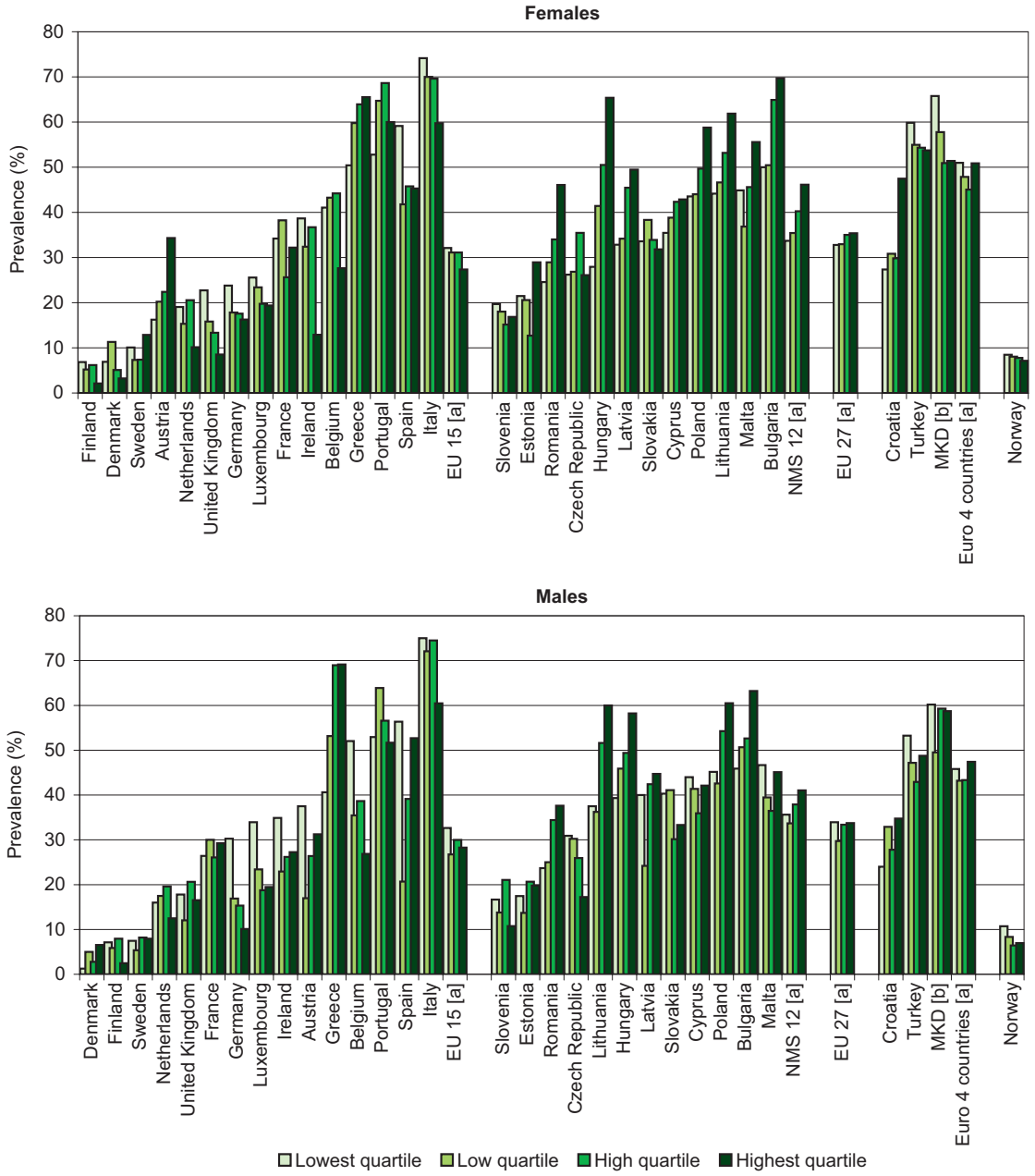
Data from Europe indicate that socially disadvantaged people often live in places with less access to public green space (Kruize et al., 2007; Bolte, Tamburlini and Kohlhuber, 2010). Socioeconomically deprived areas in Britain, for example, have fewer large green spaces, which are assumed to be more important for health effects than small ones (Mitchell, Astell-Burt and Richardson, 2011). Even where there is equal access to green space, irrespective of social position, the quality of green space may differ, depending on the social characteristics of the neighbourhood (Bolte, Pauli and Hornberg, 2011). In addition to this exposure variation by social group, a study from the Netherlands shows that the percentage of green space in people's living environment is positively associated with the perceived general health of residents, and that less-educated groups are more sensitive to the characteristics of their physical environmental (Maas et al., 2006). Another British study demonstrates that health inequalities related to income deprivation are lower in populations who live in the greenest areas compared to those who have less exposure to green space (Mitchell and Popham, 2008). Finally, gender differences in the relationship between green space and health have been reported, which may be due to gender differences in the perception and usage of green spaces (Richardson and Mitchell, 2010).

Indicator analysis: inequalities by sex, income, difficulty paying bills, employment, education level and household type

Prevalence of complaints about lack of access to recreational or green areas varies between 6% and 67% of EQLS participants by country, and the intercountry prevalence range is comparable between females (7–67%) and males (5–67%). Across EU27, 34% of participants (35% of females, 34% of males) have complaints about this lack of access. When divided into subregions, the prevalence of complaints is 32% (for both males and females) in EU15 countries, 44% (44% of females, 43% of males) in NMS12 countries, and reaches 47% (47% of females, 46% of males) in the three Euro 4 countries – Croatia, the former Yugoslav Republic of Macedonia and Turkey. In Norway the prevalence is 9% among both females and males. In the majority of countries, the highest rate of complaints was found in the 18–34 year age group and the lowest among those 65 years and over.

A pronounced variation in the prevalence difference across the four income groups is observable in many countries (see Fig. 36). Nevertheless, looking at the total for all EU27 countries, there is only a minor difference in the lack of access to recreational or green areas (a maximum difference of 4% between income quartiles for females and males). This is because those individuals in the lowest income quartile in EU15 countries complain of a lack of access more frequently (lowest income quartile: 32% of females and males; highest income quartile: 27% of females, 28% of males) while, in contrast, individuals in the lowest and low income quartile in NMS12 countries complain less often than those in the high and highest (lowest income quartile: 34% of females, 36% of males; highest income quartile: 46% of females, 41% of males). Looking at the three Euro 4 countries together, there are no major social differences between the two extreme income quartiles (lowest income: 51% of females, 46% of males; highest income: 51% of females, 47% of males), although the prevalence of complaints about lack of access to recreational or green areas is lower in the two middle income quartiles for both females and males. However, in Croatia the highest rate of lack of access is observed among individuals in the highest income quartile, in contrast to the former Yugoslav Republic of Macedonia and Turkey where the highest rate is found among individuals in the lowest income quartile.

Fig. 36. Prevalence of complaints about lack of access to recreational or green areas by income quartile and sex (2007)



Source: data from EQLS, 2007.
Notes: [a] average of national rates; [b] MKD: ISO code for the former Yugoslav Republic of Macedonia.

Stratification of the data by difficulty paying bills most of the time, from time to time or never reveals marked differences in lack of access to recreational or green areas. There is a clear social gradient, with the highest level of disadvantage most often found among those with difficulty paying bills most of the time (see Table 9). Exceptions are found for females in NMS12 countries and males in Euro 4 countries.

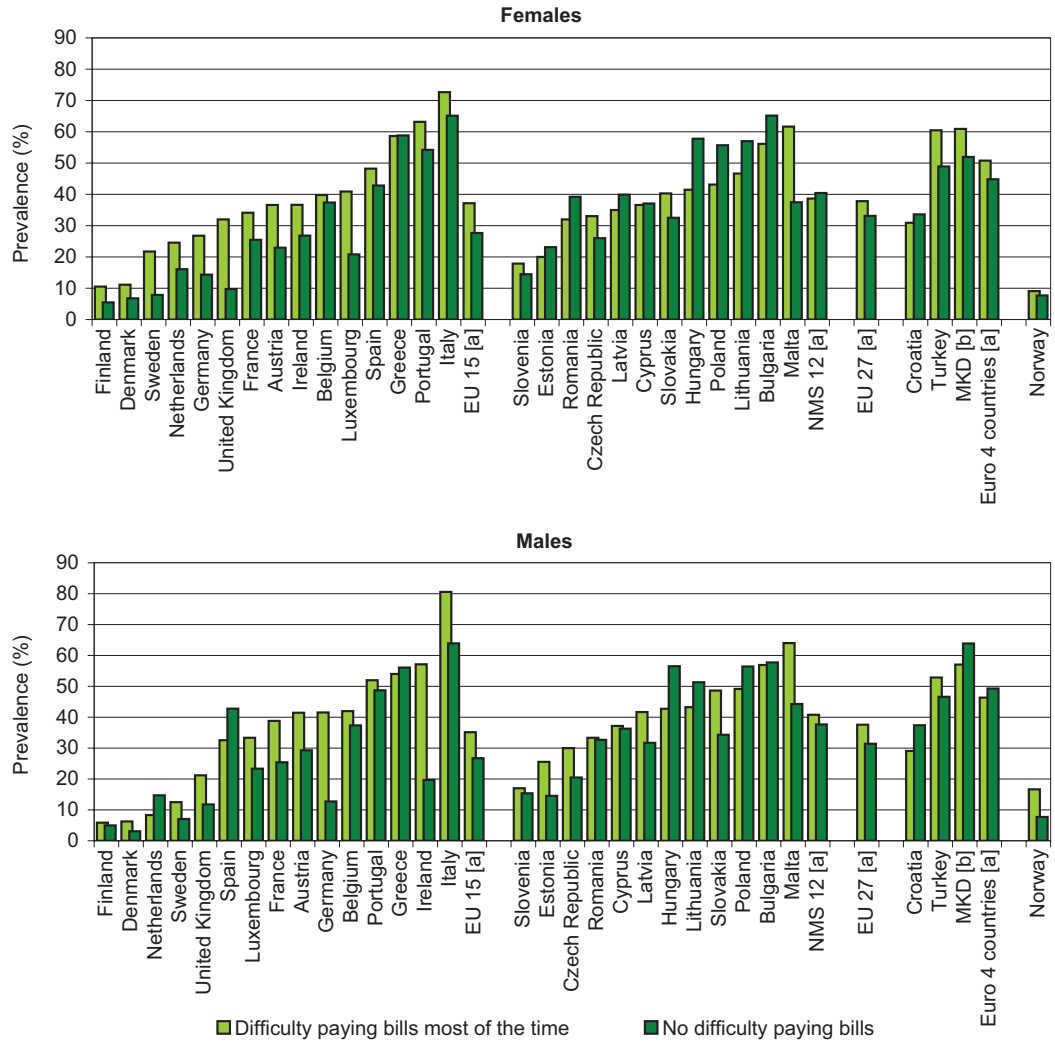
National data (see Fig. 37) show that there are large differences between countries regarding both the overall dimension of lack of access to recreational or green areas and the inequalities between males and females with various levels of difficulty paying bills. Several countries show a strong disadvantage for individuals reporting difficulty paying bills, while other countries show a balance or the opposite trend. In several countries, such as the Netherlands, Spain, Estonia, Latvia and the former Yugoslav Republic of Macedonia, variations by sex on the impact of difficulty paying bills can be observed.

Table 9. Lack of access to recreational or green areas by difficulty paying bills (2007)

	Female			Male		
	No difficulty	Difficulty from time to time	Difficulty most of the time	No difficulty	Difficulty from time to time	Difficulty most of the time
EU15 [a]	27.7	33.4	37.2	26.7	34.3	35.2
NMS12 [a]	40.5	41.2	38.7	37.7	36.8	40.8
EU27 [a]	32.4	35.9	36.8	30.7	34.5	36.9
Euro 4 countries [a]	44.8	44.3	50.8	49.3	38.8	46.4

Source: data from EQLS, 2007.
Note: [a] average of national rates.

Fig. 37. Prevalence of complaints about lack of access to recreational or green areas by difficulty paying bills and sex (2007)



Source: data from EQLS, 2007.
Notes: [a] average of national rates; [b] MKD: ISO code for the former Yugoslav Republic of Macedonia.

Looking at the impact of employment on the lack of access to recreational or green areas, the data indicate that its impact is stronger but less consistent for males, and weaker but more consistent in females. The reported lack of access is consistently slightly higher among unemployed than employed females in EU15 countries (33% versus 31%), NMS12 countries (46% versus 44%) and Euro 4 countries (57% versus 55%). Among males the disadvantage is only higher among unemployed than employed

males in EU15 countries (36% versus 30%); in contrast, it is lower among unemployed than employed males in NMS12 countries (38% versus 41%) and Euro 4 countries (41% versus 48%). Across all EU27 countries, the prevalence of complaints about lack of access to recreational or green areas shows little variation by employment: the prevalence reported by females is 39% (unemployed) and 37% (employed), while in male respondents it is 37% (unemployed) and 35% (employed).[9]

At the aggregated level, there are reversed social gradients showing an increasing lack of access with a higher level of education in all subregions and for both females and males (see Table 10). The gradient is most obvious in the Euro 4 countries and much less clearly expressed in the EU15 countries. In all subregions, differences by education level are much more pronounced than differences by sex.

However, in several individual countries the prevalence of complaints about lack of access to recreational or green areas is much higher among the less-educated than the better-educated. This is the case in Finland (17% versus 6%), the former Yugoslav Republic of Macedonia (63% versus 46%), Ireland (50% versus 20%), Italy (81% versus 66%), Malta (67% versus 50%) and the Netherlands (40% versus 19%) for females, and in Finland (20% versus 5%), France (43% versus 32%), Germany (50% versus 14%), Malta (60% versus 53%) and the United Kingdom (28% versus 14%) for males.

Finally, the impact of household composition on lack of access to recreational or green areas was considered. The lack of access is more often expressed in single-parent households than in households of couples without children in all subregions. A considerably higher proportion of single-parent households are female than male (EU15: 9% female versus 2% male, NMS12: 12% versus 3%, Euro 4: 9% versus 2%; prevalence calculated among all EQLS participants of the respective subregion). Female single-parent households have higher prevalence rates of complaints about lack of access to recreational or green areas compared to couples with children in EU15 and NMS12.

An analysis of the impact of sex on inequality among single-parent households revealed that a distinct difference (with a higher lack of access among female than male single-parent households) was seen in EU15 countries (36% of female, 26% of male single-parent households) and, less strongly, in Euro 4 countries (49% of female, 45% of male single-parent households), but not in NMS12 countries (41% of female, 42% of male single-parent households).[10]

Beyond the impact of social and demographic determinants, the Spanish fact sheet on lack of access to recreational or green areas (see Annex 1) shows that geography and climate conditions can also affect the provision of such spaces to the public.

Target groups for action

The impact of all the respective socioeconomic or demographic determinants stratified by sex was summarized (see Fig. 38), showing diverse and partially conflicting trends by subregion and sex. The population groups with a higher prevalence of complaints about lack of access to recreational or green areas are:

- males and females in EU15, males in NMS12 and females in Euro 4 countries with difficulty paying bills most of the time;
- those in the lowest income quartile in EU15, and those in the highest income quartile in NMS12 countries;
- unemployed females in all regions and unemployed males in EU15, as well as employed males in Euro 4 countries;
- all those with a higher education level in NMS12 and Euro 4 countries (in EU15 this applies predominantly to males);
- female single-parent households in all regions (with the strongest effect visible in EU15) and male single-parent households in NMS12 and Euro 4 countries.

9 Data for EU15, NMS12, EU27 and Euro 4 countries represent averages of national rates.
10 Data for EU15, NMS12, EU27 and Euro 4 countries represent averages of national rates.

Table 10. Lack of access to recreational or green areas by education level and sex (2007)

	Female			Male		
	Low education	Medium education	High education	Low education	Medium education	High education
EU15 [a]	29.3	29.5	30.1	25.8	28.0	30.8
NMS12 [a]	28.5	38.3	43.3	27.8	36.6	43.0
EU27 [a]	29.0	33.4	36.0	26.5	31.8	36.2
Euro 4 countries [a]	38.0	47.9	58.0	33.7	44.0	52.6

Source: data from EQLS, 2007.

Note: [a] average of national rates.

Health implications

Although no quantitative risk assessment of the health effects of characteristics of the built environment such as access to recreational or green areas has been performed thus far, the importance of design of the built environment and access to the natural environment for physical activity and active living has repeatedly been emphasized (Edwards and Tsouros, 2006). Green space is understood as a resource for physical and mental health as well as for well-being (Maas et al., 2006; Mitchell and Popham, 2008; Abraham, Sommerhalder and Abel, 2010).

It is very likely that the observed social differences in complaints about lack of access to recreational or green areas have an impact on social inequalities in physical activity and health.

Conclusions and suggestions

The frequency of self-reported reasons to complain about lack of access to recreational or green areas varies widely between countries, so the following conclusions, which are based on subregional averages, may not be true for each individual country.

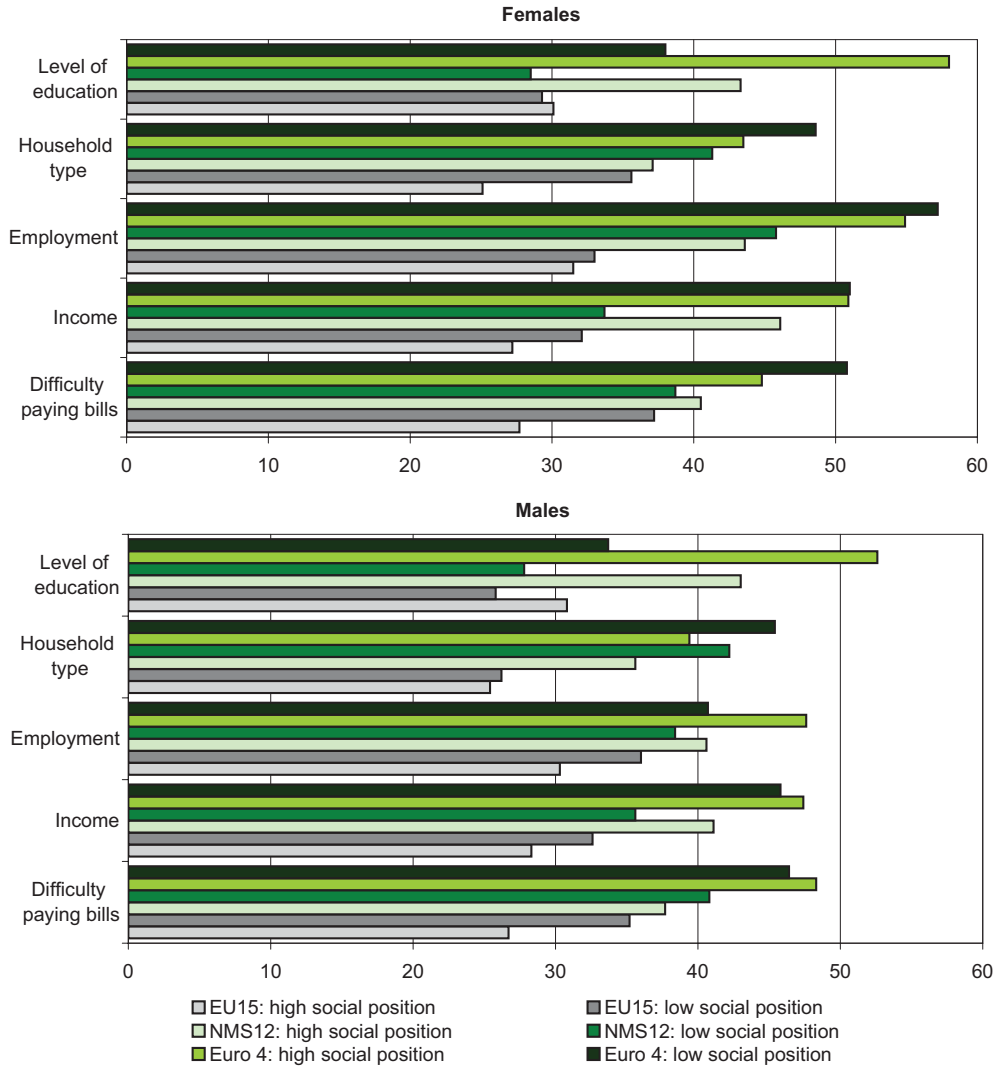
Social inequalities in access to recreational or green spaces exist, indicated by lower reported access levels among socially disadvantaged individuals, such as those characterized by the single-parent household type indicator in all subregions, and those with difficulty paying bills most of the time, primarily in EU15 countries (see Fig. 38). Unemployed females consistently report a slightly higher lack of access in all regions, as well as unemployed males in EU15, and both females and males in the lowest income quartile in EU15.

On the other hand, social disadvantage is not by default an indicator of lower levels of access to recreational or green areas; individuals with a high education level in all regions report a lack of access more often, as well as employed males in NMS12 and Euro 4 countries and individuals with an income in the highest quartile in NMS12 countries, for example. Thus, the direction and degree of social inequalities in lack of access to recreational or green areas depends on the local or regional situation in a given country or region, as well as on the socioeconomic indicator analysed. However, the seemingly logical expectation that disadvantaged groups might be more affected by a lack of access to recreational or green areas is mostly met in the EU15 region, while NMS12 and Euro 4 countries show more variation.

Combined exposures could be analysed using additional data from the EQLS. For example, question 54 of the EQLS covers reasons to complain about noise, air pollution, water quality, crime, violence or vandalism, and litter or rubbish in the streets in the immediate neighbourhood of the respondent's home. Looking at more aspects of the built environment could help to build an understanding of differences in inequality by sex, because safety issues are often more relevant for females.

Local governments play a crucial role in creating healthy built environments. The cooperation of several sectors – such as urban planning, housing, transport and public health sectors – is required (Edwards and Tsouros, 2006).

Fig. 38. Prevalence of complaints about lack of access to recreational or green areas by socioeconomic indicator and sex (2007)



Source: data from EQLS, 2007.

Note: low social position represents low level of education, single-parent household, unemployed, lowest income quartile and difficulty paying bills most of the time, respectively; high social position represents high level of education, couple without children, employed, highest income quartile and no difficulty paying bills, respectively.

Suggested mitigation actions are:

- creation and maintenance of healthy built environments with accessible recreational and green areas of good quality;
- gaining the cooperation of urban planning, housing, transport and public health sectors in health inequality impact assessments;
- better reporting on the quality, dimension, ease and convenience of access, and perception of recreational and green areas by sex and socioeconomic group;
- better research into combined exposures to hazards and into resources beneficial to health in the built environment, including their distribution by sex and social position.

INEQUALITIES IN SECOND-HAND SMOKE EXPOSURE AT HOME

Introduction

Second-hand smoke is one of the most important and widespread exposures in the indoor environment (Öberg et al., 2010). The harmful health effects of second-hand smoke have been intensively evaluated (U.S. Department of Health and Human Services, 2006; IARC, 2004). Social disparities in exposure to second-hand smoke at home in terms of a higher exposure in socially disadvantaged groups are well documented in Europe, with many studies focusing on children (Bolte and Kohlhuber, 2005; Bolte and Fromme, 2009; see also the fact sheet on potential smoke exposure at home by SES from Germany in Annex 1).

Indicator analysis: inequalities by sex, self-assessed social position, difficulty paying bills and employment

All prevalence figures quoted are based on analysis restricted to non-smokers. Prevalence of potential second-hand smoke exposure at home varies between 4% and 61% by country (4–62% among males; 4–65% among females). Across EU27, 24% of male and 25% of female respondents report potential exposure to second-hand smoke at home. Prevalence is 25% for both males and females in EU15 countries and 24% for both sexes in NMS12 countries. There are much higher prevalence rates in the three Euro 4 countries (49% of males, 57% of females).

Differences by sex exist in most countries, but in different directions: potential exposure is higher in males than females in 13 countries and higher in females than males in 13 countries. In four countries there is no difference by sex. There is no consistent pattern for age groups across the countries.

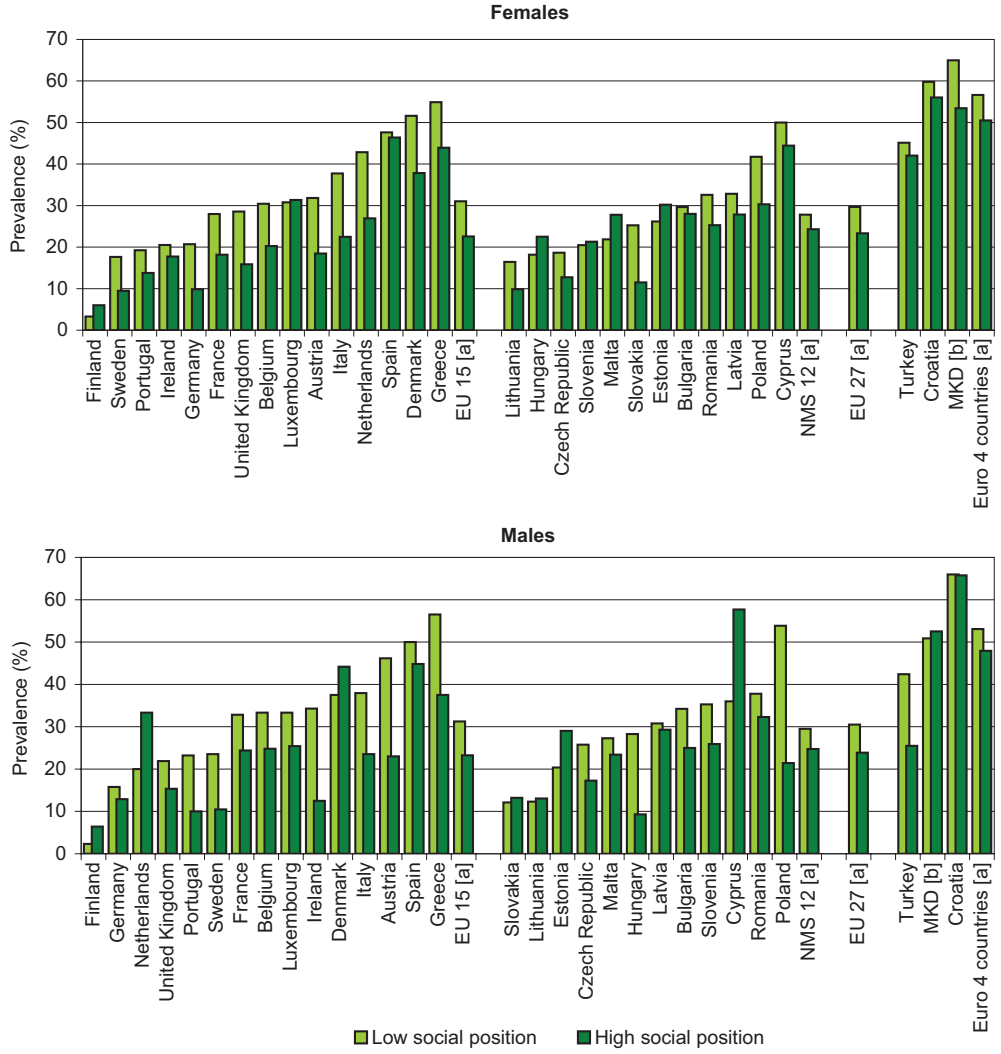
Self-assessed position on the social scale is associated with potential exposure to second-hand smoke at home in most countries (see Fig. 39). In the majority of countries, those indicating a low position on the social scale report potential exposure more often. Across EU27, prevalence rates are 30% for males with low versus 24% for males with high social position, and 30% for females with low versus 23% for females with high social position. In EU15 countries, the prevalence is 31% for both males and females with low social position versus 23% for both sexes with high social position. In NMS12 countries, the reported potential exposure for low versus high social position is 30% versus 25% among males and 28% versus 24% among females; in Euro 4 countries, it is 53% versus 48% among males and 57% versus 51% among females.

Some countries (for example, Finland, Estonia, Hungary and Malta for females and Denmark, Finland, the Netherlands, Cyprus and Estonia for males) show the reverse inequality pattern, with more frequent potential exposure among individuals with high social position.

The overall picture across all subregions is that individuals with difficulty paying bills most of the time are more frequently exposed to potential second-hand smoke at home than those with no difficulty (see Table 11). Moreover, in all regions – except in the case of females in EU15 and Euro 4 countries – there is a consistent social gradient showing an increase in potential smoke exposure at home with increasing difficulty paying bills. The largest inequality among those with difficulty paying bills most of the time versus those with no difficulty is observed for males in Euro 4 countries.

Despite the rather consistent trends, there are large differences between individual countries within each subregion, most strongly expressed among males in EU15 countries (see Fig. 40). Among those with difficulty paying bills most of the time, Euro 4 countries Croatia and the former Yugoslav Republic of Macedonia show the highest prevalence rates for both males and females, but EU15 countries Sweden and Austria also show high prevalence levels for males.

Fig. 39. Prevalence of potential exposure to second-hand smoke at home by self-assessed social position and sex (2009)



Source: data from *Special Eurobarometer 332: tobacco*; data analysis restricted to non-smokers.
Notes: [a] average of national rates; [b] MKD: ISO code for the former Yugoslav Republic of Macedonia.

Table 11. Prevalence of potential exposure to second-hand smoke at home by difficulty paying bills and sex (2009)

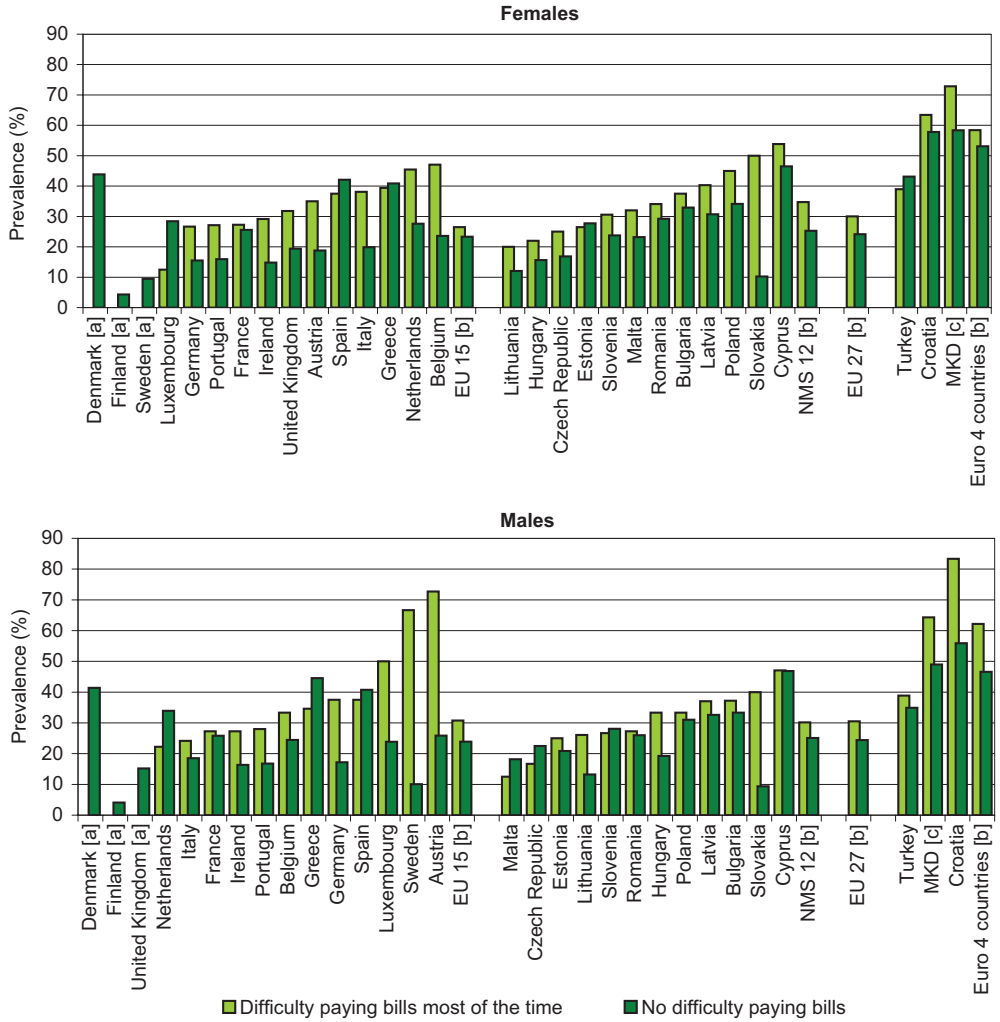
	Female			Male		
	No difficulty	Difficulty from time to time	Difficulty most of the time	No difficulty	Difficulty from time to time	Difficulty most of the time
EU15 [a]	23.3	26.7	26.5	23.9	26.3	30.7
NMS12 [a]	25.3	26.6	34.7	25.1	27.1	30.2
EU27 [a]	24.2	26.7	30.2	24.4	26.6	30.5
Euro 4 [a]	53.1	62.2	58.4	46.6	51.1	62.2

Source: data from *Special Eurobarometer 332: tobacco* (TNS Opinion and Social, 2010); data analysis restricted to non-smokers.
Note: [a] average of national rates.

Among males, there is distinct variation in levels of potential exposure between employed and unemployed individuals across countries. In 17 of the 30 countries the prevalence of potential exposure to second-hand smoke at home is higher among unemployed than employed males. In females, on the other hand, the prevalence differences are more consistent, showing a higher exposure rate among unemployed than employed females in 26 of the 30 countries.

Across EU27, 29% of unemployed versus 23% of employed males and 32% of unemployed versus 23% of employed females are potentially exposed to second-hand smoke at home. Exposure prevalence in unemployed and employed individuals differs less in EU15 countries (males: 23% versus 21%, females: 27% versus 21%) than in NMS12 countries (males: 36% versus 24%, females: 38% versus 25%), while in Euro 4 countries a large difference by employment status is found for females but not for males (males: 48% versus 47%, females: 67% versus 47%).[11]

Fig. 40. Prevalence of potential exposure to second-hand smoke at home by difficulty paying bills and sex (2009)



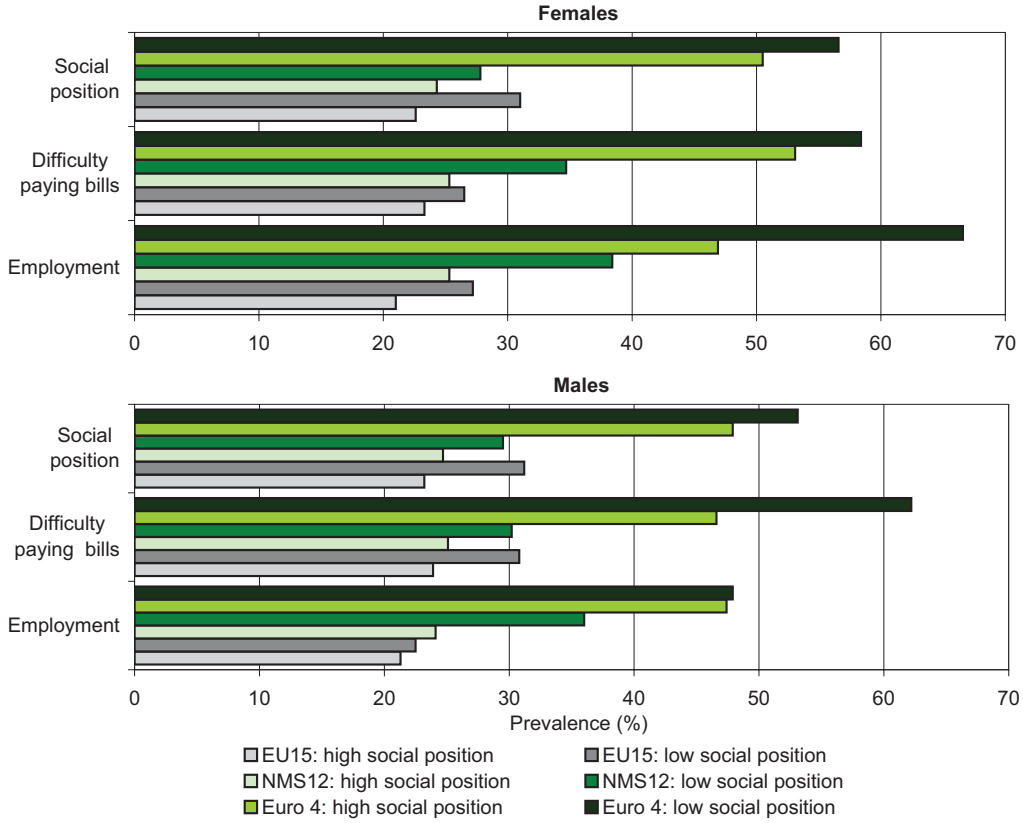
Source: data from *Special Eurobarometer 332: tobacco* (TNS Opinion and Social, 2010); data analysis restricted to non-smokers.
Notes: [a] prevalence by difficulty paying bills most of the time = 0% (due to low numbers in the respective social group); [b] average of national rates; [c] MKD: ISO code for the former Yugoslav Republic of Macedonia.

Target groups for action

The impact of all the respective socioeconomic determinants stratified by sex was summarized (see Fig. 41). There is a consistent pattern of socioeconomic inequalities in second-hand smoke exposure at home, irrespective of the socioeconomic indicator used. Higher exposure prevalence is present among individuals with low self-assessed social position, among those with difficulty paying bills most of the time and among unemployed individuals (mostly females, and especially in Euro 4 countries). Main target groups for action regarding smoking in the home are thus groups such as unemployed females and males with financial difficulties.

11 Data for EU15, NMS12, EU27 and Euro 4 countries represent averages of national rates.

Fig. 41. Prevalence of potential exposure to second-hand smoke at home by socioeconomic indicator and sex



Source: data from *Special Eurobarometer 332: tobacco* (TNS Opinion and Social, 2010); data analysis restricted to non-smokers.
Note: low social position represents low self-assessed position on the social scale, difficulty paying bills most of the time and unemployed, respectively; high social position represents high self-assessed position on the social scale, (almost) no difficulty paying bills, and employed, respectively.

Health implications

Worldwide exposure to second-hand smoke and its burden of disease in children and adult non-smokers has been estimated for the year 2004 (Öberg et al., 2011). About 1.0% of worldwide mortality and 0.7% of total worldwide burden of disease are attributable to the exposure of non-smokers to second-hand smoke, the largest disease burdens including 5.9 million DALYs lost from lower respiratory tract infections in children younger than 5 years, 2.8 million DALYs lost from ischaemic heart disease in adults, and 1.2 million DALYs lost from asthma in adults. Globally, 47% of deaths from second-hand smoke occurred in women, 28% in children, and 26% in men.

The higher potential exposure to second-hand smoke at home among the socially disadvantaged, as indicated by the *Special Eurobarometer 332: tobacco* data, is likely to contribute to health inequalities.

Conclusions and suggestions

There is wide variation in the prevalence of self-reported potential exposure to second-hand smoke at home between countries. The *Special Eurobarometer 332: tobacco* report summarizes that the level of smoking permissiveness in private settings is correlated with the proportion of smokers in a given country (TNS Opinion and Social, 2010).

Social inequalities in second-hand smoke exposure at home exist with higher exposure among socially disadvantaged groups, characterized by low self-assessed social position, difficulty paying bills most of the time and unemployment (see Fig. 41).

Legislation creating smoke-free public places is mandated in Article 8 of the WHO Framework Convention on Tobacco Control, in order to protect people from the harmful consequences of second-hand smoke exposure at the population level (WHO, 2003). Population-based tobacco control measures might reduce population smoking prevalence, and might therefore also reduce second-hand smoke exposure.

Smoking bans are one component of a comprehensive tobacco control programme. However, according to a recent Cochrane review, legislation-based smoking bans diminish second-hand smoke exposure in public places but do not change self-reported second-hand smoke exposure at home (Callinan et al., 2010). Policy and prevention measures providing education and raising awareness about the health hazards of second-hand smoke exposure focusing on individual level intervention have been shown to be less effective in socially disadvantaged groups. Thus, greater efforts need to be made to target interventions specifically to reach socially disadvantaged people.

Suggested mitigation actions are:

- creation and maintenance of smoke-free public places by full-scale implementation of the WHO Framework Convention on Tobacco Control;
- targeted interventions aiming to diminish second-hand smoke exposure at home, particularly addressing socially disadvantaged groups;
- better reporting on second-hand smoke exposure at home by sex and socioeconomic group, including possible effects of population-based tobacco control measures.

INEQUALITIES IN SECOND-HAND SMOKE EXPOSURE AT WORK

Introduction

The health effects of second-hand smoke exposure are well known and have been intensively reviewed (U.S. Department of Health and Human Services, 2006; IARC, 2004; Öberg et al., 2011). Comparable to the social disparities shown in exposure to second-hand smoke at home, individuals in lower socioeconomic groups may experience a higher risk of second-hand smoke exposure at work (Moussa, Lindström and Ostergren, 2004). A study in Germany has shown that employees with a higher education level are more likely to work in smoke-free workplaces or workplaces with at least partial smoking restrictions (Rüge et al., 2010).

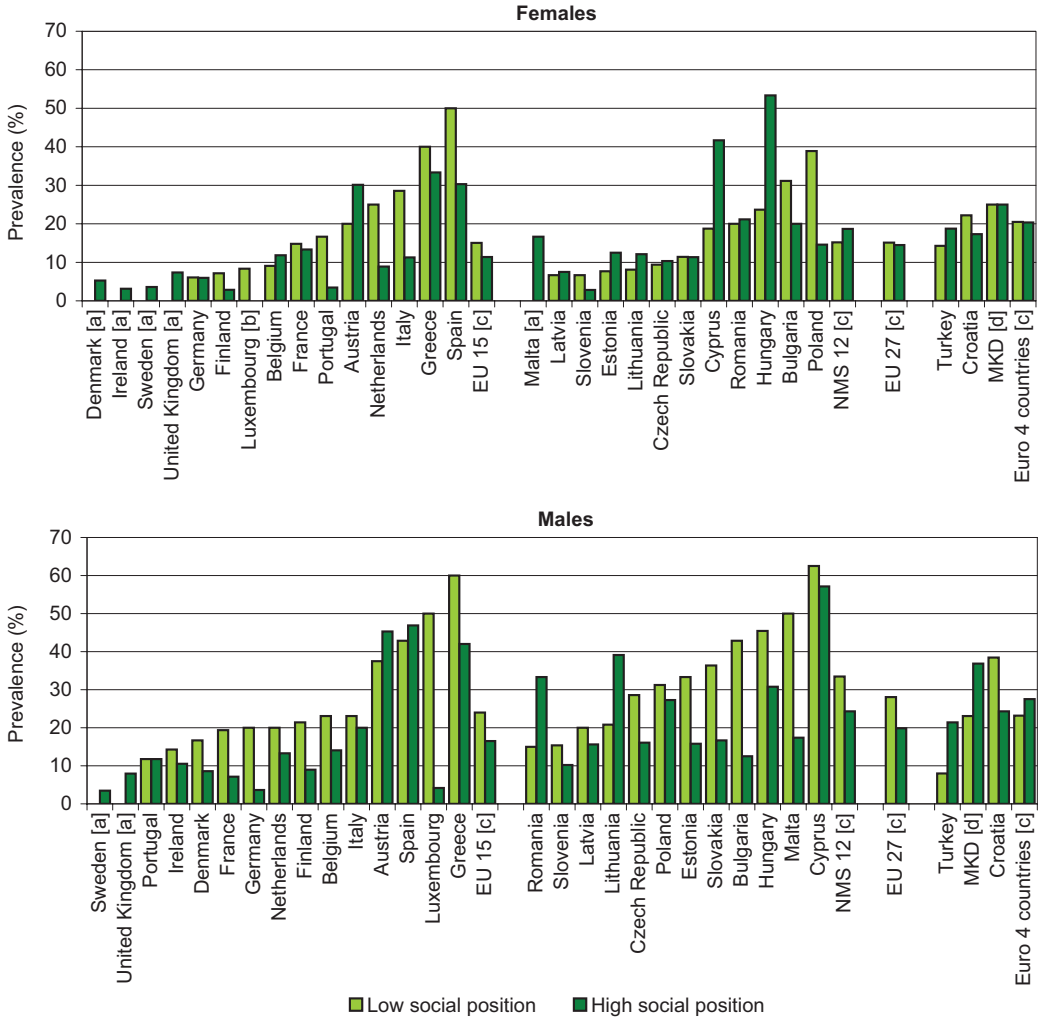
Indicator analysis: inequalities by sex, self-assessed social position, difficulty paying bills and occupation

All prevalence figures quoted are based on analysis restricted to non-smokers. Prevalence of exposure to tobacco smoke indoors at work varies between 4% and 46% by country (males: 3–54%, females: 3–40%). Prevalence rates are 23% of males and 15% of females across EU27, 19% of males and 13% of females in EU15 countries, 27% of males and 18% of females in NMS12 countries, and 25% of males and 22% of females in the three Euro 4 countries covered. Similarly, in 24 of the 30 individual countries, prevalence levels are higher among males than females, indicating the general existence of differences by sex in occupational second-hand smoke exposure.

Across all countries, there is considerable variation in exposure by self-assessed position on the social scale, which is especially expressed among males (see Fig. 42). Across EU27, 28% of males with low social position are exposed to second-hand smoke at work in contrast to 20% of males with high social

position. There is no such prevalence difference for females. Inverse social gradients with a higher exposure among individuals with a low social position are observed for both sexes in EU15 countries but only for males in NMS12 countries, where the opposite trend is found for females. In Euro 4 countries there is no difference in prevalence for females, while a higher exposure level is reported for males with high self-assessed social position.

Fig. 42. Prevalence of exposure to second-hand smoke at work by self-assessed social position and sex (2009)



Source: data from *Special Eurobarometer 332: tobacco* (TNS Opinion and Social, 2010); data analysis restricted to non-smokers.

Notes: [a] prevalence by low social position = 0% (due to low numbers in the respective social group); [b] prevalence by high social position = 0% (due to low numbers in the respective social group); [c] average of national rates; [d] MKD: ISO code for the former Yugoslav Republic of Macedonia.

Country data indicate large differences, with most countries showing similar inequality trends for males and females, but some countries – including Belgium, Spain, Cyprus, Estonia and Hungary – present opposing inequalities by social position for males and females. The largest inequalities of double the exposure prevalence are mostly suffered by those with a low self-assessed social position, but doubled prevalence levels can also be identified for individuals with a high social position (for example, in Cyprus and Hungary for females, Romania and Turkey for males).

Compared to the data on prevalence by self-assessed social position, the social differences in second-hand smoke exposure at work by categories of difficulty paying bills vary considerably between countries. In EU27, there are again inverse social gradients, with the highest exposure rate among those with difficulty paying bills most of the time (27% of males, 19% of females), followed by those with difficulty paying bills from time to time (24% of males, 16% of females), and those with no difficulty paying bills (22% of

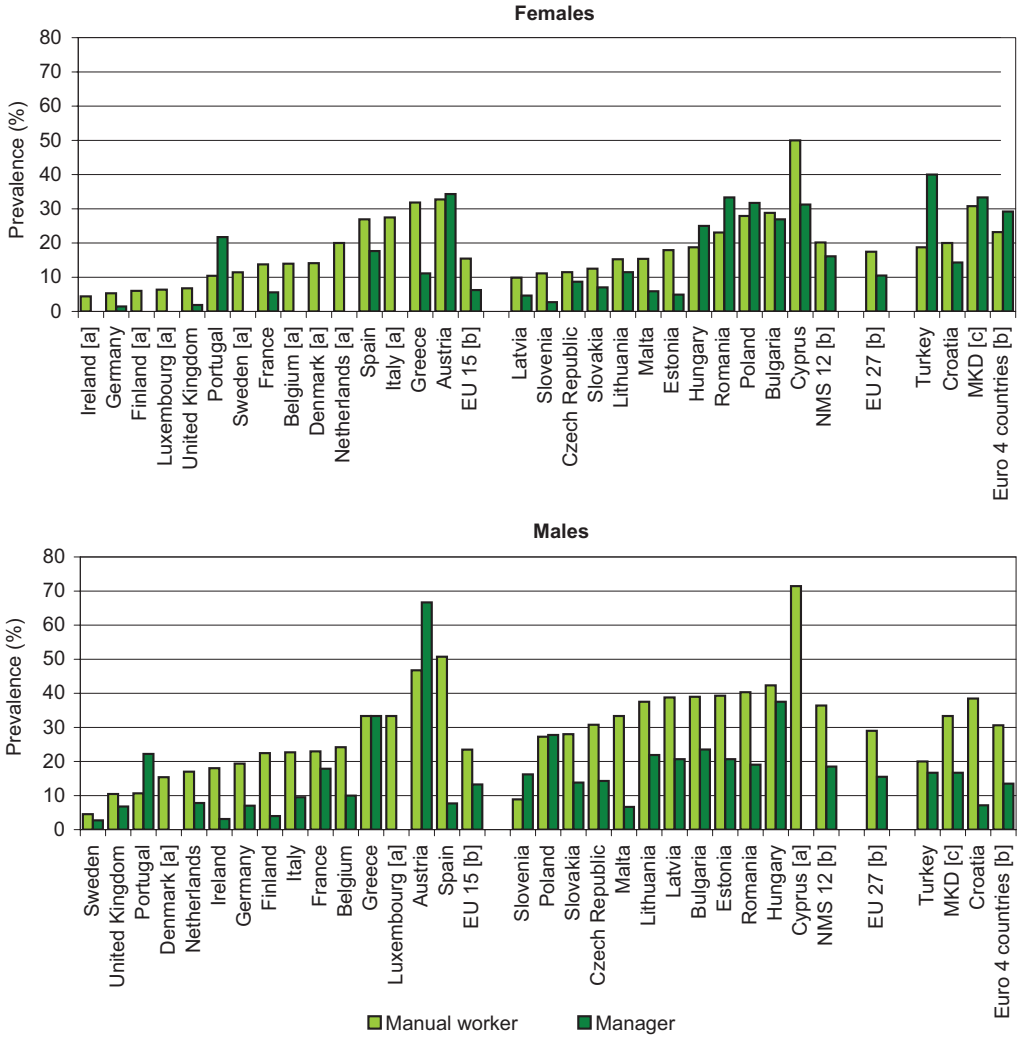
males, 14% of females). However, it is clear that in EU15 countries, inequalities by difficulty paying bills are stronger for females (prevalence rates ranging from 12% to 19%) while in NMS12 countries, males are more affected (26% to 33%). Compared to the EU countries, the three countries from the Euro 4 subregion show a rather different situation, with no clear trend for females and a reverse trend for males, more frequent exposure being associated with no difficulty paying bills (see Table 12).

Table 12. Prevalence (%) of exposure to second-hand smoke at work by difficulty paying bills and sex, 2009

	Female			Male		
	No difficulty	Difficulty from time to time	Difficulty most of the time	No difficulty	Difficulty from time to time	Difficulty most of the time
EU15 [a]	11.7	13.5	19.0	18.7	20.3	21.1
NMS12 [a]	15.9	19.7	19.6	25.8	29.1	33.2
EU27 [a]	13.6	16.3	19.3	21.8	24.2	26.9
Euro 4 countries [a]	25.7	23.2	26.2	29.0	24.0	18.4

Source: data from *Special Eurobarometer 332: tobacco* (TNS Opinion and Social, 2010); data analysis restricted to non-smokers.
Note: [a] average of national rates.

Fig. 43. Prevalence of exposure to second-hand smoke at work by occupation and sex (2009)



Source: data from *Special Eurobarometer 332: tobacco* (TNS Opinion and Social, 2010); data analysis restricted to non-smokers.
Notes: [a] prevalence among managers = 0%; [b] average of national rates; [c] MKD: ISO code for the former Yugoslav Republic of Macedonia.

When the data are stratified by occupation, a consistent pattern is visible, with few exceptions for either males or females: prevalence of second-hand smoke exposure at work is predominantly higher among manual workers than managers (see Fig. 43). In EU15, inequalities exist for both sexes, with prevalence for males at 23% among manual workers and 13% among managers, while the prevalence for females is 15% among manual workers and 6% among managers. In NMS12 countries, the inequality is less strong for females (20% among manual workers versus 16% among managers) than for males (36% versus 19%). In Euro 4 countries, the same disadvantage is found for males (31% among manual workers versus 13% among managers) but the reverse trend is shown for females, with managers more frequently exposed to second-hand smoke (23% versus 29%).

The national fact sheet on second-hand smoke exposure at work gives further details on the issue in Italy (see Annex 1).

Sensitivity analysis

As described in the data and methods section, exposure to second-hand smoke at work was defined as any exposure, including the category "Less than 1 hour a day". To assess whether the inclusion of this lowest exposure category may have caused artificial results, the prevalence of second-hand smoke exposure at work was also calculated for only those individuals indicating an exposure of one hour or more per day. Within this classification, 9% of males and 5% of females are exposed to smoke indoors at the workplace across EU27, in EU15 countries it is 7% of males, 5% of females, in NMS12 countries 11% of males, 6% of females, and in Euro 4 countries 12% of males and 9% of females.

Using this more stringent exposure definition, social differences in exposure prevalence remain. Across EU27, exposure prevalence for males is 13.5% among manual workers and 4.8% among managers, and for females is 6.5% among manual workers and 3.2% among managers. This difference persists in EU15 countries (manual workers versus managers: males 10.8% versus 4.3%, females 6.7% versus 1.3%) as well as in NMS12 countries (males 17.0% versus 5.4%, females 6.3% versus 5.7%) and Euro 4 countries (males 13.6% versus 11.1%, females 14.3% versus 4.9%).

Target groups for action

The impact of all the respective socioeconomic determinants stratified by sex was summarized (see Fig. 44). Increased exposure to second-hand smoke indoors at work shows a consistent pattern of socioeconomic disadvantage for several of the indicators studied. The strongest and most consistent inequality is found for male manual workers, who can therefore be identified as the most important target group for action on occupational exposure. Increased exposure is also found among female manual workers, but it is less strong and does not apply as consistently.

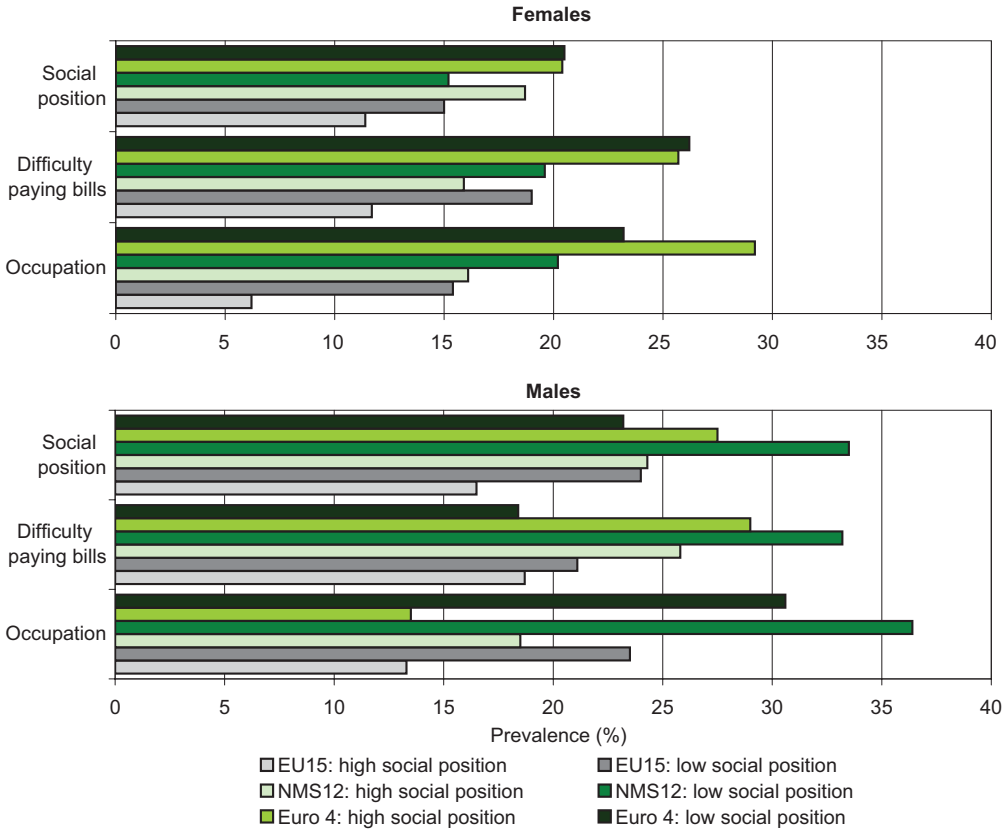
Analysing the impact of self-assessed social position as well as level of difficulty paying bills, a disadvantage can be seen for less resourced individuals in EU countries, while for the Euro 4 countries the focus of action may rather be targeted at the occupational conditions of people – especially males – without financial problems and with high social position.

Health implications

Second-hand smoke in the workplace is an important source of exposure for non-smoking adults, especially if they are not exposed at home (U.S. Department of Health and Human Services, 2006). Occupational exposure to second-hand smoke significantly increases the risk of lung cancer and ischaemic heart disease (Stayner et al., 2007; Öberg et al., 2010). More frequent exposure to second-hand smoke indoors at work among socially disadvantaged individuals may contribute to health inequalities.

Several studies have investigated the immediate effect of smoking bans on the health of non-smoking employees in bars and restaurants, and have demonstrated improvements of sensory and respiratory symptoms (see, for example, Menzies et al., 2006; Goodman et al., 2007; Ayres et al., 2009).

Fig. 44. Prevalence of exposure to second-hand smoke at work by socioeconomic indicator and sex (2009)



Source: data from *Special Eurobarometer 332: tobacco* (TNS Opinion and Social, 2010); data analysis restricted to non-smokers.

Note: low social position represents low self-assessed position on the social scale, difficulty paying bills most of the time and manual worker, respectively; high social position represents high self-assessed position on the social scale, (almost) no difficulty paying bills, and manager, respectively.

Conclusions and suggestions

Exposure to second-hand smoke indoors at work varies between countries, with an overall higher prevalence in males than females, and higher exposure levels in NMS12 and Euro 4 countries than EU15 countries.

Social inequalities in second-hand smoke exposure at work exist across EU27, with higher exposure prevalence among socially disadvantaged individuals, using the social indicators occupation, financial difficulties, and self-assessed social position (see Fig. 44). For the Euro 4 countries analysed, the inequalities are less consistent, sometimes showing lower exposure prevalence in socially deprived population groups.

At the time of the *Special Eurobarometer 332: tobacco* survey in 2009 (TNS Opinion and Social, 2010), legislation-based workplace smoking bans were already effective in many European countries. If the survey data are valid, stricter enforcement of existing smoking bans is required. That second-hand smoke exposure may still occur despite a workplace-smoking ban has been demonstrated by a study in the Netherlands, showing exposure especially of males and lower educated employees before and after implementation of the smoking ban (Verdonk-Kleinjan et al., 2009).

Suggested mitigation actions are:

- further implementation and enforcement of existing legislation-based smoking bans in workplaces;
- creation and maintenance of smoke-free public places by full-scale implementation of the WHO Framework Convention on Tobacco Control;
- targeted interventions aiming to diminish second-hand smoke exposure at work, addressing socially disadvantaged employees;
- better reporting on second-hand smoke exposure at work by sex and socioeconomic groups, including the possible effects of population-based tobacco control measures and legislation-based smoking bans in workplaces.

CONCLUSION ON ENVIRONMENT-RELATED INEQUALITIES

It has repeatedly been shown, especially in the case of children, that there are socioeconomic differences in exposure to ambient air pollution, noise and second-hand smoke and in lack of access to green space in Europe (Bolte and Kohlhuber, 2005; Bolte, Tamburlini and Kohlhuber, 2010). This analysis of data from EU-SILC, EQLS and *Special Eurobarometer 332: tobacco* adds results for adults from up to 30 countries in the WHO European Region to the body of evidence.

In line with the international debate on environmental inequalities and environmental justice, this chapter focuses on social indicators of material circumstances. Whenever possible, stratified analyses were performed to identify the impact of sex on environmental inequalities. Analysis of any modification of the health effects of environmental burdens by socioeconomic factors was not an objective of this overview.

Despite restrictions in data access and applicability of the available data, this systematic approach analysing social differences in environmental exposures shows socioeconomic inequalities in all environmental dimensions studied: noise exposure (or rather annoyance), lack of access to recreational or green areas, and exposure to second-hand smoke at home or at work. Financial limitations, indicated by a low income or self-reported difficulty paying bills, for example, are consistently associated with higher environmental threats, with some exceptions in NMS12 and Euro 4 countries. Other social or demographic determinants, such as household type, also indicate inequalities to the disadvantage of more vulnerable households.

On the other hand, analysis of data stratified by education level, and to some extent also by employment and occupation, shows that in some countries increased environmental exposures may also be associated with higher social status indicated by high education level, employment or managerial positions. Using the available data, there was no way to identify the impact of environmental health awareness (especially in relation to education) and level of expectation on these results.

Since all analyses were based on self-reported data, it would be desirable to strengthen the evidence base with more objective exposure data, as well as data on characteristics of the built environment. Ambient air pollution data are particularly relevant since the data currently available do not allow the assessment of inequalities related to air pollution. Surveys designed with suitable indicators (for example, considering only traffic-related noise) and more precise exposure assessments (such as evidence of real second-hand smoke exposure at home instead of permission to smoke at home) should be implemented. The complexity of the issue cannot be captured by the indicators currently available, so efforts are needed to assess combined or cumulative environmental exposures.

Several types of policy action may be recommended, based on these results:

- integration of an inequality perspective into urban planning (for example, in the design of buildings, streets and activity-friendly neighbourhoods, and in strengthening public transport);
- enforcement of existing legislation (such as smoking bans in workplaces);
- integration of an inequality perspective into policy measures aimed at reducing environmental hazards;
- targeted measures to protect the most vulnerable groups (individuals with the highest prevalence of exposure or who are most sensitive to the health effects of environmental threats).

Against the background of a widespread tendency to individualise health, it is essential to embed environmental concerns into the debate on health inequalities for policy-makers. According to the final report of the CSDH, one principle of action is to improve the structural determinants and conditions of daily life; hence, policies must embrace all key sectors of society, not just the health or environment sector (CSDH, 2008).

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CHAPTER 5

GAPS IN EVIDENCE AND RESTRICTIONS ON ASSESSING ENVIRONMENTAL HEALTH INEQUALITIES

CHAPTER 5. GAPS IN EVIDENCE AND RESTRICTIONS ON ASSESSING ENVIRONMENTAL HEALTH INEQUALITIES

Nita Chaudhuri, Matthias Braubach

INTRODUCTION

High-quality data should be the foundation for understanding and taking political action on environmental health inequalities in Europe. However, one of the greatest weaknesses in work on environmental health inequalities is the many gaps in data and evidence in the region. The lack of environmental risk factor and exposure data – as well as the limited stratification of environmental risk exposures by factors such as age, gender, income, ethnicity, employment and education – makes it difficult to identify vulnerable groups and the magnitude of inequality. Inconsistent inequality data also make producing comparisons within and between countries a challenge, and potentially limit the development of targeted policy responses. This can have important consequences for the health of populations, and thus the lack of data on environmental health inequalities in itself represents an environmental justice issue.

Timely, accurate, valid, reliable and relevant data help to identify important associations between environmental risk factors and sociodemographic determinants, and lead to better understanding of the patterns of exposure-response relationships and subsequent health outcomes. Such increased understanding and awareness will inform planning and decision-making for interventions and resource allocation, and can thus help to reduce the disproportionate burden of environmental risks on vulnerable groups.

Improving the availability and quality of such data is a major priority for further and more detailed assessments of environmental health inequalities. In consequence, the current data limitations – described in more detail below – need to be tackled urgently to implement sociodemographic determinants of health approaches effectively within the environmental health sector.

MISSING DATA

Lack of data on environmental exposure is one key reason why a complete picture of regional environmental health inequalities is not possible. This is especially the case for the eastern part of the WHO European Region, where information on environmental risks is scarce in general and thus already restricts environmental health risk assessments on population level. However, even in the western part of the Region, a range of environmental exposure indicators is only sporadically collected in many countries, and for various specific environmental risks no reliable data are available in any of the Member States.

Typical environmental justice indicators – such as distance to waste site, location close to busy road, location in dangerous area (prone to floods, landslides, and so on) – are rarely collected by countries, and very few of these indicators link neighbourhood and housing location to social and/or environmental

deprivation. For other relevant environmental risks considered high priority – such as air pollution, indoor air quality, chemical exposure, radiation or measured noise levels – reliable statistical data are also limited to very few countries.

LIMITED STRATIFICATION BY SOCIODEMOGRAPHIC DETERMINANTS

Although a variety of environmental risk factor data have been gathered by both national and international bodies (mostly restricted to the EU region), stratification of these risks by sociodemographic determinants is limited.

International databases such as Eurostat, for example, provide a number of environmental risk indicators for many countries in the EU. Several relevant sociodemographic dimensions of these data (such as education, employment status and ethnicity), however, are not available. Stratification of data on important risk factors such as water supply, collected by the Joint Monitoring Programme, is limited to rural–urban dimensions, which may not be relevant to all countries. Injury data provided in the WHO European Health for All database are also limited to stratification by age and sex only, leaving out, for example, the very relevant dimension of income. Environmental databases, while providing rich information on environmental conditions and trends, usually focus exclusively on this data dimension and seldom offer further breakdown of the data by population subgroups.

National statistical data are often affected by similar limitations. For example, data on air pollution are mostly restricted to the assessment of pollutant levels and are not related to sociodemographic population variables. Similarly, limited data on indoor air quality are available at the national level for some countries but cannot be broken down by sociodemographic determinants. This limits the richness of the inequality information that can be reported.

Many countries have collected environmental risk data – on traffic noise, for example – in various formats such as geographical information systems (GIS) or exposure maps. Information on sociodemographic characteristics, however, has not been collected simultaneously, and the potential overlay of mapped data on sociodemographic determinants has yet to be explored in many countries. Aggregate-level data (on districts, postal codes, deprived neighbourhoods, and so on) have also been collected; they indicate useful dimensions of environmental risks associated with social or neighbourhood deprivation levels, but do not enable the identification of environmental health inequalities at the household or personal level. While the assessment of territorial disparities is enhanced by such data collection techniques, the identification of vulnerable risk groups remains restricted.

Social deprivation indices have been used and suggested by a number of countries to identify populations at risk and provide a powerful tool for identifying major risk groups. However, such indices would need to be disaggregated to provide a more detailed understanding of the link between the separate social determinants and environmental risk factors.

DATA QUALITY

Accuracy, validity, timeliness, completeness and relevance are some of the desirable attributes that define data quality. Infrastructure and resource availability for data collection, as well as country and regional priorities, often influence the extent to which quality can be assured. In the WHO European Region there is a clear trend that when an increased level of detail or a higher quality of data is required, fewer countries are able to report on it. Also, greater variations and inconsistencies between national data exist when more detailed or objectively measured data are reported.

A key challenge for environmental risk assessment is that some exposure data tend to be based on self-reported rather than objective data, which means that perception rather than objective measurement is the basis for the assessment. Although it is often meaningful to ask individuals about their subjective

perception of exposures, rather than to consider only objective data that people may feel about very differently, self-reported data make comparison difficult exactly because they include a personal assessment. Examples of environmental exposure that are often surveyed using self-reported exposure include noise, dampness and air pollution data. The restricted validity and reliability of these self-reported rather than objective measures need to be considered when assessing survey designs or inequality relationships based on such data. However, for many environmental risk factors such information will be the only data available and, despite its limitations, may still provide useful indications of the perceived environmental burden.

Representativeness of data can also be problematic, especially in relation to data collected through national surveys that are not developed to provide detailed data on specific population subgroups. For example, small risk groups – such as poor single-parent households – may make up only a small percentage of the population, and consequently may be represented by a low number of people responding to the survey, leading to vague and, at best, indicative results. Extrapolation of such data to the national level therefore causes substantial concerns regarding the reliability of national assessments. Nevertheless, acknowledging this limitation, many inequality assessments will have to rely on such surveys since no alternative data sources are available. Targeted surveys on specific risk groups, based on adequate sample sizes, would be necessary for more reliable and detailed assessments.

CONSISTENCY AND COMPARABILITY

Consistency is another dimension of data quality that allows for comparability within and between countries. The highest consistency levels are usually provided by international studies using similar methods and definitions for each country surveyed, but these studies tend to be more general and address the full populations. By contrast, national studies often provide more detailed data and/or focus on specific target groups, but tend to be difficult to compare to similar studies undertaken in other countries.

Several criteria influence the extent to which data on environmental risk factors and sociodemographic determinants are consistently collected and reported. Numerous definitions exist, for example, within and between countries on many environmental and sociodemographic indicators, which include both subjective and objective measures. Interpretations of given risk factors may differ between countries because of sociocultural, environmental or health priorities. This leads to the development of different types of measurement indicators. For example, assessments of overcrowding may measure floor space in square metres or number of rooms, or may report on subjective notions of overcrowding. Similarly, units of measurement may also differ, including individuals, households, or percentages of the population. This makes consistency in reporting difficult, especially when individual national studies from different countries are compared and represent the main or only data source.

Similarly, countries may also collect multiple variables for one risk factor where definitions and data collection protocols may be different, again creating inconsistency in comparability. For example, various collection mechanisms exist for data on injuries and on absence from work due to injuries, making country comparison difficult. A similar situation is created by noise exposure studies which use different exposure thresholds, indicating the proportion of households exposed to more than 60 A-weighted decibels (dB(A)) in one country, while identifying households with exposure levels above 65 dB(A) in another.

Indicators can also be collected at different intervals or frequencies, making comparability between countries within specific time frames tricky. This may be the case particularly for detailed national population surveys or censuses that are not implemented on an annual basis, but also relates to international surveys. This aspect of data quality also affects the timeliness of the data to provide reliable information for decision-making to address environmental health inequalities.

Geographic scope also differs, as similarly defined indicators may be collected at local, regional or national levels. This makes it difficult to compare the magnitude of inequalities between and within countries, and is further complicated by the fact that many environmental exposures do not adhere to territorial or administrative boundaries.

Sociodemographic data often vary in relation to country-specific categories. Levels of education, for example, differ according not only to years of obligatory schooling, but also to the type of schooling, such as vocational or university. These distinctions are not always made and the categories used by countries are often not comparable. Similarly, income categories may differ by stratification of actual levels of income in local currency, or based on different definitions of high-, low- or middle-income groups. Similar problems apply for data on ethnic groups or migrants, and some countries even have legislation that bans the identification of survey participants in relation to ethnic groups.

ACCESS TO DATA

Despite all such limitations, many data useful for the assessment of environmental health inequalities are frequently collected by a range of actors working on environment, health, social protection, urban planning, transport, occupational safety and so on. However, a lack of coordination and data exchange between different national as well as international institutions prevents the effective exploitation and integration of many data sets to provide a fuller picture of environmental health inequalities. Data elements thus remain scattered and in the hands of different actors instead of being brought together.

In many countries, relevant data are not easily accessible because of legal and cost constraints, and this may also be the case for national or governmental institutions. Public authorities, as well as commercial monopolies, often collect data but are reluctant to release them, and data made available are frequently in formats that are difficult to work with.

CUMULATIVE AND MULTIPLE EXPOSURES

Individuals and households may experience many risk factors in parallel, accumulating problems that lead to multiple exposures. This requires a more complex approach to analysis, as several exposure dimensions need to be brought together within the same data set. However, most risk factors are studied, collected and reported separately, leading to an underestimation of multiple exposures when documenting clustered inequalities. It is difficult to develop a consistent approach that can be similarly applied in a number of countries with different data and priorities. Nevertheless, this should not preclude comparisons between countries using simple messages to convey inequalities.

COUNTRY PRIORITIES

Countries have different priorities in relation to environmental health inequalities, which directly affect the availability and use of data. These priorities may relate to levels of development and affluence, historical development or general environmental conditions such as climate or health status. For example, rural–urban differences in some countries represent a significant indicator of inequality, while in other countries such information is considered irrelevant. Similarly, the ability to keep the home warm during winter may not be considered relevant in countries where central heating is a basic standard in all dwellings. Water and sanitation data in many eastern European and central Asian countries are considered to be a priority, but they are not considered relevant for – and are thus no longer collected by – some EU states. In consequence, individual countries have no data available on a selected range of environmental and sociodemographic risk factors.

Sociodemographic inequalities in the eastern European and central Asian countries are among the most notable, yet little has been done in these countries to make the study of the effects of sociodemographic factors on environment and health outcomes a priority. This has led to the dearth of data apparent in this report.

DATA GAPS AND RELEVANCE FOR PUBLIC HEALTH

Although the literature on environmental health inequalities contributes to the stock of available information – particularly when similar patterns are reported frequently – the overall evidence base is limited, mostly due to the lack of statistical evidence and prevalence studies focusing on specific risk groups. Developing robust and relevant environmental health inequality indicators is, therefore, an essential requirement in order to develop a better understanding of the complex way in which environmental risk factors operate in the social environment, and to identify the respective risk groups to be targeted. Data collected with regular frequency can provide time trend information to inform environmental, health and social actors and to monitor policy responses tackling identified environmental health inequalities.

More work is needed, however, to identify and collect information on relevant environmental risk factors. In particular, data on emerging environmental health issues – such as exposure to toxic chemicals, non-ionizing radiation, nanoparticles or indoor air quality – should be collected regularly, and may provide important insights into differential exposures and impacts on vulnerable groups.

Relevant sociodemographic risk factors also need to be identified and collected, according to country priorities, in order to provide a better picture of those vulnerable groups most at risk. In many countries, for example, data on ethnicity and migrant groups as it relates to environmental risk exposure are rarely collected. Setting up agreements on the priority determinants to be considered is most practical at a national or even subnational level, but this then restricts the use of such data for international comparison.

Extending the description of data constraints, there is an important need to assess and quantify more fully the direct impact of environmental inequalities on health inequalities; this would also help to position this topic as a public health challenge. In order to make the case that disparities in environmental exposure cause health inequalities, a third data dimension is necessary: health outcomes. An ideal database for environmental health inequality assessment would therefore need to include information on health outcomes that can be categorized according to the population subgroups suffering from different exposure levels. This would not only enable an assessment of the inequalities in environmental exposure, but would also extend the assessment to a quantification of health inequalities caused by environmental inequalities. However, it appears that there is no large, international database available that would enable such an assessment.

Furthermore, the type and quality of data collected should take into consideration the context in which social determinants affect environmental conditions where people live, work and play, their differential exposure, biological susceptibility and final health outcome. This could be provided by a description of settings and the dynamic interaction of social determinants with several environmental risk factors simultaneously. For example, social class interacts with other sociodemographic factors such as gender, ethnicity and age to influence access to adequate housing, overcrowding or exposure to chemical substances. Internationally coordinated environmental health inequality studies targeting specific groups and not only full populations could therefore be initiated to examine this.

CONCLUSION

Much work needs to be undertaken to fill the data and evidence gaps that currently restrict the assessment of environmental health inequalities in the WHO European Region. A culture of free information, which requires public authorities and the private sector to give access to environmental information in the spirit of the Aarhus Convention (UNECE, 1998), should be encouraged across countries to make high-quality data available.

A detailed review of data sources and harmonization of criteria for data collection between countries would help to improve data availability, comparability and consistency. Furthermore, building capacity and sharing best practices for those countries with infrastructure and resource constraints could help to increase environmental health inequality data collection. This could include the development of surveys and GIS that simultaneously collect individual and territorial data on health, environment exposure and sociodemographic factors, particularly at country and international levels.

An environmental health inequality network could be set up to facilitate all these activities: in each country one competent agency could be mandated to compile and make available data from all sectors. This agency could also conduct independent analysis and assess national patterns. This would contribute to the development of more useful data and tools for reporting on environmental health inequalities in the region, and would also influence countries to act on the results.

In summary, priority steps to be taken towards the improvement of statistical evidence for environmental health inequality assessment would comprise:

- ensuring the right to access to available data at no or low cost;
- establishing surveys focusing on target groups in addition to full population surveys;
- facilitating the collection of reliable data on priority issues in environmental health;
- integrating and increasing the use of analysis of social and demographic variables in environmental surveys;
- developing common tools, methods, definitions and criteria for national work on environmental health inequalities.

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CHAPTER 6

PRIORITIES FOR ACTION ON ENVIRONMENTAL HEALTH INEQUALITIES

CHAPTER 6. PRIORITIES FOR ACTION ON ENVIRONMENTAL HEALTH INEQUALITIES

Matthias Braubach, Stefanie Fleischmann

INTRODUCTION

The report presents a wide range of inequalities in environmental exposure. One of the most obvious differences displayed is the disparity between individual countries and between the subregions. While these differences are relevant and can indicate the potential for improvement in those countries and subregions performing less successfully, they are not good indicators of the distribution of environmental quality within the respective populations of each country or subregion. Therefore, while acknowledging that the absolute level of environmental problems is relevant, the report goes beyond national and subregional averages, attempting to assess the inequalities in the distribution of environmental risks and to describe the exposure within different population subgroups in both absolute and relative terms.

The figures provided throughout the report identify the environmental health inequalities separately for individual countries and subregions. In this chapter, the findings are condensed and considered from the subregional and national perspectives, identifying the greatest environmental health inequalities and thereby also suggesting potential priorities for action to tackle them.

SUGGESTED SUBREGIONAL PRIORITIES FOR ACTION

Although the analysis of environmental health inequality is strongly affected by the lack of data from non-EU countries for many of the housing and all the environment inequality indicators, the data do enable the identification of some subregional priorities for action. However, it must be emphasized that – due to the wide diversity of national inequalities – only a few subregional trends for selected inequalities can be identified.

- EU15 or Euro 1 subregion: the largest injury-related inequalities occur for transport-related injuries. With housing-related inequalities, EU15 or Euro 1 countries perform rather well in relation to water and sanitary equipment; conversely, in relation to overcrowding, dampness and thermal comfort, the relative inequalities between population subgroups tend to rise and partially exceed the inequalities seen in the NMS12. Environmental inequality results often indicate that in this subregion inequalities for a range of environmental exposures are among the largest of all the subregions with available data.
- NMS12 or Euro 2 subregion: this subregion is significantly disadvantaged regarding many of the housing-related inequality indicators, and a range of gender inequalities is found for the environmental indicators. Injury-related inequalities are largest for RTIs and fatal poisonings.
- Euro 3 subregion: data for Euro 3 countries are only available for the inadequate water supply indicator and for the injury-related inequality indicators (except work injuries). For all of these indicators, greater inequalities than for some of the other subregions are identified, with the worst

results found for inadequate water supply and fatal poisonings. Euro 3 countries should set as a major priority the development of reliable mechanisms to collect and analyse data on inequalities in environmental risks so that better assessments can be produced in the future.

- Euro 4 subregion: data for Euro 4 countries are only available for the inadequate water supply indicator and for the injury-related inequality indicators (excluding work injuries), as well as for the indicators on second-hand smoke exposure and lack of access to recreational and green areas (for Croatia, the former Yugoslav Republic of Macedonia and Turkey only). Although inequalities are identified for all indicators, the main inequality challenges for Euro 4 countries lie within unintentional injury indicators (transport-related injuries and poisonings) as well as the second-hand smoke exposure indicator. As with the Euro 3 subregion, data collection as a baseline for the assessment of environmental health inequalities must be considered a priority challenge.

As these subregional trends reflect the summarized values for the respective countries, they allow an assessment of the likelihood that countries of a given subregion may face inequality problems related to a particular environmental exposure. Subregions with very obvious inequalities inevitably contain a majority of countries where the respective inequality is an issue. However, it must be cautioned that the subregional priorities can by no means automatically indicate priorities for action at a national level.

SUGGESTED PRIORITIES FOR NATIONAL ACTION

To identify potential priorities for national action among the range of environmental health inequalities, two dimensions of inequality are of relevance. First, data on the relative inequality between population subgroups for a given environmental exposure must be considered. However, as this report shows, high relative inequalities can be found in countries where the absolute population prevalence of this exposure is low, and also where prevalence is relatively low for the selected disadvantaged population subgroups, compared to other countries. Therefore, possible priorities for national action need to be identified with an acknowledgement of both the absolute magnitude of the respective environmental exposure (in total terms, such as for the whole population) and the dimension of relative differences between population subgroups.

Following this approach, data on the relative inequalities and inequality ratios were compiled from the report and graded for each country. A percentile approach was used to categorize the countries into four quartiles, the first quartile containing the countries with the lowest relative inequalities and the fourth quartile containing those with the highest relative inequalities. These data were then brought together with data on the absolute prevalence of the respective risk exposure in the total population – these were also categorized into quartiles, the first quartile containing the countries with the lowest absolute prevalence rates, and the fourth quartile containing those with the highest absolute prevalence rates.

Assessing potential priorities for national action: methodology

Table 13 shows how this approach is applied to an example environmental risk factor in relation to poverty. The columns show the inequality ratio quartiles, with quartile 1 (countries with lowest exposure inequalities in relation to poverty) on the left, and quartile 4 (countries with highest exposure inequalities in relation to poverty) on the right. The rows show the absolute exposure prevalence quartiles for the total population, with quartile 1 (countries with lowest absolute prevalence) at the top, and quartile 4 (countries with highest absolute prevalence) at the bottom.

Table 13 indicates that the combination of the absolute and relative dimensions results in an overall country assessment.

- Country A performs well on both inequality dimensions, reporting – in relation to all other countries – both low absolute exposure prevalence and low inequality by poverty.

Table 13. Potential priorities for national action assessment ranking scheme

Quartiles for absolute exposure prevalence (total population)	Quartiles for inequality ratios in exposure prevalence (population below/above poverty threshold)			
	1 (lowest)	**2**	**3**	**4** (highest)
1 (lowest)	**Country A**			**Country B**
2				**Country G**
3			**Country H**	**Country D**
4 (highest)	**Country C**	**Country I**	**Country E**	**Country F**

Colour coding:

- Countries with no suggested priority for national action
- Countries that would be classified as having a suggested priority for national action if they fell into a higher quartile for just one of the two inequality dimensions
- Countries with suggested priority for national action (defined as countries being in the fourth quartile for both the absolute and relative inequality dimensions, or in the third quartile for one and in the fourth quartile for the other inequality dimension)

- Country B is in the quartile of countries showing the highest inequality in exposure prevalence between those above and below the poverty threshold, but the absolute population prevalence of exposure to this risk factor is very low. Although the respective inequality needs to be addressed by focusing local action on the population groups that experience disproportionate exposure levels, it can hardly be considered a national priority issue in Country B.
- The opposite case is represented by Country C, which falls into the highest quartile regarding absolute exposure but shows – compared to the other countries – rather modest poverty-related inequality. The respective environmental health risk must therefore be considered a national health challenge in Country C and calls for general public health action. However, as the exposure risk affects those above the poverty threshold almost as much as those below, there is little to gain from targeted interventions aiming at the reduction of inequalities in Country C.
- Finally, some countries combine both disadvantages. Country D is in the third quartile for absolute prevalence and in the fourth quartile with one of the highest relative inequalities by poverty, while Country E shows one of the highest absolute prevalence rates of all countries covered, and also falls into the third quartile of relative inequalities. Country F is categorized in the highest quartile for both dimensions. For countries D, E and F, the respective environmental health risk is greater than in most other countries, and its distribution within the population is also much more unequal than in most other reporting countries. In consequence, they can be identified as countries in which the respective inequality in environmental exposure is – compared to the other countries – expressed most strongly and thus might represent a priority for national action and follow-up.
- In addition to the combinations discussed above, Table 13 also helps to identify countries that are just one step away from a suggested need for action, represented by countries G, H and I in the table. If Country H were to experience an increase either in the absolute prevalence or in the relative inequality by poverty, it could quickly fall into the fourth quartile on one of the two dimensions, thus being identified as a country with suggested priority for national action. A similar situation occurs for countries G and I, as they are in the fourth quartile for one dimension already, and would become a country with a suggested priority for national action if they fell into the third quartile for the other dimension. Thus, countries G, H and I may be considered "at risk", since a deterioration of the situation could quickly result in their being categorized as having priorities for national action.

Using this approach, the figures and tables displayed in this assessment report were analysed to assess possible priorities for national action, applying the colour scheme defined in Table 13 to indicate countries with suggested priorities for national action (countries D, E and F), countries close to being classified as having suggested priorities for national action (countries G, H and I) and countries with a comparatively low relevance of inequalities.

Potential priorities for national action assessment findings

Possible priorities for inequality action are identified for the countries listed in Table 14, based on the merged analysis of relative and absolute inequality dimensions. However, it must be emphasized that a large number of countries cannot be assessed because no data are available, and therefore the identification of suggested priorities for national action is restricted to the respective and varying number of reporting countries for each given indicator. A more detailed table showing the assessment by country is available in Annex 3.

Interpretation of results

In countries with suggested priorities for action, national follow-up is needed to:

- confirm and validate the findings based on national data;
- identify the social and environmental context and causal mechanisms of the findings;
- evaluate and interpret the respective inequalities.

This is especially important as the assessments presented in this report are based on quantitative data only, and might thus identify inequalities which, in a given national context, may not present a problem for country-specific reasons that cannot be considered by this international assessment report. Therefore, in these countries, action should first be focused on gaining a better understanding of the findings and the causal mechanisms leading to the observed disparities. Practical action should follow when the inequalities are confirmed as resulting from unfair societal processes.

In most cases, action would aim at the reduction of relative inequalities by reducing the exposure prevalence of the most affected population groups, which would also have an impact on the absolute exposure prevalence. In addition, countries might also consider general environmental protection measures to reduce the absolute population exposure, but would then need to pay attention to the distribution effects of the applied measures to ensure that more exposed population groups benefit as much from these efforts as the less exposed.

It must also be noted that this classification is based on a relative international comparison; thus individual countries may be performing more poorly than their neighbours, but may not have been identified as countries with potential priorities for action because other countries – many of which might have a lower developmental level – are reporting higher prevalence and inequality levels. Thus, if a similar classification approach were undertaken across only the EU15 countries, for example – a group more comparable in terms of economic situation than the group including all the Member States of the WHO European Region – some of these countries would have been categorized as countries with potential priorities for action, while they might not be categorized as such when data from a wider range of countries are taken into consideration. This is especially valid for "at risk" countries which, if categorized into a higher quartile for only one of the two dimensions, would immediately be classified as countries with suggested priorities for national action (see countries G, H and I in Table 13).

Furthermore, in some of the countries with small populations, the samples providing data for this assessment report were relatively small. This could have resulted in substantial random variability of the results, which must be borne in mind in their interpretation.

Finally, Table 14 reveals two important conclusions. First, for each environmental health inequality indicator, a large number of countries do not report the required data. For seven Member States, data were only available for 5 or fewer of the 30 assessed inequality dimensions covered within the 14 environmental health inequality indicators, and for five countries no data were identified for any of the inequality dimensions covered. In this context, environment and health policy-makers as well as experts from social support and protection sectors should bear in mind that the lack of data on the existing exposure differentials may represent an inequality in itself, hiding potential disparities between population groups behind national averages. Second, in a considerable number of countries the inequality trends are reversed and the environmental burden is higher in, for example, groups of higher

social position or income. This indicates that general trends say little about the situation in individual countries, and that for some environmental health risks, action may have to be targeted not only at the socially disadvantaged.

Table 14. Suggested priorities for national inequality action

Chapter	Indicator	Relative inequality dimension	Countries with suggested priorities for action	Country coverage
Housing	Lack of flush toilet in dwelling	Above versus below relative poverty level	Bulgaria, Hungary, Latvia, Poland, Slovakia	30
		Single-parent households versus all households	Austria [a], Bulgaria [a], Estonia [a], Greece [a]	30
	Lack of bath or shower in dwelling	Lowest versus highest income quintile	Belgium, Bulgaria, Cyprus, Estonia, Hungary, Latvia, Poland, Portugal, Romania	30
		Single-parent households versus all households with children	Greece [a], Lithuania, Poland, Portugal, Slovenia	30
	Overcrowding	Single-parent households versus all households	Austria, Czech Republic	30
		Lowest versus highest income quintile	---	30
	Dampness in the home	Lowest versus highest income quintile	Bulgaria, Estonia, Latvia, Lithuania, Poland, Romania	30
		Single-parent households versus all households	Cyprus, Poland, Romania	30
	Inability to keep home warm in winter	Above versus below relative poverty level	Greece	30
		Household type	Cyprus, Germany, Poland	30
	Inability to keep home cool in summer	Lowest versus highest income quintile	Cyprus, Greece, Italy, Portugal	27
Injury	Work-related injuries	Male versus female	Germany, Luxembourg, Portugal, Switzerland	15
		Age group	France, Portugal, Spain	15
	Mortality rate of all transport injuries	Age group	San Marino	10
	Mortality rate of RTIs	Age group	Croatia, Cyprus	37
		Male versus female	Croatia, Italy, Lithuania, Portugal, Serbia, Slovenia, Uzbekistan	37
	Poisoning mortality rate (all causes)	Male versus female	Belarus, Estonia, Finland, Greece, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Poland, Russian Federation, Slovakia, Ukraine	43
	Poisoning mortality rate (excluding alcohol poisoning)	Male versus female	Estonia, Ireland, Kyrgyzstan, Latvia, Lithuania, Malta	32
	Alcohol poisoning mortality rate	Male versus female	Estonia, Finland, Kyrgyzstan, Latvia, Lithuania, Poland, Slovakia	28
	Fall mortality rate	Male versus female	Belarus, Estonia, Finland, Latvia, Lithuania, Romania, Russian Federation	45
Environment	Complaints about noise exposure at home	Above versus below relative poverty level	Denmark, Germany, Luxembourg, Netherlands, Romania [a]	30
	Complaints about lack of access to recreational or green areas	Female versus male	Poland [a], Portugal, Turkey	31
		Lowest versus highest income quartile	Belgium, Bulgaria [a], Greece [a], Hungary [a], Lithuania [a]	31
		No difficulty paying bills versus difficulty paying bills most of the time	---	31
	Exposure to second-hand smoke at home	Female versus male	Luxembourg, the former Yugoslav Republic of Macedonia, Turkey	30
		Low versus high self-assessed social position	Greece, Poland	30
		No difficulty paying bills versus difficulty paying bills most of the time	---	28
	Exposure to second-hand smoke at work	Male versus female	Austria, Lithuania	30
		Low versus high self-assessed social position	Bulgaria, Turkey [a]	28
		Manager versus manual worker	Cyprus, Italy, Malta, Spain	30

Notes: [a] reversed inequality dimension.
Details of the country assessment can be found in Annex 3.

CONCLUSION

CONCLUSION

Editorial group

"Tackling the determinants of health inequalities is about tackling the unequal distribution of health determinants."

(Graham, 2004)

KEY MESSAGES

There are four main conclusions from this assessment report.

1. Environmental health inequalities exist in all subregions and in all countries, and they are most often suffered by disadvantaged population groups.

- Environmental health inequalities exist across the region and are expressed by both intercountry and intracountry differences. Intracountry differences by social or demographic determinants can often exceed the intercountry differences, indicating that specific population groups are more strongly exposed to certain environmental risks within the respective country.
- For most of the environmental health inequality indicators for which stratification by socioeconomic determinants such as income or poverty is possible, the findings show a rather consistent pattern with socioeconomically disadvantaged individuals or households being more frequently exposed to environmental risks. However, in some countries, as well as for some risk factors, obverse inequalities can be found, indicating higher exposure levels in more affluent population groups.
- Environmental health inequality data can most often be stratified by age and gender, and frequently by socioeconomic determinants (mostly income-related, but also in relation to education or employment, for example) and household type. Each of these determinants is associated with significant inequalities.
    - Income and poverty-related inequalities are identified for noise exposure, exposure to tobacco smoke at home and at work, and for housing-related inequality indicators, where they are expressed most strongly. Compared to the other social and demographic determinants applied, income- and poverty-related determinants display some of the strongest inequalities at regional as well as subregional and national levels (for EU27, the lack of a toilet in the home is, for example, eight times higher in the lowest income quintile than in the highest income quintile).
    - Differences in national income levels are also associated with injury-related fatalities, with low/middle income countries reporting higher mortality rates.
    - The indicators show that gender-related inequality is most strongly associated with injury, where male fatality rates are often three times (and beyond) female fatality rates. Gender differences also appear in relation to tobacco smoke exposure, yet play no important role for housing- and location-related risk factors.
    - Age-related inequalities are present for injuries (especially falls) but are less prominent for the other inequality indicators.
    - Household type-related inequalities are especially identified for single-parent households, and increase when combined with income-related determinants. Large variations by household type are identified for housing-related risk factors, putting vulnerable households at higher risk.
    - Data on inequalities by education, employment/occupation level, self-reported social position and difficulty paying bills are only available for some of the environment-related inequalities, but show a more diverse inequality pattern. For example, high education level is consistently associated with lower self-reported access to recreational and green areas, while low social

position is most often associated with increased exposure to second-hand smoke both at home and at work. On the other hand, employment/occupation level shows different inequality patterns in exposure to second-hand smoke, depending on sex and subregion.

2. The magnitude of inequalities and the distribution of inequalities between advantaged and disadvantaged population groups can be very diverse between countries and also depends on the socioeconomic or demographic variable used for stratification.

- There are strong differences in the magnitude of environmental health inequalities between countries, and these differences are visible between countries both on disparate and on similar developmental levels. They are formed by both the differences in absolute exposure levels and the differences in the expression of relative inequalities, and show that each country provides a unique context for the development of environmental health inequalities.
- For a range of inequality dimensions, some countries exhibit opposing inequality directions compared to the majority of countries. This variation of inequality direction was often found for inequalities by sex and age, but also occurred – depending on the environmental risk considered – in relation to inequalities by income and poverty, by household type, and other determinants such as social position, difficulty paying bills, and occupation.

3. To allow reliable identification of the most relevant target groups and to understand better the national inequality patterns and their causal mechanisms, more detailed environmental health inequality reporting and assessment must be carried out at the national level.

- Large intercountry variations and national exceptions from regional or subregional trends exist for many indicators. More detailed environmental health inequality assessment should be carried out at a national or subnational scale, as general patterns for the WHO European Region or its subregions are not necessarily reflected in all countries.
- The general population exposure to environmental risks does not necessarily indicate the level of relative inequalities. For some indicators, inequality expressed in relative terms is higher in countries with rather modest general exposure prevalence. This situation often applies to the more affluent countries due to the very low prevalence of environmental risks in the advantaged population subgroups (such as those with the highest SES).
- The use of national databases for country-specific environmental health inequality assessments will enable more detailed findings by providing additional data on exposure as well as enabling analysis of a more complete set of social and/or demographic determinants.

4. The evidence base for the assessment of environmental health inequalities is weak and needs to be strengthened.

- The overall availability of reliable and consistent national and international data capable of indicating differences by social or demographic determinants is insufficient. In particular, a large evidence gap exists between EU Member States, EU candidate countries and European Free Trade Association countries on the one hand, and the other countries in the WHO European Region on the other. This evidence gap becomes especially apparent when it is noted that of the 14 environmental health inequality indicators covered in this report, only 5 can draw data from the whole WHO European Region, while consistent data for all 14 indicators are available from the EU countries.
- Many environmental health inequality indicators covered in this report are restricted to stratification by only one or two sociodemographic determinants, and for a number of environmental health priorities (such as chemical exposure, air quality, distance to waste sites or location in dangerous residential areas) no inequality indicators could be developed because of a lack of data.
- Several of the indicators used are based on self-reported data and have been taken from national surveys with relatively small sample sizes.

In summary, this report compiles and quantifies a diverse range of environmental health inequalities, proving that challenges of environmental justice are apparent in all countries, and documenting that each of the environmental inequalities covered is associated with a range of health effects, thus contributing to health inequalities. However, the data are rather limited, both in terms of quantity (including low country coverage, lack of data on risk factors and on sociodemographic determinants) and sometimes quality (such as small sample sizes and dependency on self-reported or vague exposure conditions). Therefore, this assessment report marks only a first milestone in the progress towards a reliable and comprehensive assessment of environmental health inequality in the WHO European Region.

Furthermore, it is not possible without further investigation to say whether the observed differences in environmental exposures between different sociodemographic groups are simply the product of chance, or whether they reflect the inequities discussed in Chapter 1: inequalities resulting from a combination of influences, which imply unfairness and injustice and are avoidable. A qualitative assessment of whether the differences described in this report are unavoidable inequalities or unfair reflections of inequity is a task best conducted at the national level, where the particular social and policy context is better understood. Therefore, the results of this report should encourage Member States and their governments to follow up in more detail on the findings and inequalities presented. This should permit the identification of areas where action is most needed and where it is possible to reduce the described inequalities.

FURTHER PERSPECTIVES FOR ACTION

The findings of the environmental health inequality assessment report indicate that, although to differing extents, environmental health inequalities exist in all Member States of the WHO European Region. Many countries need to tackle environmental health inequalities as a priority issue, although national priorities and disadvantaged groups vary. Six general recommendations for action that can be derived from this report are given below, but need to be tailored to the national situation.

Action 1: general improvement of environmental conditions

Irrespective of target groups and target areas, general improvement of housing conditions, safety regulations and education, and environmental conditions would reduce the general exposure level of all citizens, thereby also improving the situation of those most affected or most vulnerable. Disadvantaged population groups may even benefit to a greater extent from such interventions, and thus basic measures providing adequate environmental conditions to all would be likely to mitigate a range of environmental health inequalities.

As indicated in the Introduction (Fig. 1), the expression of inequalities as gradients across population subgroups may offer helpful information in deciding whether universal action for the benefit of all is a suitable strategy for tackling these inequalities. This report enables the assessment of environmental health issues affecting most or all population groups, which call for universal actions to create healthy environments for all. Such general interventions could be suggested, for example, to address:

- water supply in all rural areas of Euro 3 countries (see Fig. 3, Chapter 2);
- overcrowding in EU15 and NMS12 countries (see Fig. 11, Chapter 2);
- dampness in dwellings in EU15 and NMS12 countries (see Fig. 14, Chapter 2);
- inability to keep the home cool in summer in EU15 and NMS12 countries (see Fig. 18, Chapter 2);
- noise exposure in EU15 and NMS12 countries (see Fig. 34, Chapter 4).

However, as environmental conditions and inequalities may be diverse, more detailed national assessment on general environmental priorities is recommended before taking action (see Action 3 below).

Action 2: mitigation and reduction of risk exposure in the most affected population groups

Targeted and short-term action is necessary to reduce exposure burdens in the most exposed as well as the most vulnerable population groups. If specific inequality assessments to identify the most affected groups are not available, area-based approaches could be applied. These could focus on environmental exposure hotspots or neighbourhoods/residential locations known to be most deprived and/or exposed to housing and environmental risks, including transport-related exposures such as noise, air pollution and safety threats.

As with identification of universal actions, some findings indicate that specific target groups are most at risk. Acknowledging that especially steep or skewed gradients suggest the application of risk group-specific interventions, this report proposes that targeted action could be taken, for example, to address:

- lack of flush toilet in low-income households in NMS12 countries (see Fig. 7, Chapter 2);
- lack of bath or shower in low-income households in NMS12 countries (see Fig. 9, Chapter 2);
- RTI mortality in young male adults across all regions (see Fig. 26, Chapter 3);
- lack of access to recreational/green areas in population with high education level in Euro 4 countries (see Table 10, Chapter 4).

Again, within individual countries, gradients and inequalities may be diverse or reversed, so more detailed national assessment is recommended before taking targeted action (see Action 3 below).

Action 3: national environmental health inequality assessments

This report shows that the profile of environmental health inequalities is very different across Member States. To allow targeted action, further country-specific work is necessary to collect more and better data on national priorities and the population groups most at risk. This could also be achieved by integration of inequality-sensitive items in national health and/or environment surveys, or the development of multiple indices which bring the data together to provide a more holistic measure. The methodology and environmental health inequality indicators developed during this project could provide a backbone for country-specific adaptations of the WHO European environmental health inequality assessment. Furthermore, an effort towards better data collection standardization would allow more useful and reliable international comparisons.

Action 4: sharing experiences – case studies on successful interventions

A number of countries have already provided evidence on their experiences of identifying and assessing environmental health inequalities, as well as the actions and interventions used to tackle those inequalities (see Annex 2). A review of case studies based on interventions in the health sector as well as in non-health sectors (including environment, transport, urban planning, work, education, social and housing) could identify successful approaches and elements of good practice for the reduction of environmental health inequalities related to, for example:

- enforcement of legislation (such as smoking bans, speed limits and building codes);
- integration of an inequality perspective into urban planning (such as safe design of buildings and activity-friendly neighbourhoods, and safe and ecological transport modes);
- integration of an inequality perspective into policy measures aimed at the reduction and equal distribution of environmental hazards;
- targeted environmental, social and infrastructural measures to protect the most vulnerable groups.

Action 5: review and modification of national intersectoral policies in relation to environmental health inequalities

Reflecting the fact that environmental and health inequalities are often caused by policies and decisions made outside the environment and health sectors, increased communication and exchange between sectors are necessary to ensure shared information and to prevent the negative consequences of equity-sensitive policies and measures. Moderated round-table discussions could bring together high-level representatives of different sectors to discuss and agree on opportunities to reduce unequal distributive effects of policy-making. In this context, briefing papers could be developed that inform non-health sectors about the health and equity consequences of their actions.

Action 6: monitoring of environmental health inequalities

While single assessments and status reports on environmental health inequalities will be useful to provide evidence and raise awareness, continuous monitoring of environmental health inequalities is necessary to trace the trends, re-assess priorities and evaluate the success of policy or technical interventions. Again, national action in monitoring the development of environmental health inequalities will be most effective. Nevertheless, WHO will make use of its Environment and Health Information System (ENHIS) as an existing structure to monitor environment and health trends, and extend selected ENHIS indicators to cover stratification by relevant social or demographic determinants as respective data become available.

REFERENCE

Graham H (2004). Tackling inequalities in health in England: remedying health disadvantages, narrowing health gaps or reducing health gradients? *Journal of Social Policy*, 33(1):115–31.

ANNEX 1

NATIONAL ENVIRONMENTAL HEALTH INEQUALITY FACT SHEETS

ANNEX 1. NATIONAL ENVIRONMENTAL HEALTH INEQUALITY FACT SHEETS

CONTENTS

Dwellings supplied with piped water by proportion of Roma population

Hungary

KEY MESSAGE: The percentage of dwellings supplied with piped water differs between municipalities in Hungary with different proportions of Roma population.

Data source: The data are taken from the 2001 census undertaken by the Hungarian Central Statistical Office and stored at the Regional Informational System of the Ministry of National Development.

Data description: The parameters are defined as "dwellings supplied with piped water" and as "proportion of Roma population in municipality".

Data coverage: The available data have national coverage, stratified by municipality level (Local Administrative Unit2, formerly known as NUTS5).

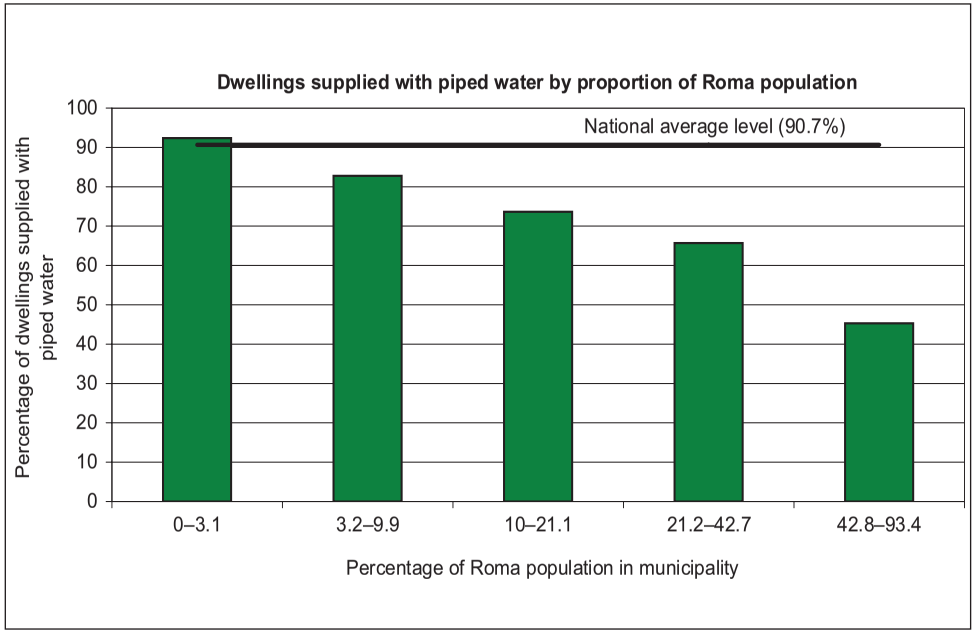
Social dimension: This inequality fact sheet describes "dwellings supplied with piped water" in association with the proportion of Roma population in the respective municipality (divided into five groups by natural breaks in the data).

Context: The Roma population is the only official ethnic group in Hungary. The census definition of a Roma inhabitant is based on a personal declaration of being a Roma (aggregated description of the Gipsy, Romany and Bea population).

The Roma population is relatively small, comprising only 2.02% of the total population according to the 2001 census in Hungary. However, the proportion is assessed as 7% in the EU strategy on Roma inclusion.

Roma inhabitants live mainly in the less urbanized, rural areas where the population has a mixed ethnic–religious composition. High unemployment rates and a low educational level characterize this ethnic group.

The national average of dwellings supplied with piped water is 90.7% but can be below 50% depending on the respective municipality.



Analysis and interpretation: A strong, significantly inverse association is found between between the percentage of dwellings supplied with piped water and the proportion of Roma population at the municipal level in Hungary, based on the 2001 census.

The band showing the lowest percentage of dwellings supplied with piped water is characterized by the highest proportion of Roma population. In this band less than one-half (45.29%) of dwellings are supplied with piped water, a figure 50% lower than the national average (90.7%).

Policy implications: Earlier surveys have shown that approximately 1.6% of the total population of Hungary lives in segregated habitats (colonies) with poor environmental conditions such as a lack of sewerage and gas supply, the presence of garbage deposits and waterlogged soil. 94% of these colonies are inhabited predominantly by Roma. The most deprived areas are those parts of the country with the highest numbers of colonies, and consequently a higher proportion of Roma population.

Significant improvements of living conditions can be achieved by implementing complex programmes to change environmental factors at local and national levels. These planned programmes will be in accordance with the main aims of the newly adopted EU strategy on Roma inclusion to close the gap in access to housing and public utilities such as water and electricity (EU Framework for National Roma Integration Strategies up to 2020, 5.4.2011 COM(2011) 173 final).

Lack of flush toilet by wealth status, urban/rural residence and region

Georgia

KEY MESSAGE: Households with low wealth status levels are much more likely to live in dwellings without flush toilets in Georgia. Rural areas are especially affected by this inequality.

Data source: Data on the availability of flush toilets are taken from the Reproductive Health Survey carried out in Georgia in 2010 jointly by the National Center for Disease Control and Public Health, the Centers for Disease Control and Prevention, the United Nations Population Fund and the United States Agency for International Development.

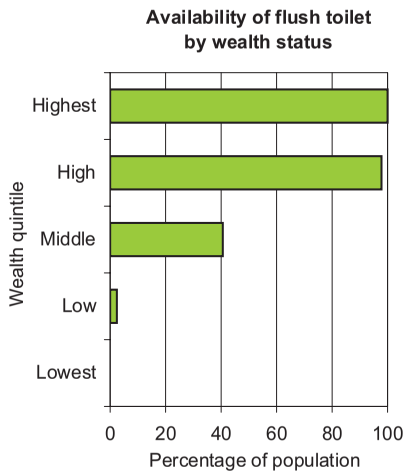
Data description: The household chapter of the survey defines various parameters, including classifications of "flush toilet" and "pit latrine" as pre-coded options, among other alternatives, and refers to households.

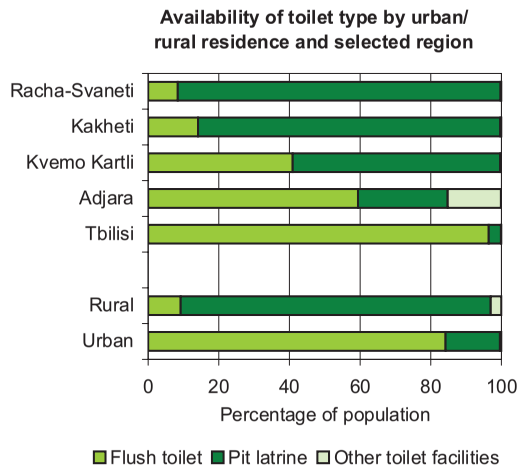
Data coverage: The available data have national coverage and are available for 2010. Future surveys are planned.

Social dimension: This inequality fact sheet stratifies "availability of flush toilet" by wealth quintile, residence and selected regions. Wealth status is based on household assets, including durable goods (such as refrigerator, television, car and computer) and dwelling characteristics (such as type of source for drinking-water, toilet facilities, fuel used for cooking and heating, main roof material and overcrowding). The sample of households was divided into quintiles of equal size based on a weighted frequency distribution of households by the resulting asset score indicating wealth status.

Context: In general, 48% of all Georgian households have a flush toilet with adequate hygienic standards, while 50% have a pit latrine that provides a much less appropriate hygienic context. However, the availability of a flush toilet is highly associated with urban settings and increased social status and wealth: almost three out of four urban households (74%) are classified in the two highest wealth quintiles, while only 3% of rural households are as wealthy. Instead, more than 70% of rural households belong to the low and lowest wealth quintile.

In consequence, the availability of flush toilets versus pit latrines follows a strong social and geographical pattern, putting rural and less developed regions with less economic power and more traditional housing stock at a disadvantage.





Analysis and interpretation: There is a very strong difference in the availability of flush toilets between households by wealth quintile, ranging from 0–100%. Similarly, strong disparities regarding the availability of flush toilets exist by urban/rural residence and geographic area. Overall, the lowest wealth quintile households live exclusively in dwellings without a flush toilet.

The situation is most severe in rural areas (around 10% of households having access to flush toilets) and particularly in mountainous areas (such as the Racha and Svaneti regions, at 8%).

The unequal distribution indicates the degree to which wealth is distributed in geographic areas, demonstrating a direct effect of poverty and economic disadvantage on basic sanitary equipment. Looking at the regional variation, Tbilisi metropolitan area has the largest proportion of households in the highest two wealth quintiles (91%) and thus the highest level of flush toilet availability (96%), while regions with most households in the lowest two wealth quintiles report that 60% and more of their dwellings are only equipped with pit latrines.

Policy implications: There is a very strong difference in the availability of flush toilets between households in Georgia by wealth quintile, as well as by urban/rural residence and geographic area. Lowest wealth quintile households exclusively live in dwellings without flush toilets, which are a predominantly rural feature, while urban households strongly benefit from economic wealth and thus have a very high level of access to flush toilets. Political measures to reduce the unequal distribution of hygienic sanitation equipment therefore need to be tackled predominantly through economic measures and an improvement of living conditions in rural areas.

Lack of bath or shower in dwelling by urban/rural population and region

Kyrgyzstan

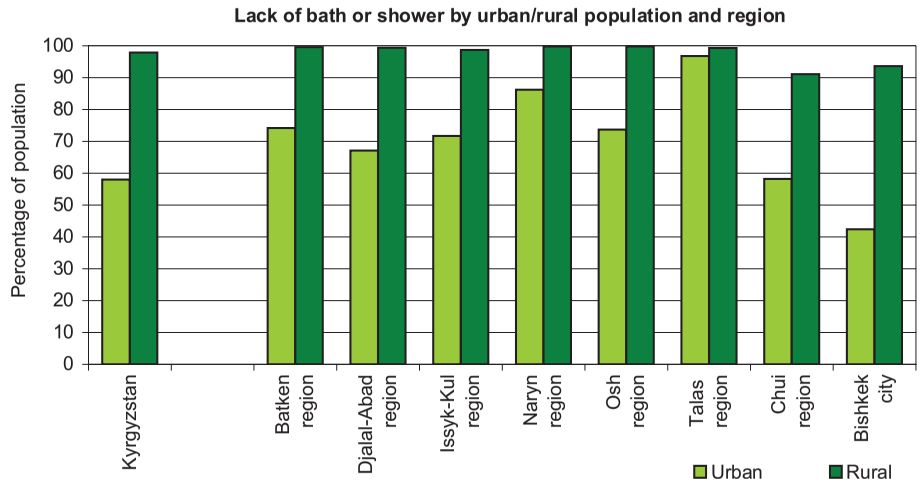
KEY MESSAGE: In Kyrgyzstan larger proportions of rural than urban populations lack a bath or shower in their dwelling. The national ratio is 1.7:1, with regional variations.

Data source: Data on the availability of a bath or shower in the dwelling are taken from the national census, conducted every 10 years by the National Statistical Committee of Kyrgyzstan. The data used are from the 1999 census. Summary data of the 2009 census can be downloaded from the web site at: http://www.stat.kg, but housing amenities data are still under analysis.

Data description: The parameter is defined as "bath (shower) in dwelling", corresponding to dwellings in which a bath or a shower is installed either in a separate bathroom or in any other room fitted for this purpose, irrespective of the type of supply of hot water.

Data coverage: The survey has national coverage, stratified by seven regions and the city of Bishkek. Data are available for 1999.

Social dimension: This inequality fact sheet stratifies the percentage of urban and rural populations with no bath or shower in the defined regional entities.



Context: The 1999 population census of Kyrgyzstan recorded 1 109 000 households, with 4 787 000 residents; 135 households (253 people) were homeless. The census contains information on the level of housing amenities in the country. Whereas electricity is available to practically all the population, many houses – especially those not built by the state – lack running water, central heating, hot water supply, bath or shower, gas and sewerage connections.

In 1989 73% of housing was owned by citizens, whereas according to the 1999 census home-ownership has risen to 94.6%. This rise occurred due to the privatization of state-owned houses, and has increased the level of private responsibility for housing amenities such as hygiene facilities.

Analysis and interpretation: Only 15.9% of the population of Kyrgyzstan have a bath or shower in their dwelling. However, there is strong urban–rural inequality, as 58% of the urban population versus 97.9% of the rural population do not have a bath or shower. Similarly, strong differences exist by region. Among urban areas the lowest percentage of population having no bath or shower is in the Chui region (58.2%) and the highest is in the Talas region (96.8%). Among rural areas the lowest percentage of the population having no bath or shower is also in the Chui region (91.1%), while the highest is in the Osh and the Naryn regions (99.8%). The highest rates of access to a bath or shower are in the capital city, Bishkek.

In Kyrgyzstan lack of a bath or shower in the dwelling is much more strongly evident in the rural than the urban population (at a ratio of 1.7:1). The difference between regional proportions of rural and urban populations lacking a bath or shower is lowest in the Talas and Naryn regions.

Policy implications: There is a very strong difference in availability of a bath or shower between urban (42%) and rural (2.1%) populations in Kyrgyzstan. In the city of Bishkek the population lives in houses with a higher level of amenities than the population of other areas, indicated by availability of a bath or shower for 57.6% of the urban and 6.4% for the rural population.

At present, following privatization, the majority of housing stock is in private ownership. Access to new houses with amenities depends on the socioeconomic level of the household. Data from the 2009 census will help to identify regions requiring urgent attention regarding lack of a bath or shower. Guidance on the improvement of housing conditions is included in national housing regulations. However, sanitary and epidemiological requirements for residential houses and indoor spaces are currently only recommendations; technical regulations are yet to be developed. Development and revision of general building and development plans of cities and residential areas should take into consideration new types of building, including low-rise and individually designed dwellings. Issues of providing existing dwellings with sanitary amenities (including a bath or shower) and the necessary infrastructure need to be resolved. There is a need to improve and develop technical regulations on housing in order to ensure safe and comfortable conditions for the population of Kyrgyzstan.

Overcrowding by tenure group and household income

Great Britain

KEY MESSAGE: The highest proportions of overcrowding for all income quintiles are found in the social rented sector. Overcrowding affects all tenure groups but in each case is more prevalent in the three lowest income quintiles. Policies that target overcrowding in the social rented sector have the potential to benefit more families.

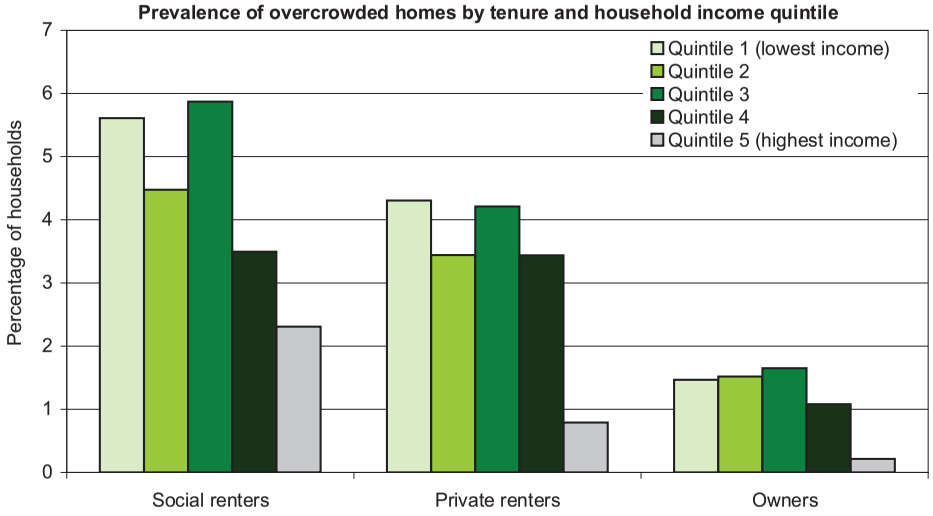
Data sources: Data on overcrowding are available from various sources including the General Lifestyle Survey (GLS), formerly known as the General Household Survey (http://www.ons.gov.uk/ons/search/index.html?pageSize=50&newquery=general+lifestyle+survey).

Data description: The GLS parameter chosen to assess overcrowding is based on the 'bedroom standard': the number of bedrooms required in a house is calculated from the number of people living there and their relationships to each other. One bedroom is allocated for each married/cohabiting couple, for any other person aged over 21, for each same-sex pair aged 10–20 and for each pair of children under 10. Where there are one or more bedrooms too few for the occupants of the house it is said to be overcrowded.

Data coverage: The GLS data used are for the years 2004 to 2006. The overall sample was 31 233 households (occupied by 74 314 people). Sampling for the GLS is based on a probability-stratified two-stage sample design and is representative of Great Britain. The data are weighted to the population and to take account of non-response and attrition. Northern Ireland is not included in the coverage of the survey.

Social dimension: This inequality fact sheet stratifies overcrowding by tenure and income quintile. The tenure categories are owner-occupation, rental from a social landlord (such as a local authority) and rental from a private landlord.

Context: Overcrowding has historically been linked to increased transmission of infectious disease. In addition, overcrowded conditions are now seen as detrimental to educational attainment – for example, by denying young people the opportunity for uninterrupted study. For adults, anxiety and depression can result from crowded conditions and lack of opportunity for privacy. While overcrowding levels have fallen in the last few decades, some sources report that recent economic trends have halted and may reverse progress. As overcrowding is highest in low-income households it is frequently associated with substandard housing and other aspects of deprivation.



Analysis and interpretation: The chart above was created using data from 28 901 valid cases within a total survey sample of 31 233 households (92%). Owner-occupation is the dominant tenure, representing approximately 71% of the sample, with social rented homes making up approximately 19%, and the remaining 10% private rented. However, this pattern of tenure distribution is not reflected uniformly within each income quintile. The likelihood of a household being overcrowded increases with declining household income, as illustrated by the fact that the overall percentage of overcrowded homes in the lowest income quintile (3.4%) is more than 10 times that in the highest income quintile (0.3%).

The chart shows the percentage of overcrowding in each tenure group for each of the five income quintiles. Overcrowding is evident in each tenure group and in each quintile. The highest percentages of overcrowding for all income quintiles are found in the social rented sector whereas the lowest percentages are found among owner-occupiers. Quintiles 1–3 exhibit not dissimilar levels of overcrowding in each tenure category, implying that overcrowding is not a problem restricted to the poorest in society.

Policy implications: Knowledge of overcrowding levels and the capacity to link this information to household income, tenure and to a variety of other sociodemographic variables can help to inform and evaluate housing, economic and social policies to improve both health and equity. There is wide acceptance of the need to increase the availability of good-quality affordable housing for all, not least the poorest, most socially excluded. However, it is clear from the data that policies that tackle overcrowding in the social rented sector (and in the three lowest income quintiles, irrespective of tenure grouping) have the potential to impact positively on the lives of the largest number of people.

Dampness in dwelling by age, income and household type

Norway

KEY MESSAGE: Low-income groups and single-parent households in Norway are more likely to report dampness in their dwelling.

Data source: Data are taken from EU-SILC and the national Survey of Living Conditions (SLC) by Statistics Norway. Data are available at: http://epp.eurostat.ec.europa.eu and http://www.ssb.no.

Data description: EU-SILC: the parameter is defined as proportion of the population "living in a dwelling with a leaking roof, damp walls, floors or foundations, or rot in window frames or floor" (variable HH040). Possible values are "yes" or "no". SLC: the parameter is defined as "a dwelling that is damaged by rot and mould in some or all the rooms". Possible values are "yes" or "no".

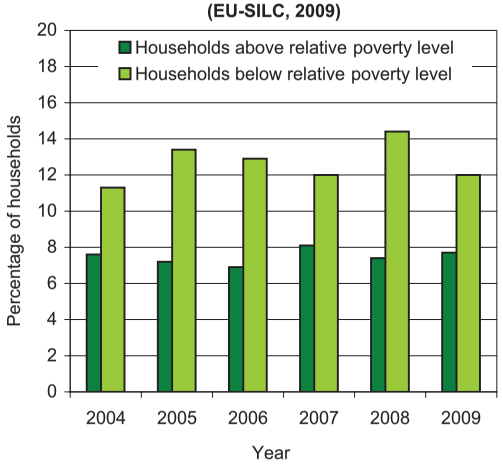
Data coverage: The data have national coverage. EU-SILC: data are available annually from 2004 to 2009. SLC: this annual survey changes topics during a three-year cycle. Housing conditions were topics in 1997, 2001, 2004 and 2007.

Social dimension: This inequality fact sheet stratifies data by age, income (below or above 60% of the median equivalent, or relative poverty level) and household type.

Reported dampness by household type (SLC, 2007)

Household type	Reported dampness (%)
Single (16–24 years)	5
Single (25–44 years)	5
Single (45–66 years)	3
Single (>66 years)	2
Two adults (16–44 years)	5
Two adults (45–66 years)	3
Two adults (>66 years)	1
Two adults with children aged 0–6 years	3
Two adults with children aged 7–19 years	4
Single parents	7

Self-reported dampness by relative poverty (EU-SILC, 2009)



Context: Dampness has been associated with respiratory symptoms in several epidemiological studies: a damp environment may cause increased levels of bacteria, moulds and mycotoxins. In particular, associations between mould growth and respiratory symptoms have been extensively studied. In occupational settings, where the exposure levels may be very high, an association between mould and adverse health effects such as asthma and allergies has been found. In private households, however, exposure levels are much lower and studies have failed to show such associations.

Compared to the countries in the EU, Norway has few dwellings with reported dampness (EU: 15.9%; Norway: 8.2% (2009)). However, Norway is comparable to the other Scandinavian countries (Sweden: 6.6%; Denmark: 7.8%). Tenure status differs between the household types "two adults with children" and "single parent", in that couples with children are more likely to own their flat or house, whereas single parents are more likely to live in a cooperative shareholding flat. A higher percentage of single parents are also tenants.

Analysis and interpretation: The number of reports of dampness is lowest in the highest age group. The household type that most frequently reports dampness consists of one adult with children. There is more reported dampness in the group earning below the relative poverty level (in the period 2004–2009, around 9–10% of the total population had an income level below the relative poverty level). Single-parent families are a major subset within this group, constituting around 17–23%. In comparison, the figure for households with two adults with children is around 8%.

Reporting dampness is subjective and does not give an indication of the extensiveness of the problem; thus it may not represent a serious housing problem. However, the psychological factor is important, since people may be afraid of developing associated health problems, or may relate already existing health effects to dampness in the dwelling. In addition, single parents constitute a large proportion of the low-income group and are more often tenants than couples with children. Both low income and tenure status may influence the ability to deal with the dampness problem or to move to a drier dwelling.

Policy implications: The data show a social inequality with regard to dampness in dwellings, in that the highest frequency of reported dampness is among low-income households. In addition, there are differences between household types, with more single parents than single people or couples with children reporting dampness. In Norway, indoor maintenance is the dwelling owner's responsibility. People living in freehold or cooperative shareholding flats thus have equal opportunities to deal with dampness, but people with low income levels may not be able to afford the necessary maintenance work. The housing market in Norway is under high pressure; not all population groups are able to buy their own flats and some therefore depend on the market for rental flats. If there are dampness issues in the rented flat and the owners are not willing to undertake maintenance to improve the indoor environment, these residents have few opportunities to change their housing conditions. An obligatory survey report on rental flats could be a regulatory step to secure a decent indoor environment. In addition, a system whereby low-income groups could be given a favourable loan to be able to buy their own flat could also be considered. Similarly, loans could be given to home-owners who are unable to perform the necessary maintenance for economic reasons.

Lack of home heating by education and household composition

Serbia and Montenegro

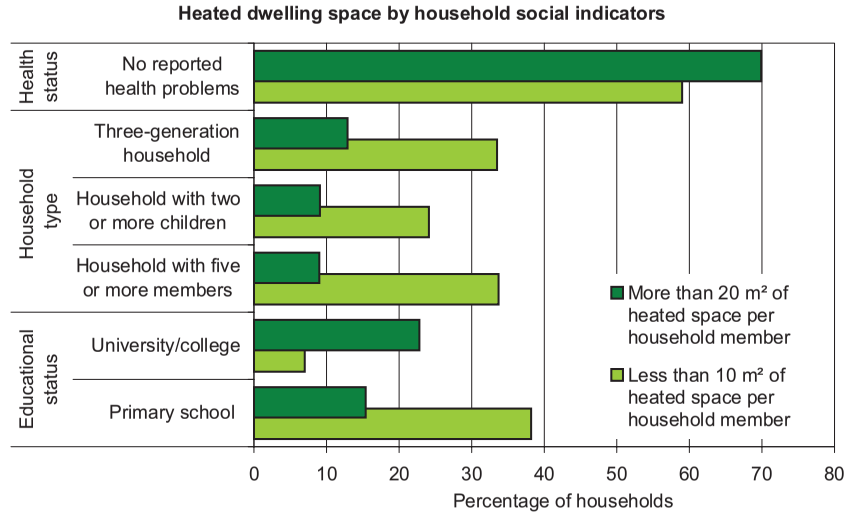
KEY MESSAGE: Poorly educated and overcrowded households in Serbia and Montenegro are suffering from a lack of home heating, which also affects their health status.

Data source: Data are taken from the study "Stuck in the Past" carried out by UNDP in 2004 in Serbia and Montenegro. Further details can be accessed from the main report at: http://www.undp.org/energy/docs/Stuck_in_the_Past.pdf.

Data description: The parameter "home heating" is presented as "square metres of heated space per household member". Parameters were defined through two surveys forming part of the UNDP study which examined household energy usage.

Data coverage: The data used are from 2002–2003. The survey was repeated in 2008 but the main results (unpublished) were very similar to those from 2002–2003 and indicate no significant changes in relation to the identified inequalities.

Social dimension: This inequality fact sheet stratifies the amount of heated space per household member by level of education (primary school and university/college) and household size and composition (large households, households with two or more children and three-generation households), and puts this into context with variations in health status (proportion of household members without health problems).



Context: Factors such old housing, poor insulation, heating with "dirty fuels" (wood and lignite coal), indoor pollution and overcrowding are associated with poverty. Poor households practise risky forms of energy saving and often heat only about half their living space in order to save on energy costs.

As a result, the relative amount of heated space stratifies by income per household member and is associated with a range of social or household-related characteristics.

The problems indicated by the data are less marked in urban areas but represent the normal living conditions for households with low income in rural areas. This type of household typically has a substandard house with low efficiency heating devices and an amount of heated space per household member that is below 8 m^2; these factors are also closely associated with health-related inequalities.

Analysis and interpretation: Poor households heat only about half their living space in order to save on energy costs. On average more than one in four households (26%) heat less than 10 m^2 per person, considered the necessary minimum. However, this proportion is increased for households with low education level and for large households. Lack of heat, overcrowding and indoor pollution come together as inequalities in poor households and result in severe reductions in usable floor space in winter time (because of a restricted heated area), which disrupts the normal household dynamics and puts pressure on personal and hygiene habits as well as social and cultural norms.

The social and household-related differences are associated with health-related inequalities, indicating that in households with less heated space, there is an increased probability of households reporting health problems. The differences are even more significant for heated space per member of less than 5 m^2.

Policy implications: There is a very strong correlation between poverty and lack of heating space. Reducing the heated area of a household can lead to tensions and dysfunctional relationships between household members. Insufficient heated space can have consequences for the health and quality of life of the household. Coping strategies are particularly limited for poor households, whose lack of capital often forces them to adopt dangerous and inefficient energy-saving strategies.

Better governance and a more comprehensive policy are needed. Policy-makers need to establish an enforceable concept of property rights and public goods, to build housing capacity, to improve institutional and corporative governance, to develop better polices and reforms, and improve information flows and structures.

Work-related injuries by sex and economic sector

Croatia

KEY MESSAGE: Male workers in Croatia are more likely to suffer an occupational injury than female workers. Most work accidents occur in the agriculture, forestry and fishing, manufacturing, water supply and waste management, and construction sectors.

Data source: Data are taken from the report on accident at work notifications by the Croatian National Institute of Public Health. Data from 2008 onwards, broken down by sex, can be downloaded from the Institute's web site at: http://www.hzjz.hr/publikacije.htm.

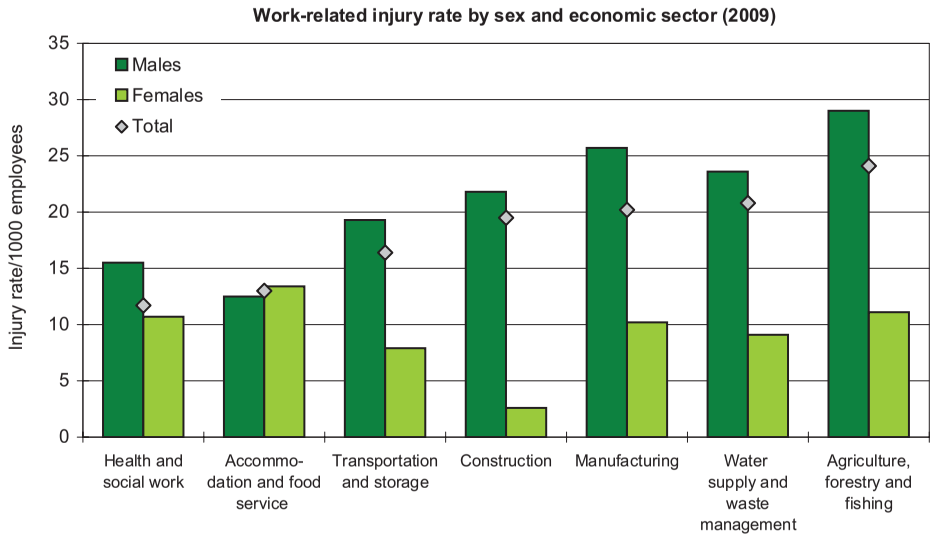
Data description: Data cover all recognized work accidents which result in absence from work. Work accidents are accidents suffered by insured people (insurants) in connection with their work, or whilst travelling on company business. According to Croatian legislation, commuting accidents (defined as travel to and from work) are also included.

Data coverage: Data cover all fatal and non-fatal work accidents, including commuting accidents, broken down by economic sector and sex.

Social dimension: Although work accidents contribute to no more than 3–6% of total sick leave, their share is significant, given the consequences they cause. While cases of sickness cause an average loss of 20 to 29 days, a work accident leads to an average of over 60 days of absence from work, and 1–5% of injuries end in permanent disability.

Context: On 31 December 2009, Croatia had 1 530 233 active insurants, which constitutes 41.3% of the working-age population (ages 15–65), or 86.7% of the active labour force (the employment male to female ratio was 54:46). Croatia annually registers over 20 000 work-related injuries. In other words, between 15 and 17 employees per 1000 are annually injured at work.

In 2009 the overall rate was 12.8 per 1000 employees (9.8/1000 excluding commuting accidents). The average rate was 16.7/1000 for males, and 7.1/1000 for females. By industry sector, the highest specific rates were in agriculture, forestry and fishing (24.1/1000), water supply and waste management (20.8/1000), manufacturing (20.2/1000) and construction (19.5/1000). These figures, which place Croatia among the countries with a low rate of registered work injuries, have been relatively constant over the last decade.



Analysis and interpretation: In 2009 the majority (76.2%) of work-related injuries, following the trend of preceding years, were sustained at the workplace, while 23.8% happened on the way to or from work. Approximately 70% of cases were work injuries to males, 30% to females. Males suffered 85.3% of accidents at work and only 14.7% while commuting, while for females the ratio was 58.8%:41.2%. The majority of work accidents sustained by males occurred in agriculture, forestry and fishing (29.0/1000), manufacturing (25.7/1000), water supply and waste management (23.6/1000) and construction (21.8/1000); those sustained by females occurred in accommodation and food service activities (13.4/1000), agriculture, forestry and fishing (11.1/1000), health and social work (10.7/1000) and manufacturing (10.2/1000). Men were more exposed to risk: 94.7% of fatal accidents were suffered by male workers (5.7/100 000), only 5.3% by female workers (0.4/100 000). Of these, 83% of those sustained by males, but none of those sustained by females, were work-related. The most dangerous sector, with the highest number of injuries or fatalities at the workplace, is agriculture, forestry and fishery, followed by water supply and waste management.

Policy implications: On 29 December 2008, the Croatian Government adopted the National Occupational Health and Safety Programme 2009–2013. The strategic aim of the Programme is to ensure safe and healthy work travel and workplace conditions. To achieve this aim, adoption of the EU Occupational Health and Safety at Work Strategy 2007–2012 is being considered. Implementation of a national programme will help to solve a multitude of problems in the area of occupational health and safety, such as ill-suited education, lack of harmonization and research projects, unsystematic implementation and, most of all, negligence of occupational injury and disease prevention measures.

Fundamental objectives of occupational health care and safety are: reduction of occupational injuries and diseases, and improvement of workers' health status by means of prevention and reduction of economic losses due to occupational injuries and diseases (sick leave, premature and disability pensions).

Transport-related mortality by sex and age

Malta

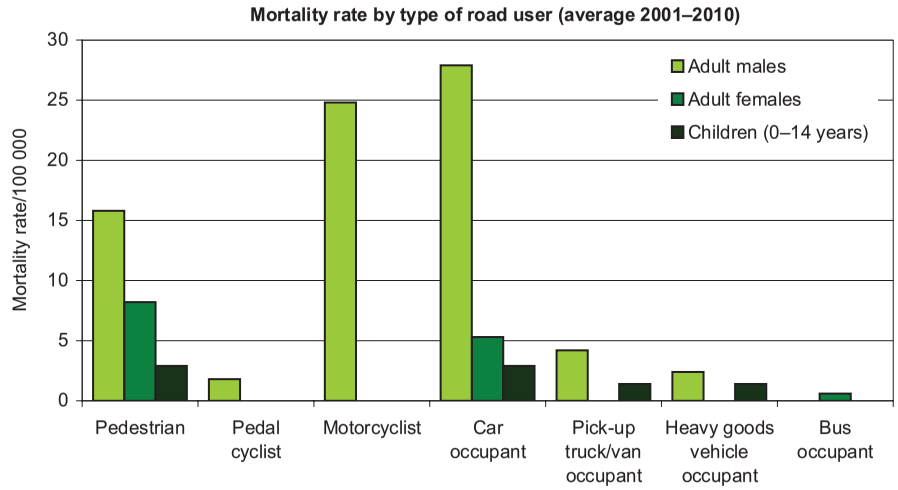
KEY MESSAGE: The vast majority of all transport-related deaths in Malta occur among males, with the highest proportion in the 15–29 year age group. Over the last decade, the proportion of female deaths has increased.

Data source: Data are taken from the National Mortality Register held by the Directorate of Health Information and Research. The register holds mortality data for Maltese residents.

Data description: The parameter is defined as "transport accidents" according to ICD-10 codes V01–V99.

Data coverage: Annual data are available. Data presented are for 2001–2010.

Social dimension: This inequality fact sheet stratifies "transport-related mortality" by target group (adult male, adult female and child) according to the type of transport accident. The number of transport-related deaths for this period was 168. Since the numbers are low, data must be interpreted with caution.



Context: Malta is a densely populated country with 1307 people per km^2. Since the 1980s the number of licensed vehicles per capita has risen steadily, from 0.33 in 1986 to 0.63 in 2001. At the end of 2009, the number was 297 776 or 0.72 vehicles per capita.

Transport accidents accounted for 10.4% of all deaths in the 15–44 year age group in 2008, representing 4.4% of all the potential years of life lost in those under the age of 65. Over the reference period, driving licences in Malta were held predominantly by males (61% of licence holders). The proportions of male and female licence holders in the younger age groups tend to be closer, implying that more younger females are taking up driving. Nevertheless, a greater percentage of males than females take up driving at an early age. In 2009 59% of all driving licences in the 18–24 year age group were held by males. At present 93% of motorcycle licence holders are male.

Over the last decade, measures have been taken to slow down traffic in villages, such as constructing more speed bumps and installing speed cameras to deter speeding. A public transport reform policy was launched in July 2011, with the aim of making public transport more efficient, more effective and operating over a wider network.

Analysis and interpretation: Between 2001 and 2010, 81% of all transport-related deaths occurred among males and 19% among females. The average male to female mortality ratio decreased over the years, from 5:1 in the period 2001–2005 to 3.6:1 in the period 2006–2010. The lowest ratio, 2.2:1, was in 2010. The largest number of male deaths occurred in the 15–29 year age group, while mortality in females was highest in the 60+ year age group. 34% of all male deaths occurred among car occupants (73% drivers and 27% passengers) and 30% among motorcycle users. 50% of all female deaths occurred among pedestrians and 34% among car occupants. There were no transport-related deaths related to motorcycle use among females over the 10-year period. It is important to note that most deaths occurred on Saturdays and Sundays.

The discrepancy between proportions of male and female licence holders may explain part of the difference between the total numbers of transport-related deaths by sex, not taking into account the possibility that a greater proportion of female licence holders do not actually drive. In addition, males tend to get their driving licence earlier, possibly accounting for the bigger proportion of deaths in males in the younger age groups. Males may also be driving more dangerously than females. A larger proportion of males take up motorcycle driving, which in this reference period accounts for 41 deaths or 30% of all male transport-related deaths. Since most deaths occur at weekends, some transport fatalities may be related to drinking and driving. It is also important to note the number of deaths of unprotected or less protected road users such as pedestrians, pedal cyclists and motorcycle users.

Policy implications: Since the vast majority of transport-related deaths occur among males, any policy that manages to reduce transport-related mortality would automatically reduce sex-related inequality. Encouraging public transport use and alternative modes of transport among younger age groups, especially males, well before they take up driving may reduce the number of deaths occurring in the 15–29 year age group. In addition, further enforcement and augmentation of penalties for driving dangerously (such as speeding) may be called for to deter drivers from speeding and from drinking and driving. Breathalyser testing of all car drivers involved in a traffic accident may warrant further discussion. In parallel, the fact that the population is increasingly ageing must be noted. Car-free zones will definitely make areas safer for pedestrians.

Mortality from accidental poisoning by age and urban/rural residence

Poland

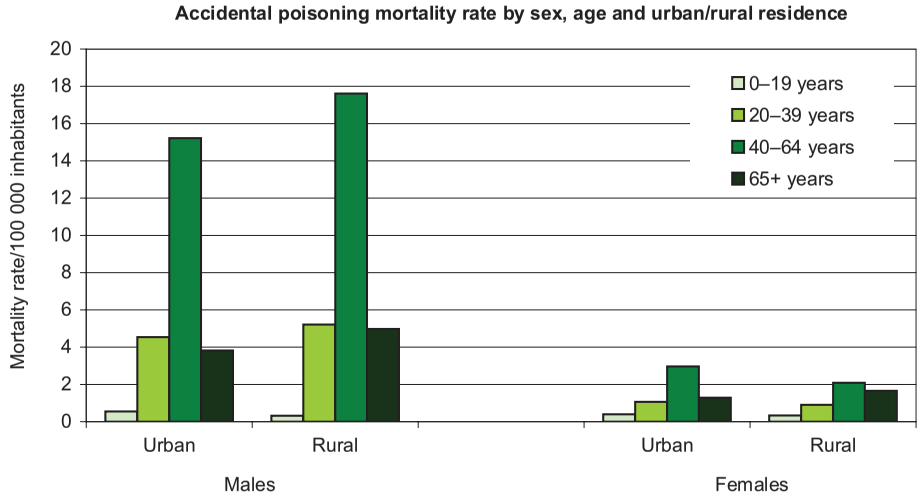
KEY MESSAGE: Mortality from accidental poisoning in Poland is almost five times higher in males than in females. There is a high increase in death rates in the 40–64 year age group. Alcohol is the main cause of mortality from accidental poisoning.

Data source: Accidental poisoning-related mortality data are taken from death certificates, with cause of death based on ICD-10 codes (adopted in 1997). Data are routinely gathered by the Polish Ministry of Health. Data by age group and sex on a national level with urban and rural area stratification are available from the Central Statistical Office at: http:// www.stat.gov.pl/gus.

Data description: The indicator is defined as accidental poisoning mortality (see ICD-10 definition of "accidental poisoning by and exposure to noxious substances", codes X40–X49).

Data coverage: The data have national coverage at the municipality level, stratified by urban and rural area, age group and sex. Data are available in current ICD-10 classification since 2002. This analysis is based on data from 2009.

Social dimension: This inequality fact sheet stratifies mortality from accidental poisoning by age and sex. There are four almost equal age groups. In addition, data can be broken down by urban or rural residence.



Context: Between 1500 and 2000 deaths as a result of accidental poisoning are recorded in Poland every year. Accidental poisoning is most often caused by substance abuse, recklessness or substance given or taken in error or inadvertently.

There are different absorption routes: via the digestive tract (medicines, alcohol, mushrooms, detergents, and so on), the respiratory tract (carbon monoxide, for example), the skin and mucous membranes (atropine, pesticides, caustic substances, and so on) as well as the soft tissues (various drugs).

The most common causes of mortality from accidental poisoning in Poland are alcohol abuse, leaks from gas installations (mainly in old buildings or dwellings inhabited by poor families), a lack of safe storage for medicines and chemicals and children lacking appropriate care.

Analysis and interpretation: There is a clear difference between the sexes in accidental poisoning-related mortality (about five times more deaths occur among males than females) and there are also significant disparities between age groups. More detailed data show the peak of accidental poisoning-related mortality among the 40–49 year age group in both sexes. A decreasing death rate is observed after the age of 50. In males, higher accidental poisoning-related death rates occur in rural areas (except among those under 20 years) while for females, higher rates are found in urban settings (except among those over 64 years).

Accidental poisoning-related mortality peaked in Poland in 2005–2006, when a high number of deaths was recorded. Since then, there has been a declining trend (reduction by approximately 5% every year). The main causes of mortality from accidental poisoning in Poland are:

- 75% – accidental poisoning by alcohol (ICD-10 code X45)
- 17% – accidental poisoning by other gases and vapours (ICD-10 code X47).

Policy implications: In Poland, about 2000 deaths are reported every year as a result of accidental poisoning. Nearly 92% of such deaths are caused by alcohol consumption and exposure to gases. People aged between 40 and 64 years have a higher risk of mortality from accidental poisoning than any other age group.

Key policy-making activities should be focused on national campaigns against alcoholism and drug abuse on the one hand, and modernization of old gas installations and prevention of gas leaks (especially in old buildings) on the other.

Mortality from falls by age and sex

Romania

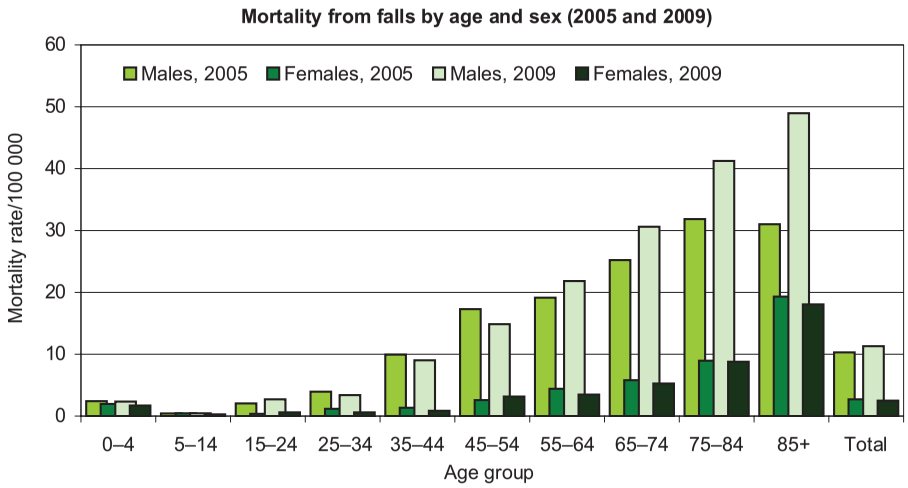
KEY MESSAGE: The risk of death from falls is almost five times higher for males than females in Romania. The groups at greatest risk are children aged 0–4, males over 45 years and females over 75 years.

Data source: Data on deaths by falls are recorded by the Romanian National Institute of Statistics, based on the data reported by all health units and providers. Data are available at the national level at the National Centre for Public Health Information and Statistics, within the National Institute of Public Health. Data stratified by sex and age groups are available on request.

Data description: Deaths caused by falls (ICD-10 codes W10–W19) are reported by all medical providers via death certificates to the district offices of the National Institute of Statistics. Data are stratified by sex and 5-year age groups in categories from 0–4 to 85+.

Data coverage: The available data have national coverage from 1970. The ICD-10 classification has been used since 1994. A validation process for the main cause of death is made at the district public health directorates.

Social dimension: This inequality fact sheet stratifies mortality due to falls by sex and age groups, aiming to assess the magnitude of inequality and to identify potential target groups for preventive interventions.



Context: A country assessment carried out by the WHO Regional Office for Europe on the status of the implementation of Regional Committee resolution EUR/RC55/R9 and European Council recommendation 2007/C 164/01 on the prevention of injury and promotion of safety revealed that despite the absence of a national policy for injury prevention, several preventive measures are in place to reduce numbers of falls and their health consequences. These include regulatory measures for child-specific environments, improvement of emergency responses for all types of emergency, and health promotion initiatives on life skills, including fall prevention.

Nevertheless, the results show that the national standardized mortality rate from falls is higher than in the EU and the WHO European Region, accounting for about 1400 preventable deaths per year. The recent mortality trend even shows an increase from 6.4/100 000 (2005) to 6.8/100 000 (2009), indicating that future action is necessary.

Analysis and interpretation: The overall crude death rate from falls increased from 6.4/100 000 in 2005 to 6.8/100 000 in 2009, signalling a high and increasing number (about 1400 people) of preventable deaths. The risk of death from falls is about five times higher for males than for females. The incidence of fatal falls in females slightly declined from 2.7/100 000 in 2005 to 2.5/100 000 in 2009.

The age distribution of mortality for 2005 and 2009 reveals increasing values for males (total male incidence rose from 10.3/100 000 to 11.3/100 000), especially in the case of males aged 55 years and above. However, there is a constant presence of three peaks of risk that could be tackled:

- the 0–4 year age group (both sexes)
- males over 45 years, increasing with age
- females over 75 years, increasing with age.

Policy implications: According to the mortality data, the most vulnerable groups are children (especially boys) aged 0–4 years and individuals above 55 years, for whom the level of risk strongly increases with rising age, especially for males. Specific public health interventions for these target groups should be designed and implemented. Education and information on risks, identification of people at risk, secondary prevention to improve adaptability to new physical conditions, and screening for high-risk conditions and visibility or hearing impairment should be undertaken, with prompt secondary intervention accessibility and rehabilitation procedures to avoid complications. To reduce the magnitude of risk of death by falls for vulnerable groups, systematic education of those responsible for children and the elderly should also be implemented. Specific surveys and better monitoring of the circumstances of lethal accidents, together with a systematic validation procedure for coding the cause of death on the death certificate, could contribute to the provision of fuller evidence for intervention.

Exposure to traffic noise within residential areas by household income level

Netherlands

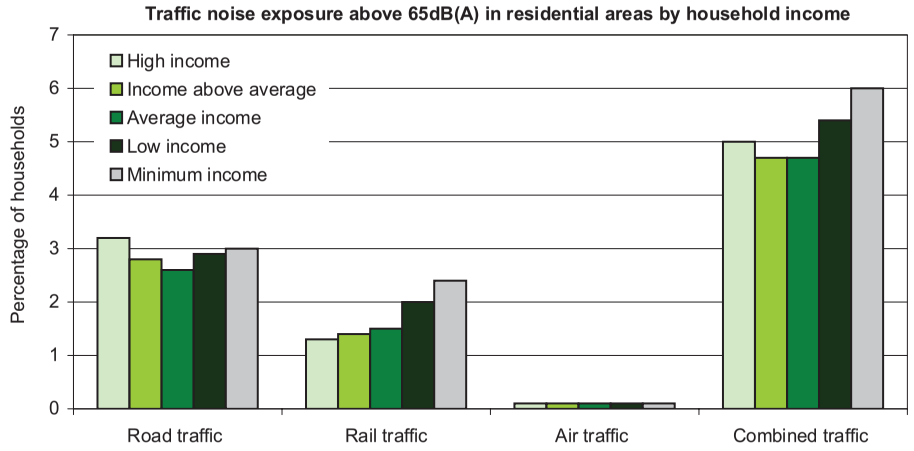
KEY MESSAGE: Inequalities in traffic noise exposure by income level are small but present in the Netherlands.

Data source: Data on road, rail and air traffic noise exposure were modelled with the Dutch GIS noise calculation model EMPARA version 2004-1. In addition, the combined noise exposure from these sources was calculated. Input data are available from different Dutch data sources and are irregularly updated. Output data on noise were combined with data on housing locations from the Address Coordinates of the Netherlands database.

Data description: The parameter is defined as modelled traffic noise level at home.

Data coverage: Data are available for the whole country. Input data were from 2000–2002. For road and rail traffic the resolution was 25 × 25 m; for air traffic noise the resolution was 250 × 250 m. The noise levels within these grids were assigned to all dwellings within that grid.

Social dimension: For this inequality fact sheet noise data were combined with income data at the 6-digit postcode level (about the size of a street). Income data were derived from the "Geomarktprofiel" telephone survey of Dutch residents in 2001, in which people were asked to characterize the dominant income level in their postcode area.



Context: In the densely populated country of the Netherlands a large proportion of the population (80%) is exposed to traffic noise of more than 50 dB(A). Several noise measures are taken to reduce noise exposure, such as noise barriers, quieter road surfaces, and insulation of homes. However, increasing traffic noise remains a problem, with adverse effects on health and well-being.

Dutch environmental policy focuses on the general population and not on specific subpopulations. Spatial plans are tested for noise standards. These standards are set by the state to ensure a safe and healthy living environment for all. The noise distribution among the population in the Netherlands is the result of a complex interaction of public policy decisions, market forces, historical context and public perceptions. To understand exposure differences among socioeconomic groups and take the most effective policy measures it is important to unravel the complex underlying mechanisms.

Analysis and interpretation: The data show the percentage of homes per income category with a modelled noise level higher than 65 dB(A) for different sources of traffic noise (road, rail and air traffic, and a combination of these). The results are mixed. In general, the differences between income categories are small. Lower-income categories are exposed to slightly higher noise levels than higher-income ones, depending on the source of noise. Differences are most pronounced for rail traffic; this may be because workers' dwellings tended historically to be built close to railways. Based on regional analyses covering areas with a large airport (not shown here), higher-income categories are exposed to higher air traffic noise levels in the proximity of large airports. This maybe explained by the fact that flight paths are planned over less densely populated areas, where more high-income households live. No clear trend was found for road traffic. No robust explanation is available, but it may be assumed that some higher-income households live close to busy roads for accessibility reasons.

It must be noted that modelled noise exposure beyond 65 dB(A) does not correspond entirely to the percentage of the population complaining about noise.

Policy implications: Dutch environmental policy in relation to spatial planning often focuses on the general population rather than specific target groups. The results above show that such an approach can provide fairly equal outcomes to the population, as the differences between income categories are small. However, inequalities may grow due to the current economic situation and political climate. Lower-income categories often have fewer choices about where to live and are more frequently in weaker health. Including social dimensions in spatial planning would give insight into the effects for different income categories and, if necessary, enable planners to take precautions. Furthermore, policy-makers should take into account any accumulation of issues in the neighbourhood and at work and focus not only on problems, but also on the amenities of the local environment, such as quiet and green space. These environmental amenities may improve health; for example, through stress reduction.

Lack of access to recreational/green space by region

Spain

KEY MESSAGE: Access to green space varies significantly among different regions in Spain. Regional variation strongly exceeds variation by income or social class. A north–south distribution is apparent.

Data source: Data on the lack of access to green space are taken from the National Health Survey carried out every few years by the National Institute of Statistics in collaboration with the Ministry of Health, Social Policy and Equality. The reported data for this fact sheet are taken from the last survey in 2006 which included 31 300 homes, distributed as 2236 census sections. Methodology and data can be downloaded from: http://www.msps.es/estadEstudios/estadisticas/encuestaNacional/home.htm.

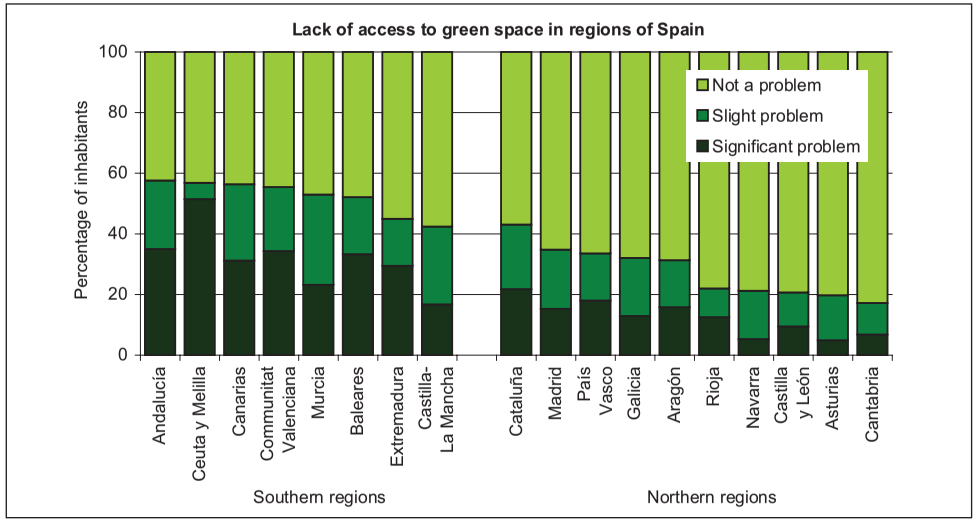
Data description: The parameter is defined as "homes with lack of access to green space" and refers to the response given by members of a household to the survey question "does your home have one of the following problems?" where the problem listed was "lack of access to green space". The percentage of respondents answering "significant problem", "slight problem" or "not a problem" was recorded.

Data coverage: The survey has national coverage but can be broken down into various territorial units such as the autonomous communities, which represent Spanish regions.

Social dimension: This inequality fact sheet stratifies the percentage of people reporting a lack of access to green space per region in Spain. No evidence for a social dimension of this inequality (such as by income) was found.

Context: Access to green space has been found to benefit many aspects of health and well-being, enabling residents – particularly those in urban areas – to cope better with the stresses of living in large conurbations. Generally, the proportion of green space per person diminishes as population density increases; thus compact cities show very low per capita green space allocation. In Spain there is significant variability in the degree of urbanization among the regions.

A number of social variables such as income and education level were analysed but did not explain the variability in access to green space among autonomous communities. Analysed at the geographical level, it was not possible to explain inequalities in access to green space in terms of a social dimension. However, there seems to be a clear north–south spatial pattern, with the lowest provision of green space in the regions in the south.



Analysis and interpretation: The problem of lack of access to green space among households in different regions presents significant variability. The graph presents southern and northern regions (representing the autonomous communities) in decreasing order according to the combined percentage of respondents reporting "significant problem" or "slight problem" of access to green space and thus in order of decreasing problem of lack of access to green space. It appears, with a few exceptions, that the percentage of respondents considering access to green space to be a problem is higher in (mostly) southern regions (such as Andalucía, Canarias, Comunitat Valenciana, Murcia, Baleares, Extremadura) than in northern regions (such as Cantabria, Asturias, Castilla y Leon, Navarra, La Rioja, País Vasco). This could possibly be caused by climatic differences among regions, where most southern regions have warmer and drier climates, hence having fewer green areas. However, this would not necessarily imply a lack of access to natural space.

The differences among the regions could not be explained in terms of a social dimension. Several social variables such as income level, education level and social class as defined by occupation were analysed, but did not explain regional differences. It appears that the regional north–south disparity is greater than the disparity due to income, education or social class of the respondents. Higher disaggregation of data by provinces would enable a more detailed analysis.

Policy implications: There is a significant difference in access to green space across different regions in Spain. The factors determining this variability cannot be elucidated through this analysis, as the regions include both urban and rural areas, as well as populations of varying income and social levels. A higher geographical segregation and independent study of urban and rural areas would enable a more rigorous analysis of the relation between access to green space and level of income and social class.

At this geographical level, there were no significant differences in access to green space according to level of income or social class as determined by occupation. The apparent north–south distribution in access to green space may thus be influenced by per capita income, degree of urbanization or simply climate. However, it indicates that southern regions may need to be more active in providing high-quality green space to the population.

Potential smoke exposure at home by SES

Germany

KEY MESSAGE: In Germany, children living in households with low SES are more affected by tobacco smoke exposure at home than those with higher SES.

Data source: Data on the presence of smokers in the households of 1790 children aged 3 to 14 years are taken from the Federal Environment Agency's German Environmental Survey 2003/6 for Children (GerES IV); data on SES from the concurrent German Health Survey for Children and Adolescents (KiGGS) study by the Robert Koch Institute. Public use files with data from GerES IV and KiGGS are available on request via http://www.uba.de/survey and http://www.kiggs.de, respectively (in German).

Data description: In question 72 of the questionnaire, every household member was listed with the possible values "smoker" or "non-smoker". The total number of smokers living in the household was summarized.

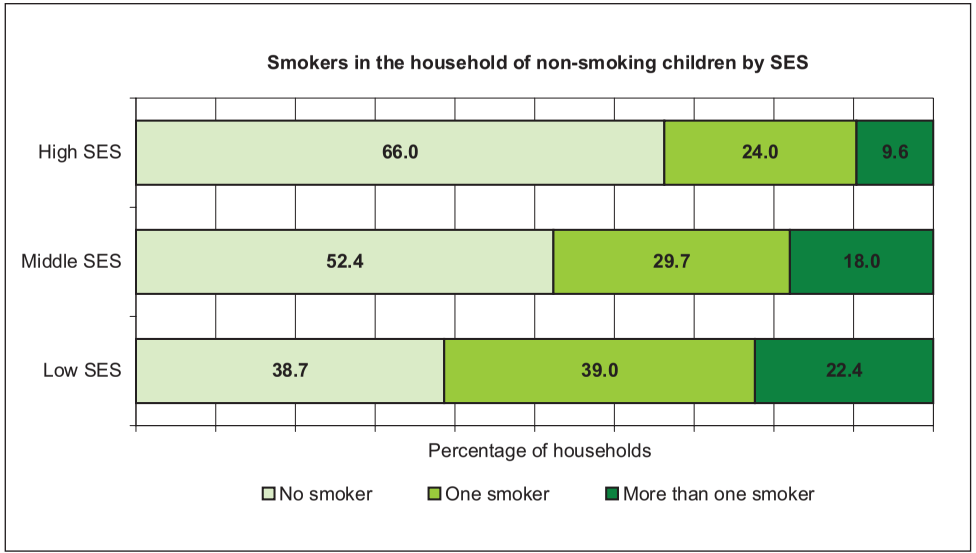
Data coverage: The available data of GerES IV are representative of children in Germany. Future surveys are envisaged.

Social dimension: This inequality fact sheet stratifies the presence of smokers in the household by SES. The SES index combines information on the parents' educational and professional status and on the household's net income. The low SES group comprises approximately the lowest 25%, the middle SES group approximately the middle 50% and the high SES group approximately the highest 25% of the children.

Context: It is well known that children's health is affected by parental smoking. Children of parents who smoke show, for example, an increased frequency of sudden infant death syndrome, acute and chronic inflammation of the middle ear, asthma and infections of the lower respiratory tracts. Almost one-half of children aged up to 17 years are living in a household with at least one smoking parent (data from KiGGS study).

With the aim of improving the health outcomes for these children, it is important to know which part of the population is most affected by (second-hand) smoke. With this knowledge, targeted information and prevention measures can be taken in order to improve further the protection of non-smokers – including children.

Encouraging their parents to ban smoking at home is likely to improve health outcomes for these children.



Analysis and interpretation: Children in low SES families are more prone to be exposed to environmental tobacco smoke. In the GerES IV data a strong social gradient of number of smokers in the children's households could be observed: according to the parent interviews, 34% of the high SES non-smoking children live in households with one or more smokers, but this percentage increases to 61% for the low SES non-smoking children.

The findings from the questionnaire data were confirmed by nicotine and cotinine (a nicotine metabolite) analysed in urine, as well as benzene measured in indoor air. The analyses revealed a distinct social gradient for both cotinine in children's urine and benzene in the air of children's rooms: the lower the SES, the higher the proportion of children exposed to tobacco smoke (cotinine levels above the limit of quantification: 70% versus 32%; mean of benzene: 2.56 $\mu g/m^3$ versus 1.70 $\mu g/m^3$). This reflects the fact that in low SES families smoking is more prevalent than in families with high SES.

Policy implications: The best prevention of second-hand smoke is a low rate of tobacco consumption in the whole society. Together with a high tax on tobacco, an advertising ban on tobacco products and measures to prevent people from starting to smoke, as well as measures to help smokers to stop their tobacco consumption, smoking bans are of high importance. Tobacco control measures for the working environment are in place, and since September 2007 smoking has been banned in all buildings of the federal government, on public transport and at passenger stations.

In addition, smoking in restaurants and other public places has been banned (unfortunately with numerous exceptions) in all federal states of Germany since the beginning of 2008. Harmonization of the different laws in the federal states (without exceptions), as well as targeted information and prevention measures for highly affected sections of the population – such as people/families with a low SES – would help to further reduce tobacco consumption in society.

Exposure to second-hand smoke at work by sex, age, income, and employment

Italy

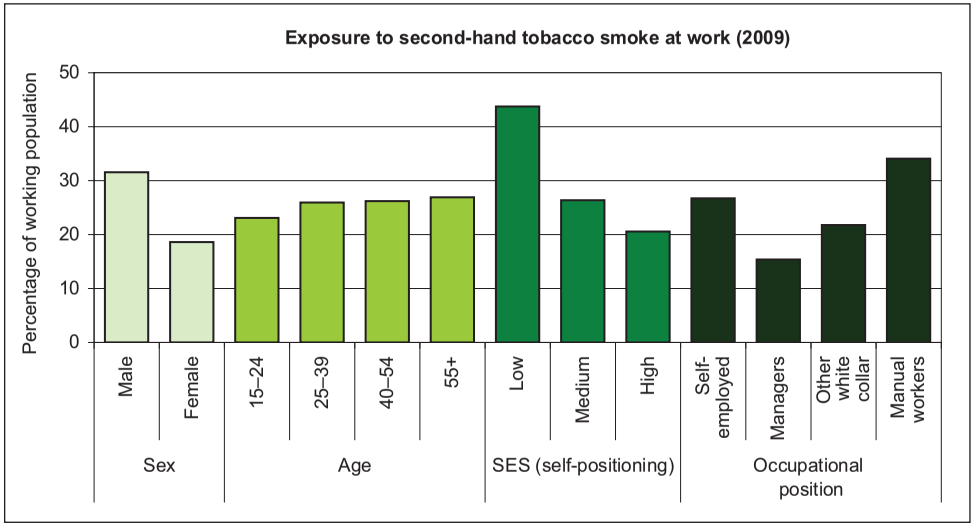
KEY MESSAGE: The 2005 law banning smoking in indoor public places in Italy also affected exposure to second-hand tobacco smoke. Nevertheless, differences in second-hand smoke exposure remain, and are especially strong in workplaces.

Data source: Data are taken from the Eurobarometer survey on tobacco (2009), and the national annual survey on smoking conducted by DOXA, the Italian branch of the Gallup International Association, and the Italian National Institute of Health.

Data description: Data on exposure to tobacco smoke at the workplace are given as a percentage of responses to the question "how often are you exposed to tobacco smoke indoors at your workplace?" Survey respondents are a representative sample of the total population over 14 years.

Data coverage: Data relate to Eurobarometer data of 2009. Reported data by DOXA are analysed for the period 2005–2009. The questionnaires have national coverage.

Social dimension: This inequality fact sheet analyses exposure to tobacco smoke at the workplace by sex, age and SES. The data show SES stratification by self-positioning on a social scale, as well as by occupational position, which reflects a similar situation.



Context: A new law imposing a ban on smoking in public and at workplaces, allowing it only in specially designated spaces, came into force in Italy on 10 January 2005. The law has had substantial immediate effects, leading to approximately 90% of public places becoming smoke-free. For workplaces other than hospitality venues, this percentage decreases from 90 to 70 (according to the DOXA surveys of 2005, 2006, 2007, 2008 and 2009).

While the percentage of smoke-free places has remained constant over time for workplaces (and slightly decreased to 85% for public places), the Italian population's favourable attitude towards the smoking ban law has increased over time (Eurobarometer data).

Although the impact of a law applying universally to every work environment was expected to be the equalization of exposure for all social categories of workers, reported data indicate that differences remain.

Analysis and interpretation: Eurobarometer data show large inequalities in exposure to second-hand smoke at work according to both SES and occupational scale, in favour of more advantaged positions. The data refer to respondents citing any period of exposure (less than 1 hour, 1–5 hours, more than 5 hours).

The pollution levels from second-hand smoke in public and at workplaces have been reduced by the law, as demonstrated by local studies on particulate matter with an aerodynamic diameter smaller than 2.5 μm ($PM_{2.5}$) and ultrafine particles and nicotine concentrations in indoor air of public places, and on the presence of urinary cotinine in non-smoking employees of these workplaces, but their social distribution is unknown. Local studies on hospital admissions for heart failure suggest that smoking bans may also be effective in reducing the impact of second-hand smoke exposure on coronary heart disease and narrowing its socioeconomic distribution.

However, social inequalities in exposure to second-hand smoke at work are still observed in Italian Eurobarometer data at the end of 2009, probably due to a selective implementation of the ban, with lower compliance among self-employed and manual workers.

Policy implications: A smoking ban is a good policy for controlling exposure to second-hand smoke at work, and should also be effective in tackling social inequalities in smoke exposure at work, due to the higher prevalence of smokers among blue-collar workers.

Despite the successful Italian ban on smoking in public and workplaces of 2005, significant social inequalities in exposure to smoke at work were still observed by 2009: among 30% of workplaces did not comply with the law. Low-income, manual and self-employed workers are most affected by continued exposure.

These disappointing results in the workplace suggest the need to develop selective programmes to ensure enforcement of the law in occupational environments.

ANNEX 2

EXAMPLES OF NATIONAL PRACTICES IN ANALYSIS AND PRESENTATION OF ENVIRONMENTAL HEALTH INEQUALITIES

ANNEX 2. EXAMPLES OF NATIONAL PRACTICES IN ANALYSIS AND PRESENTATION OF ENVIRONMENTAL HEALTH INEQUALITIES

CONTENTS

ENVIRONMENTAL HEALTH INEQUALITY ACTION IN FRANCE: A REPORT ON THE SIGFRIED PROJECT

INTRODUCTION

Analysing the associations between the environment and health has become a major issue for public health in France, brought into focus by the country's National Environmental Health Action Plans (NEHAPs). The second NEHAP of 2009 was prepared in response to the Fourth Ministerial Conference on Environment and Health, organized by the World Health Organization in 2004. Environmental inequality has become a fundamental theme that guides policy developments in France and the NEHAP has been adopted in every region.

The SIGFRIED Project, led by INERIS (the French National Institute for Industrial Environment and Risks), has been set up to identify and stratify environmental indicators and to map environmental disparities using spatial analysis techniques. The indicators bring together environmental and population data for several research applications:

- to highlight vulnerable areas with significantly elevated exposure risk indicators in order to define environmental monitoring campaigns, to manage and plan remedial actions;
- to map environmental disparities throughout France;
- to provide environmental indicators to quantify spatial relationships between environment, disease and socioeconomic data.

This project uses the GIS-based modelling platform PLAINE (Environmental inequalities analysis platform), which allows the ongoing systematic collection, integration and analysis of data on emission sources, environmental contamination, exposure to environmental hazards, population and health.[1]

The Equit'area Project, led by EHESP (the School of Public Health), is investigating the association between infant mortality, deprivation and proximity to polluting industries.[2] A specific deprivation index was calculated using the smallest administrative unit for which socioeconomic and demographic information is available from the National Institute of Statistics and Economic Studies (INSEE) 1999 census data.

DATA AND METHODOLOGY

The case study combined information from national databases and a spatial approach to increase the effectiveness of the maps used for planning and decision-making on safeguarding public health. A spatial database was assembled from a set of variables characterizing environmental and population data. This approach integrated the emissions register and census data onto the map and analysed the spatial relationships between emissions sources and socioeconomic indicators. The following examples show the results produced by applying this method to data from the Nord-Pas-de-Calais region of France, using different administrative scales depending on objectives and data availability.

1 Caudeville J et al. (2011). Construction d'une plate-forme intégrée pour la cartographie de l'exposition des populations aux substances chimiques de l'environnement. *Environnement, Risques et Santé*, 10(3):239–242.

2 Padilla C et al. (2011). Mortalité infantile, défaveur et proximité aux industries polluantes: une analyse spatiale conduites à fine échelle (agglomération de Lille, France). *Environnement, Risques et Santé*, 10(3):216–221.

Emission source data (road traffic and industrial) from national databases were used to build a proximity indicator to pollution sources as a proxy for exposure (see Fig. 1). Census data were used to build socioeconomic indicators (see Fig. 2). Proximity indicators were then stratified on the demographical information and spatial relationships between environmental and socioeconomic data were mapped and analysed (see Fig. 3).

Road traffic and industrial site proximity indicators

Two main data sources were used.

- The industrial facilities data used in the study were extracted from the French Register of Pollutant Emissions from 2003 to 2009. The collection of these data meets the requirements of the EU protocol on Pollutant Release and Transfer Registers (PRTR), signed in Kiev in 2003, and those of the EU regulation concerning the establishment of a European PRTR (Regulation (EC) No. 166/2006, 18 January 2006).
- Emission source data on road locations and traffic capacity were compiled using a georeferenced national emissions database: the National Spatialized Inventory.

Emission source data were collected, harmonized and stored on a GIS. Distance-to-source indicators (proxy) were built using adapted distances and a GIS-based buffer tool (see Fig. 1). Buffer zones around sources were generated using different distances related to emission type, such as 1 km from industrial sites and 200 m from roads, and were used to create the proximity indicators.

Proxies were then aggregated using referent grid or administrative boundaries. Analysing the relationships between environmental and population indicators means that data could be presented under a common denominator, such as their spatial location or distribution. This was achieved by depicting the different data as layers and superimposing these layers in the same geographical system. In the above example, data were normalized by surface unit and aggregated on county boundaries using geometric ratios.

Socioeconomic indicators

Several data sources were used:

- administrative boundary information, varying according to the unit scale of analysis
- population data from INSEE 2006 census data.

The Townsend deprivation index presented here (see Fig. 2) was calculated using four variables from data provided by routine census surveys:

- economically active people unemployed
- households with more than one person per room
- households without a car
- households not owner-occupied.

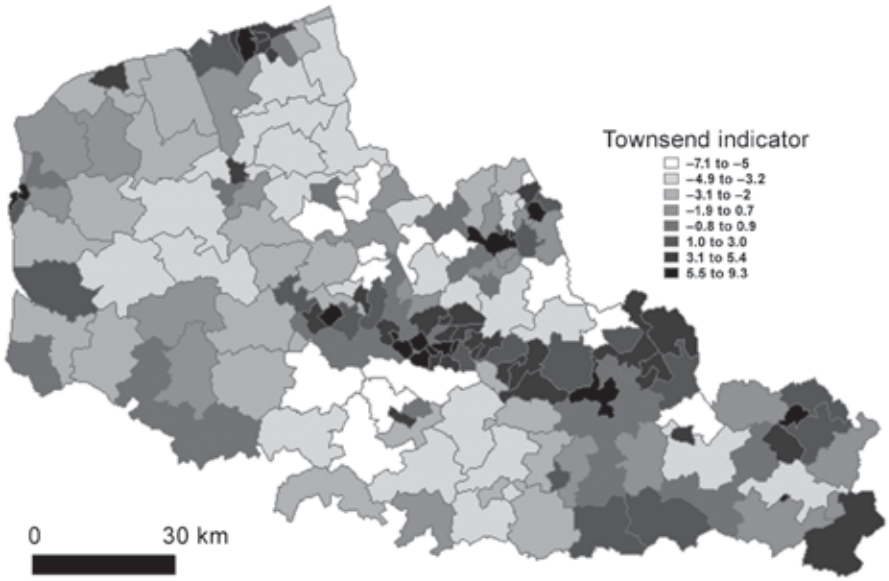
Negative values of the overall Townsend scores reflect less deprived areas; positive values reflect more deprived areas.

Socioeconomic indicators (also called deprivation indices) are widely used in public health, both in epidemiological analysis and in allocation of resources.

Fig. 1. Areas with proximity to industrial sites and principal roads using buffer zones

Source: INERIS.

Fig. 2. Mapping the Townsend index on the case study area



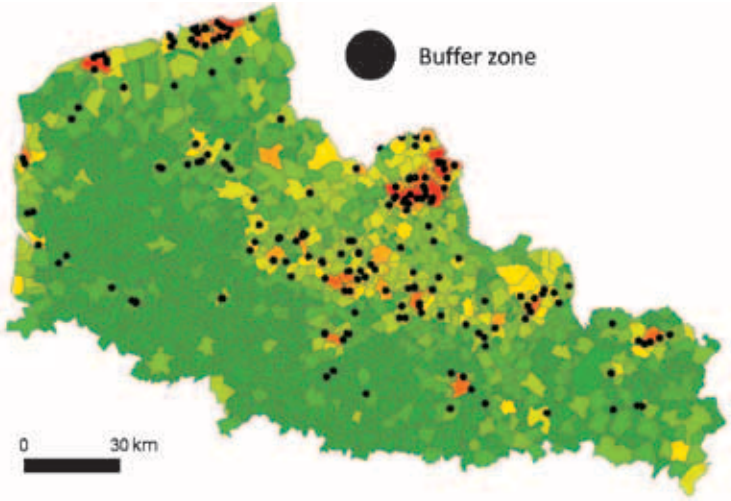
Source: Nord-Pas-de-Calais Regional Health Observatory.

RESULTS

Stratification of environmental indicators on population data

Environmental indicators were aggregated with population data (in this case, stratified by age and sex) to quantify and map population under risk from exposure. Fig. 3 locates (a) and quantifies (b) residential populations close to industrial sites (within 1 km). In this example, around 16% of the population in the Nord-Pas-de-Calais region (700 000 inhabitants) is living in close proximity to an industrial site. A similar approach was used to aggregate the traffic map with the demographic data.

Fig. 3. Aggregation of industrial indicators with gender and age subgroup data



Percentage of inhabitants living around industrial sites

	Female	Male
0–3 years	17.5	17.5
3–6 years	16.7	16.7
6–11 years	16.4	16.4
11–18 years	16.5	16.4
18–25 years	21.4	20.1
25–40 years	17.8	18.0
40–55 years	16.1	15.5
55–65 years	13.5	15.4
65–80 years	16.0	15.1
>80 years	16.9	16.0

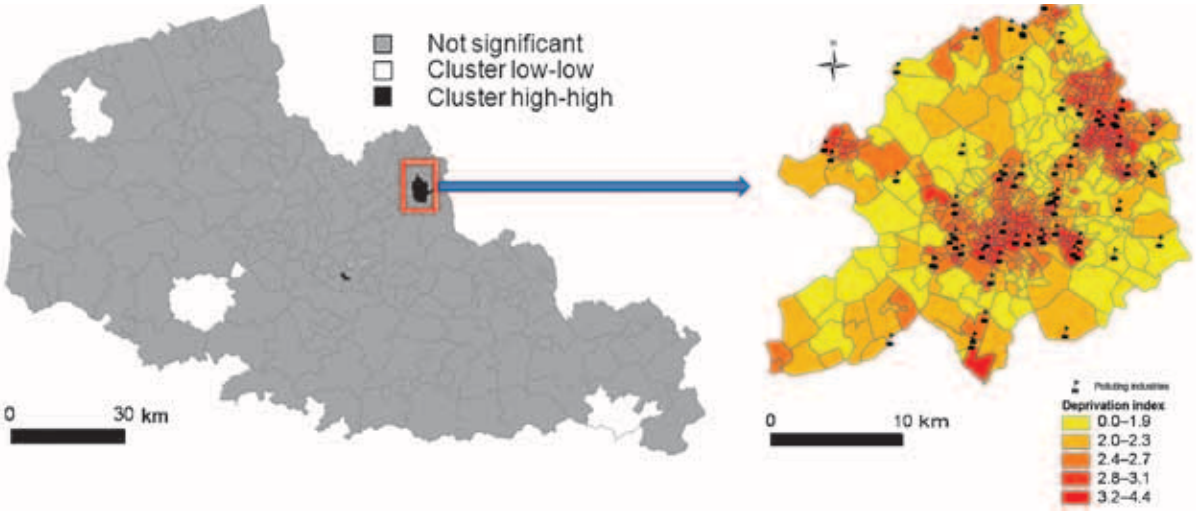
Source: INERIS.

Other types of aggregation could also be studied, such as socioeconomic subgroups or income levels.

Analysing relationships between environmental and socioeconomic indices

Environmental and socioeconomic indices were then analysed using different spatial scales in order to assess inequality relationships. The bivariate local Moran test identifies spatial patterns in two variables. The black areas in Fig. 4(a) show correlations between high-risk environmental and socioeconomic indicators at the county level: in these areas, the strongest inequalities are detected for both deprivation and proximity to industrial sites. The white clusters show areas where the results are low for both indicators, and the grey areas show negative correlations or outliers.

Fig. 4. Bivariate local Moran results and Equit'area Project results



(a) *Source:* INERIS. (b) *Source:* EHESP.

A relevant spatial scale is essential to capture and identify inequality phenomena. Other approaches can also be used in order to refine this analysis. The Equit'area Project used the smallest administrative unit in France for which socioeconomic and demographic information is available from the national census. An index was constructed using a principal component analysis from a selection of 20 socioeconomic and demographic variables, reflecting multiple dimensions of socioeconomic deprivation such as income, education attainment, employment, housing characteristics, family structure, and immigration status.

The study setting was the black area highlighted by the local Moran test: the Lille metropolitan area, an urban area of 85 municipalities (about 612 km^2). As shown in Fig. 4(b), most polluting industries identified are located in areas with a high deprivation score.

CONCLUSIONS

The examples presented here show how GIS can be used to build indices in order to map and analyse environmental and socioeconomic inequalities. The initial screening approach enables identification of a vulnerable area where a more refined approach is developed at a smaller scale. In this particular aggregation, the results demonstrate that most of the polluting industries are localized in areas with a high deprivation score.

The geography of census data clearly has a fundamental influence on any study for which the data are used. Associations observed at the regional level applied to individuals within the regions can lead to a so-called ecological fallacy. Nevertheless, those approaches allow a quantification of relationships in order to identify areas that accumulate different types of inequalities, such as health, environmental and socioeconomic.

In the SIGFRIED Project, strong correlations were also found between cancer and socioeconomic indicators in this region. All these results facilitate the management and planning of targeted response actions in order to minimize health inequalities.

THE UNITED KINGDOM SUSTAINABLE DEVELOPMENT INDICATORS: REPORTING ON ENVIRONMENTAL INEQUALITIES

INTRODUCTION

In 2005 the United Kingdom committed, as part of its sustainable development strategy, to report on environmental inequalities within its measures of sustainable development.

A methodology was developed through a series of studies examining environmental quality indicators related to economic and social data linked to specific geographical areas nationwide. As part of this project, the Environment Agency with the Department of the Environment, academic researchers and nongovermental organizations developed a list of environmental quality variables to be imported into a GIS tool known as the Environmental Quality Index (see Table 1 for the variables covered). The GIS tool provides an illustration to different users, often working at different geographical scales, of the relative environmental quality of an area compared to national and local averages.

The geographical display of different environmental indicators alongside social and economic data for a given area provides users with an ability to articulate their own priority interests for reporting. An annual snapshot of environmental equality was also generated, illustrating as broadly as possible the spread of environmental quality across the social gradient.

DATA AND METHODOLOGY

In order to develop a single indicator summarizing overall environmental inequality, the limitations of the data would need to be accepted in moving from a highly involved and flexible GIS to a single graph that captured a fair reflection of the data presented.

Given the spatial resolution of the data, broken down to areas with an average number of 1500 residents, a rationalization of what could be illustrated was required. Researchers and the government were also keen to avoid stigmatising areas based on nationally aggregated data, so the data was displayed against deciles (groups of 10%) of the population broken down by deprivation rather than spatially.

Deprivation indices are an approach to measuring social and economic disadvantage in the United Kingdom, derived from over 30 years of work by the government to provide policy-makers with information on the geographic nature of social and economic policy priorities. As such, across the different countries within the United Kingdom, locally determined indices of multiple deprivation have been developed and published periodically by governments in England, Wales, Scotland and Northern Ireland.[3]

Across these different geographical areas different methodological approaches have been selected that articulate the issues pertaining to the different countries. Evidently, the geography of these nations varies markedly, as does the geographical scale at which policy interventions are made.

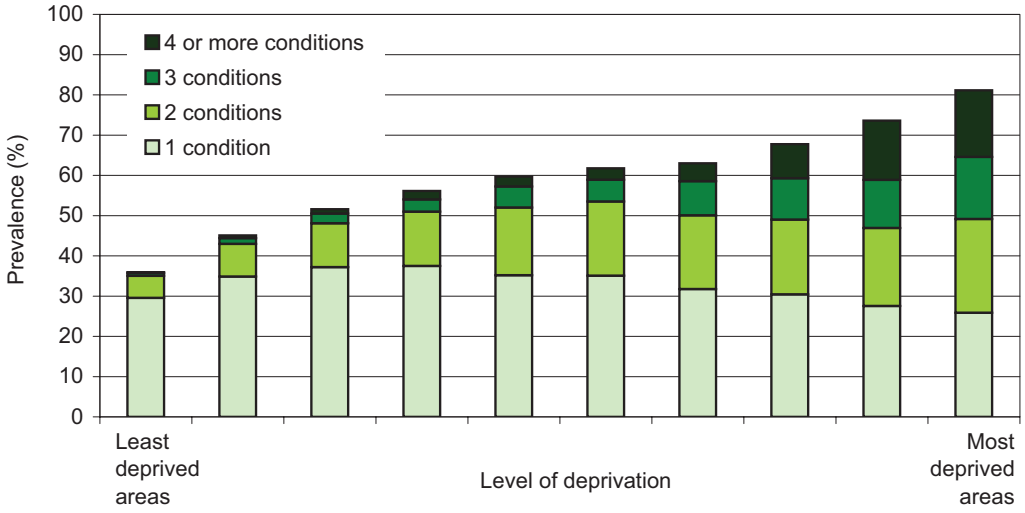
3 More information regarding indices of multiple deprivation is available from the Office of National Statistics (www.ons.gov.uk) and from the Department for Communities and Local Government (www.imd.communities.gov.uk).

Table 1. Index of Multiple Deprivation and environmental quality spatial statistics available in England

Index of Multiple Deprivation – Living Environment		
Indoor living	Central heating	
	Housing condition	
Outdoor living	Road traffic accidents	
	Combined air quality indicators	Nitrogen dioxide
		Particulate matter (PM10)
		Sulphur dioxide
		Benzene
Environmental quality indicators		
Proximity to regulated sites		
Carbon dioxide emissions		
Ecological footprint		
Derelict land		
Fly tipping		
Litter		
Detritus		
Graffiti		
Green space		
Biodiversity		
Flood risk		
River water quality		

As an example, an indicator of environmental equality has been developed for England as a geographical area that covers 11 environmental conditions or characteristics: river water quality, air quality, green space, biodiversity, flood risk, litter, housing condition, road accidents and the presence of regulated sites, including waste management sites, landfill sites or sewage treatment works. Fig. 5 below illustrates – for the deprivation deciles representing high to low levels of the English Indices of Multiple Deprivation – the degree to which environmental conditions affect these populations.

Fig. 5. Environmental conditions by deprivation deciles in England



Source: Department for Environment, Food and Rural Affairs, Environment Agency (England & Wales), Department for Communities and Local Government.

Note: for each of the environmental conditions, the population living in areas with, in relative terms, the 10% least favourable conditions have been determined.

RESULTS

As is evident from Fig. 5 above, there is a clear bias toward improved environmental quality among populations that are also less socially and economically disadvantaged (or deprived). This general trend has emerged in each publication of the data, despite the adjusted list of environmental conditions measured (as a result of data availability and spatial coverage).

This has resulted in some significant findings for policy-makers.

- It is clear that people in deprived areas experience greater exposure to air pollution, flooding, close proximity to large industrial and waste management sites and poor river water quality. The evidence shows that the poorer the population, the more exposed it is to more unfavourable environmental conditions.
- Around 0.2% of people living in the least deprived areas may experience four or more environmental conditions that are "least favourable". This rises to around 17% of people living in the most deprived areas.

CONCLUSIONS

In June 2011, the United Kingdom Government produced a 60-year vision for the natural environment in England, publishing a White Paper entitled *The natural choice: securing the value of nature*.[4] In this high-level policy document the indicator of environmental quality was presented to illustrate not only the presence of environmental inequality in England, but also to endorse the value of environmental improvement and good stewardship to promote better and healthier lives in England. The indicator of environmental quality has thus been exemplary in helping to set clear policy goals for the government and its partners to improve health and well-being and the environment.

4 http://www.defra.gov.uk/environment/natural/whitepaper/, accessed 21 September 2011.

IDENTIFICATION OF ENVIRONMENTAL HEALTH INEQUALITIES IN POPULATIONS LIVING CLOSE TO WASTE DISPOSAL SITES IN ITALY

INTRODUCTION

The patterns of associations between proximity to waste disposal sites and social deprivation, based on international data, have recently been reviewed.[5] Similar assessments are being worked on in Italy, and several projects have been developed at both regional and local levels to assess the health effects of exposure to environmental pollution from waste disposal facilities, mainly incinerators and landfills. The Moniter Project in the Emilia–Romagna region (www.moniter.it), the ERAS Project (www.eraslazio.it) in the Lazio region, and various studies performed in the Campania region provide useful information on the measurement of inequality in waste site exposure.

At the national level, within the EU Integrated Assessment of Health Risks of Environmental Stressors in Europe Project (INTARESE), the "Waste" work package, coordinated by Dr Francesco Forastiere of the Lazio Region Health Service, has developed indicators for the health impact of pollution from the entire process of disposal of municipal solid waste, collecting data from three different countries (Italy, Slovakia and England) for a total of 905 municipal urban solid waste landfills and 53 waste incinerators. The following example refers to the work on Italy within this project.[6] A project funded by the Italian Ministry of Health is currently considering the health-related issues of waste, with the aim of characterizing population exposures in different regions.

DATA AND METHODOLOGY

Country-specific sources of information were identified and data about Italian municipal solid waste production and management were provided by the Italian Environmental Protection Agency (APAT). Data were checked for consistency and integrated with information collected from an independent body, the National Waste Observatory. Local databases were used where available to improve information on the waste facilities. The assessment referred to the situation in 2001.

APAT provided a database of information on incinerators operating during the period 2001–2007. In addition, a detailed census of the 52 incinerators operating in 2005 was made by the National Agency for New Technologies, Energy and Sustainable Economic Development, funded by the National Association of Stakeholders in Waste Management (Federambiente).

APAT also provided a database of landfill sites in Italy (a total of 619 in 2001) with information on the total capacity and waste land filled per year. Unfortunately, the database did not contain GIS coordinates and it was impossible to retrieve this information for the entire country. Using contacts with regional environmental authorities, geographical information could be obtained for five regions: Piemonte and Emilia–Romagna (in the north), Toscana and Abruzzi (in the central region), and Campania (in the south), covering a total of 118 landfills. For the rest of the country, it was assumed (with a moderate level of confidence) that the characteristics (sex, age and SES) of the population around the 501 missing landfills were similar to those of the 118 studied sites.

5 Martuzzi M, Mitis F and Forastiere F (2010). Inequalities, inequities, environmental justice in waste management and health. *European Journal of Public Health,* 20(1):21–6.

6 Forastiere F et al. (2011). Health impact assessment of waste management facilities in three European countries. *Environmental Health,* 10:53.

Census tracts are the smallest units of aggregated population data that are available and geocoded in Italy. There are 352 138 census tracts, with 162 residents on average in each (ranging from 0 to 3386 people). GIS coordinates of all incinerators and landfills were collected where available (country-wide for incinerators and within five regions for landfills), and the population living within a specific radius of both incinerators and landfills was classified according to the census tract and its deprivation value. For each census tract in Italy, a deprivation index was available from a national project funded by the Ministry of Health,[7] summarizing five dimensions of socioeconomic position (education, occupation, home ownership, family composition and nationality), by mean of an unweighted average of z-scores of each factor. For the purpose of this study, the corresponding population was distributed in quintiles of deprivation, ranging from very well off (level I) to very underprivileged (level V).

The distance from the point source (landfill site and/or incinerator) was used to estimate the exposed population. Buffer zones of 3 km around incinerators[8] and 2 km around landfill sites[9] were used as the likely limits of the dispersion of emissions. For each plant (incinerators and landfills), increasing distance (1, 2 and 3 km) from the centre (the formal address of the plant) was defined and the census tracts that matched these areas were included in the study.

RESULTS

Table 2 shows the characteristics of the populations living close to the incinerators in Italy. More than a million people are affected, including 9010 neonates. More than 19% of the affected population is aged 65+ and the socioeconomic distribution is skewed towards higher deprivation (25% in class V (deprived) versus 12.6% in class I (less deprived)). More than half of the affected population lives close to plants built after 1990. The majority of residents within 3 km (64.4%) are located in the 2–3 km buffer zones.

Table 2. Characteristics of residents living within 3 km of an incinerator in Italy, 2001

Variable	N	%
Total	1 060 569	
Sex		
M	511 831	48.3
F	548 738	51.7
Age		
0	9 010	0.8
1–14	123 061	11.6
15–44	435 825	41.1
45–64	289 430	27.3
65+	203 243	19.2
SES		
I	133 211	12.6
II	159 735	15.1
III	223 059	21.0
IV	257 009	24.2
V	264 401	24.9
Missing	23 154	2.2
Distance		
0–1 km	50 990	4.8
1–2 km	326 798	30.8
2–3 km	682 781	64.4

7 Caranci N et al. (2010). The Italian deprivation index at census block level: definition, description and association with general mortality. *Epidemiologia e Prevenzione*, 34(4):167–76.
8 Elliott P et al. (1996). Cancer incidence near municipal solid waste incinerators in Great Britain. *British Journal of Cancer*, 73(5):702–10.
9 Elliott P et al. (2001). Risk of adverse birth outcomes in populations living near landfill sites. *British Medical Journal*, 323:363–8.

Table 3 shows the characteristics of the population living close to the 118 landfills in the five regions with geocoded data, and the corresponding figures for the whole country, assuming that the characteristics (sex, age and SES) of people around the 501 missing landfills were similar to those of the 118 studied sites. In Italy, more than 1 350 000 people would be affected, including 11 766 neonates. More than 18% of the population is aged 65+ and the socioeconomic distribution is skewed towards higher deprivation (26% in class V versus 13% in class I). The majority of residents within 2 km (85.7%) are located in the 1–2 km buffer zone.

Table 3. Characteristics of residents living within 2 km of a landfill site in Italy, 2001

Variable	N (observed data in five regions)	%	N (estimated data at the national level)
Total	257 513		1 350 852
Sex			
M	125 750	48.8	659 655
F	131 763	51.2	691 197
Age			
0	2 243	0.9	11 766
1–14	32 801	12.7	172 066
15–44	107 244	41.6	562 577
45–64	67 971	26.4	356 560
65+	47 254	18.4	247 883
SES			
I	34 252	13.3	179 678
II	38 715	15.0	203 090
III	57 801	22.4	303 210
IV	59 320	23.0	311 179
V	67 339	26.1	353 244
Missing	86	0.0	451
Distance			
0–1 km	36 716	14.3	192 603
1–2 km	220 797	85.7	1 158 249

CONCLUSIONS

A direct relationship between small area deprivation and residence near incinerators and landfills was found in Italy. Population estimates of social inequalities in exposure to residence near landfills are less reliable at the national level, due to the lack of complete information about the accurate location of plants.

These findings provide useful information to take into account, together with other factors such as the transport of waste from sources to plants, that could contribute significantly to the overall impact of these facilities.

ASSESSING AND REPORTING ON INEQUALITIES RELATED TO LACK OF HEATED SPACE AND INDOOR POLLUTION IN SERBIA AND MONTENEGRO

INTRODUCTION

Poverty reflects a lack of household capital: households are poor if they are not able to meet their basic needs or secure a healthy lifestyle. Households' strategies for coping with their inability to obtain energy services often have unwelcome consequences. Especially poor households practise a risky form of energy saving to reduce costs, such as using cheap and low-quality fuels, reducing the number of heated rooms and using fuels, such as unseasoned wood, that produce indoor pollution.

This work presents some evidence of the influence of poverty and social inequality on health in Serbia and Montenegro. The assessment was performed through the United Nations Development Programme (UNDP) during 2002 and 2003, investigating the energy sector in Serbia and Montenegro.[10]

DATA AND METHODOLOGY

Three surveys and a series of focus group interviews were conducted to understand the structure of energy services in Serbia and Montenegro. Two surveys examined households: the first examined actual energy usage patterns (consumption, appliances) and the second explored perceptions about energy processes and services. The perception survey was conducted to test the reliability of the findings of the energy usage survey and to provide additional insights into energy consumption patterns as well as people's perceptions, needs, apprehensions and expectations about energy. A third survey looked at energy providers and auxiliary services. A series of focus group interviews was conducted with energy users to gain a deeper understanding of the complex processes examined in the surveys.

The energy usage survey was administered to a random sample of 1720 households. Municipalities, neighbourhoods, streets, houses and apartments were randomly selected. The perception survey was conducted on a separate sample of 1650 households randomly selected from the 2002 census in Serbia and voting lists in Montenegro. All findings were compared with the results of the Living Standards Measurement Study survey conducted as part of Serbia and Montenegro's Poverty Reduction Strategy Process, which sampled more than 6500 households, and the household consumption survey conducted by the Federal Statistical Office. The results of the household survey were used for a cluster analysis to distinguish groups of households based on their energy patterns and welfare status.

The energy usage survey reveals that during the 2002/2003 heating season, the most frequently used fuels were wood and coal (61% of households), district heating (including central heating) (22%) and electricity (12%). In urban settlements, almost equal numbers of households used wood and coal (40%) and district heating (38%), while 16% of households used electricity as the primary fuel for heating. In rural settlements, 87% of households used wood and coal, and only 7% used electricity as the primary fuel for heating. Gas was used as a heating fuel mostly in Vojvodina (13% of households). In Belgrade almost half of households (47%) used district heating.

10 UNDP (2004). *Stuck in the past: energy, environment and poverty in Serbia and Montenegro*. Belgrade, UNDP (http://www.undp.org/energy/docs/Stuck_in_the_Past.pdf, accessed 21 September 2011).

INEQUALITIES RELATED TO HEATING

The surveys revealed that many households in Serbia and Montenegro lack sufficient heating conditions.

- More than one-third of households (37%) assess their quality of heating as poor and insufficient. The percentage is higher (42%) among people over 60.
- Households that use electricity for heating, households with below average economic status and households that heat less than 5 m^2 per household member assess their quality of heating as poor and insufficient much more frequently than other households.
- To cut energy expenses, 17% of households reduce the temperature in the rooms they heat, and 27% of households reduce the number of rooms they heat. Households that use electricity for heating and households with below average economic status are more likely than other households to lower the temperature and reduce the number of rooms they heat (see Table 4).
- Households that assess their quality of heating as poor and insufficient, households that heat less than 10 m^2 per household member and households whose economic status is below average are more likely to experience health problems (see Table 4).

Table 4. Socioeconomic indicators, by heated space and type of fuel (%, except where otherwise indicated)

Indicator	Heated space		Type of fuel				
	Less than 10 m^2 of heated space per household member	More than 20 m^2 of heated space per household member	Electricity	District heating	Wood and coal	Other	All households
Income							
Up to 2500 dinars ($42) per household member in June 2003	33.3	8.4	13.0	4.4	27.3	19.2	20.0
More than 9000 dinars ($150) per household member in June 2003	0.7	21.8	12.3	20.6	2.0	13.7	8
Average total household income per member (US$)	46	102	81	103	54	83	69
Highest educational level attained							
Primary school	38.2	15.4	12.1	8.1	36.3	19.1	26.2
University or college degree	7.0	22.8	19.2	25.9	8.3	14.3	13.8
Household size and composition							
Five or more members	33.7	9.0	18.9	10.4	26.7	23.8	22.0
Two or more children under the age of 18	24.1	9.1	18.0	9.9	18.6	21.0	16.8
Three- generation household	33.5	12.9	16.7	9.4	30.9	26.0	24.1
Health status							
Proportion of households without health problems	59.0	69.9	69.2	73.2	60.4	66.5	64.7

Source: perception survey.

Note: the differences are even more significant for heated space per member of up to 5 m^2. About 47% of households with at least five members and 34% of households with at least two children heat no more than 5 m^2 per household member; 40% of these households are three-generation households. About 59% of households that heat no more than 5 m^2 had income per household member of less than 2500 dinars ($42) in June, while none had income per household member of more than 9000 dinars ($150).

INEQUALITIES IN INDOOR AIR POLLUTION

The survey also indicated that in relation to heating conditions, many households suffer from health problems related to indoor air pollution.

- Households with at least five members were more likely to use wood or coal for heating (81%).
- Households that heat less than 10 m^2 per member are most likely to burn wood or coal (81%); households heating more than 20 m^2 per member use district heating (46%), coal and wood (38%), electricity (8%) and gas (5%) (see Table 5).
- Households in apartments with district heating make up a disproportionately high percentage of people with university or college education and people working in trade, transport and communications, finance, public administration, police and military, education, health care and social welfare. Households that burn solid fuels represent a higher than average share of people working in agriculture, trade and crafts.

Table 5. Reduction of heated space in apartments, by type of fuel

Space per household member	Electricity	District heating	Wood and coal	Other	Total
Heated space of less than 10 m^2	38.9%	4.2%	51.9%	28.0%	38.5%
Heated space of 10–20 m^2	43.5%	44.7%	32.4%	43.0%	37.0%
Heated space more than 20 m^2	17.7%	51.0%	15.7%	28.9%	24.5%
All rooms heated	26.7%	95.6%	19.2%	29.1%	37.6%
Only some rooms heated	73.3%	4.4%	80.8%	70.9%	62.4%
Average apartment space	72.8 m^2	61.9 m^2	86.9 m^2	109.3 m^2*	80.7 m^2

Source: perception survey.

* This figure reflects the effect of one housing unit of more than 900 m^2, which increased the average.

INEQUALITIES IN ASSOCIATED HEALTH CONDITIONS

The household surveys shed light on the relation between health problems and lack of heated space and indoor pollution.

- People who live in homes with a heated area of less than 10 m^2 per household member have a higher incidence of health problems (41%) than people who live in households with larger heated areas per member (30%).
- There are statistically significant differences in the number of household members with health problems between households using wood for heating (39.6%) and those using district heating (26.8%) (see Table 4).
- There are significant differences in the number of health problems between groups using residential heating based on electricity (12.2%), or using air conditioners (18.4%) or central heating (26.3%), in comparison to the group using naphtha burning stoves (56%), solid fuel light cooking stoves (42.1%) and gas heaters (41.9%).
- The difference in the incidence of health problems and type of heating is most apparent in the case of users of electricity masonry stoves (8.7% having health problems) and users of solid fuels masonry stoves (36.7% having health problems).

CONCLUSIONS

Households are suffering from lack of heat and high levels of indoor air pollution. During the winter many poor households heat only half of their living space in order to save on energy costs. More than 25% of households heat less than 10 m^2 per person, considered to be the necessary minimum. About 60% of the population uses wood and lignite coal – the worst polluters – as their major source of energy for heating, domestic hot water and cooking.

Indoor air pollution is considerable and is correlated with chronic illnesses, including respiratory disease. The health and demographic statistics, survey evidence, mortality patterns and anecdotal evidence together lead to a stark conclusion: indoor pollution is having deleterious effects on 1.5 million households in Serbia and Montenegro.

Health problems and winter mortality are closely affiliated to the above factors. Mortality in Serbia and Montenegro during the winter months can be more than 30% higher than the monthly average mortality rate, with poor households disproportionately affected. Flu epidemics, weather conditions, inadequate clothing, insufficient physical activity, bad nutrition, and high-density housing explain part of the differential, but energy-related factors – such as increased indoor air pollution, inadequate home heating and low temperatures in bedrooms – also play a role, often interacting with other factors.

ANALYSIS AND PRESENTATION OF ENVIRONMENTAL HEALTH INEQUALITIES CONCERNING "GREEN SPACE" IN SCOTLAND

INTRODUCTION

The term "green space" is used to describe any vegetated land or water within or adjoining an urban area. Thus, it includes:

- disused railway lines, rivers and canals (sometimes called "green corridors");
- woods, grassed areas, parks, gardens, playing fields, children's play areas, cemeteries and allotments;
- countryside immediately adjoining a town which people can access from their homes.[11]

Green space can also describe derelict, vacant and even contaminated land which has the potential to be transformed. Quality green spaces contribute to improving health and well-being for urban communities. Nested within the Scottish Government's strategic objective for a healthier Scotland is an objective to sustain and improve health, especially in disadvantaged communities. A taskforce charged with bringing forward an action plan to tackle health inequalities in Scotland identified several key roles of green spaces in creating healthy, sustainable communities.

- Green spaces provide valuable opportunities for social, physical, environmental and purposeful activities that enhance the well-being of the whole population and can be particularly beneficial to people struggling with poor mental health.
- Green spaces improve physical health by providing no-cost opportunities for sports, walking, cycling, gardening and conservation work. They increase levels of physical activity and reduce the risk of people having a range of illnesses or poor health – they are particularly valuable in low-income communities.
- Green spaces support children's physical and social development by offering opportunities for play and physical activity that are essential for early years development, as well as for older children and teenagers. In low-income communities where private gardens are few, public green spaces are particularly crucial in supporting children's development.
- Green spaces offer improved community health through the role of green infrastructure and green networks, which reduce health risks from traffic, air pollution, noise flooding and temperature extremes, as well as providing opportunities for physical and social activity and play.

By contrast, degraded and poor quality green space is considered to limit development of healthy sustainable communities by:

- discouraging physical activity
- undermining well-being
- increasing social isolation
- damaging community morale
- denying children access to outdoor play
- increasing health inequalities.

An understanding of how proximity of, and access to, urban green space aligns with social variables is of considerable policy significance and can inform interventions with potential to bear directly on health, well-being and inequities in health. Organized approaches to securing better green space, distributed

11 Greenspace Scotland (2004). *What is greenspace?* Stirling, Greenspace Scotland (http://www.greenspacescotland.org.uk/default.asp?page=26, accessed 26 September 2011).

more equitably between population groups, are consistent with the Scottish Government's strategic aspirations to deliver a wealthier and fairer and a healthier Scotland. The right sort of green space, appropriately located in relation to population, is also consistent with the remaining three Scottish Government strategic objectives; namely, to create a safer and stronger, a smarter and a greener Scotland. The collection of appropriate measures of green space aligned to social variables is potentially very valuable in policy terms.

Analysis of accessibility of green space raises a further issue. Technically, measuring proximity can be done at various levels of sophistication: firstly, Euclidian distance can be used and a factor incorporated to divide or multiply the distance to account for network distance; secondly, if required, actual access points can be mapped for some green spaces (such as conventional parks) and then used with network analysis. However, proximity is only one factor that impacts on accessibility and use of green space; perception of crime, functionality and design can also influence use and these can be considered under community consultation.

DATA AND METHODOLOGY

Over the last decade the analysis of green space has been significantly improved by the availability of detailed georeferenced socioeconomic and health data. These data can be combined with detailed green space data, usually within a GIS. This has allowed researchers to undertake a more detailed analysis of the issue and also aided the presentation of this topic to policy-makers.

Most of these data come from government or quasi-government sources and the opening up of national mapping organizations' data sets, and much is now available for interactive mapping on web sites. The example of Scotland (similar data and analyses have also been produced in England and Wales) illustrates the data sets available and resulting analyses have been based on the following elements:

- datazones – small area units of 500–1000 people, representing the default unit for the collection of most government data in Scotland;
- the Scottish Index of Multiple Deprivation[12] – a range of socioeconomic data at datazone units, based on 38 indicators available in a range of domains, including income, employment, health, education, skills and training, housing, geographic access and crime;
- unit postcodes – approximately 15 households tied to a unique identifier and a classification of these postcodes on an urban rural scale;
- Ordnance Survey (the mapping agency of the United Kingdom Government) "MasterMap Address Layer 2" (based on the Local Land and Property Gazetteer), which maps every individual building in the country;
- detailed classification of green space by type at the local authority level, as well as some nationally available data sets.[13]

By spatially integrating different sets of data within a GIS it is possible to get an understanding of the spatial distribution of green space, and the quality and potential impacts on health. An early example of this approach was carried out for the Scottish and Northern Ireland Forum for Environmental Research (SNIFFER), comprising the Scottish Executive, Scottish Environmental Protection Agency, Forestry Commission Scotland and Scottish Natural Heritage.[14]

12 Scottish Government (2010). *Scottish Index of Multiple Deprivation*. Edinburgh, Scottish Government (http://scotland.gov.uk/Topics/Statistics/SIMD, accessed 26 September 2011).

13 Scottish Government (2008). *Planning Advice Note 65*. Edinburgh, Scottish Government (http://www.scotland.gov.uk/Resource/Doc/225179/0060935.pdf, accessed 26 September 2011).

14 Fairburn J et al. (2005). *Investigating environmental justice in Scotland: links between measures of environmental quality and social deprivation*. Edinburgh, SNIFFER.

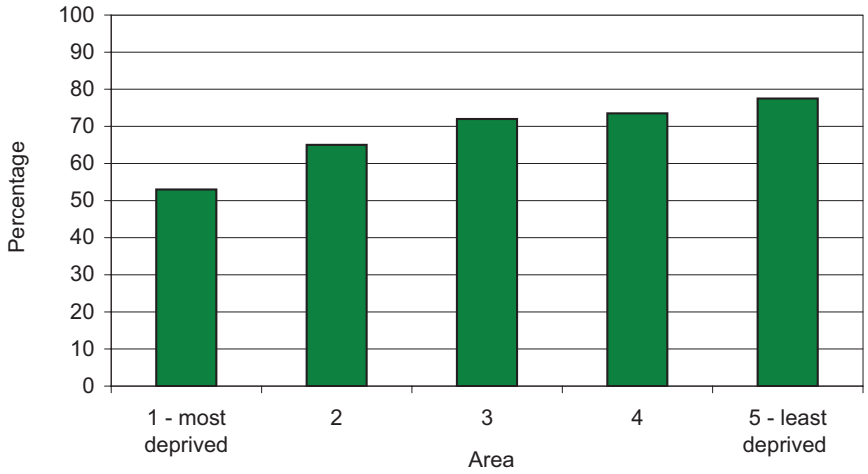
RESULTS

All of Scotland has now been mapped in detail at the local authority level for green space access. The early proximity (Euclidean) studies have been improved by the use of analysis of routes to green space; this also allows planners to evaluate how many people will be affected by improvements to green space, as well as improvements to possible routes. For example, by classifying the population into 10 deciles by the Scottish Index of Multiple Deprivation it was possible to show that people in deciles 9 and 10 (the two wealthiest) were twice as likely as those in any other decile to be living near a local nature reserve.

Complementing the quantitative/GIS method has been the use of largely qualitative methods for use in community consultation. Greenspace Scotland, Scottish Natural Heritage and the Institute of Occupational Medicine produced a health impact assessment guide for green space, which is intended to aid the assessment of health and equity impacts of existing and proposed green space.[15] It is hoped that the guidance will contribute to a greater recognition of green space's role in improving health and greater emphasis on the health effects of green space in proposals.

Starting in 2010, the Scottish Household Survey is now publishing data on perceived green space quality across Scotland, by Index of Multiple Deprivation and local authority of residence. An example is provided in Fig. 6.

Fig. 6. Percentage of adults (aged 16+) who agreed there were any 'safe and pleasant' parks or green spaces available in the area, by Scottish Index of Multiple Deprivation quintile, 2009



CONCLUSIONS AND OPPORTUNITIES FOR REPLICATION

This approach provides a very strong evidence base for policy-makers at the local level and can be used in particular to bring together local authorities to develop integrated and spatially targeted policy. In fact, Forestry Commission Scotland used just such an approach when making grants available to improve green spaces and to plant new woodlands.

The difficulties for many countries in replicating the approach to green space described in this example at the national level (and in some case even at the local level) must be acknowledged. However, it is undoubtedly the case that such an approach could be replicated by local authorities in some countries. Local authorities will generally have a local gazetteer (usually containing information down to the individual house), data on the location of green space and some socioeconomic data for the population. Such an approach does need a reasonably high level of technical competency, especially in GIS. However, there are several detailed guidance manuals available from the United Kingdom demonstrating how to use this approach.

15 Greenspace Scotland (2008). *Health impact assessment of greenspace – a guide.* Stirling, Greenspace Scotland (http://www.greenspacescotland.org.uk/upload/File/Greenspace%20HIA.pdf, accessed 26 September 2011).

ASSESSMENT OF ENVIRONMENTAL HEALTH INEQUALITIES IN FINLAND: RESIDENTIAL EXPOSURE TO AMBIENT AIR POLLUTION FROM WOOD COMBUSTION AND TRAFFIC

INTRODUCTION

The methods and results below are extracted from the final report of the Finnish PILTTI study.[16] The main results will also be published in two scientific articles.[17 18] In addition to the material briefly summarized below, the PILTTI study also used a GIS to map the distribution of the two types of exposure over Finland, estimated the health impacts and forecasted the changes in exposure and health impacts to 2020.

The aim of the PILTTI project was to assess the adverse health effects from air pollution by primary fine particulate matter (aerodynamic diameter smaller than 2.5 μm ($PM_{2.5}$)) in Finland from traffic and domestic wood combustion – how the exposures and risks are distributed in space, time and across the sociodemographic strata. $PM_{2.5}$ is the air contaminant, and most likely also the environmental contaminant, with the highest burden of disease impact in Finland, Europe and the world. The two sources being assessed are those with the greatest contrast in area covered, and thus the greatest exposure and risk differences. They are also the $PM_{2.5}$ sources on which national regulation and local actions can exert the highest impacts. They therefore provide a relevant target for environmental health inequality assessment.

DATA AND METHODOLOGY

Residential location and sociodemographic population data for Finland were obtained from the Statistics Finland Grid Database (www.stat.fi/tup/ruututietokanta/index_en.html). The data set contained population numbers for Finland on a resolution of 250 x 250 m^2 for 2004. For exposure modelling, the population data were transformed into 1 km^2 spatial resolution with GIS-based modelling platform ArcMap 9.2.

Source emission data for domestic wood combustion and traffic were divided into two categories because of different temporal variations in the data, and different dispersion characteristics. The four categories were:

- domestic wood combustion in residential buildings
- domestic wood combustion in recreational buildings
- direct traffic emissions, tailpipe, tyre and brake wear
- suspended traffic emissions (road dust).

16 Ahtoniemi P et al. (2010). *Health risks from nearby sources of fine particulate matter: domestic wood combustion and road traffic (PILTTI)*. Helskinki, National Institute for Health and Welfare.

17 Taimisto P et al. (2011). Evaluation of intake fractions for different subpopulations due to primary fine particulate matter (PM2.5) emitted from domestic wood combustion and traffic in Finland. *Air Quality, Atmosphere & Health,* 4(3–4):199–209.

18 Karvosenoja N et al. (2011). Integrated modeling assessments of the population exposure in Finland to primary PM2.5 from traffic and domestic wood combustion on the resolutions of 1 and 10 km. *Air Quality, Atmosphere & Health,* 4(3–4):179–188.

$PM_{2.5}$ emissions of domestic wood combustion and road traffic were calculated with the Finnish Regional Emission Scenario model of the Finnish Environment Institute.[19] The emissions are calculated from the parameters of activity levels, emission factors and emission control technologies for Finland in 2000 and disaggregated to 1 km and 1 hour resolutions.

Emission–exposure relationships for emissions of domestic wood combustion in residential and recreational buildings, as well as direct and suspended traffic emissions for the entire population of Finland, were estimated using the intake fraction (iF) concept. The estimation of iFs for air pollution emissions are based on emission, dispersion, concentration, population and breathing rate data.

The applied atmospheric dispersion model was the Urban Dispersion Modelling system developed at the Finnish Meteorological Institute. Meteorological data from 10 synoptic weather stations from 2000 to 2003 were used in the calculations.

Incremental $PM_{2.5}$ concentrations were calculated for incremental unit emissions with a 1 km grid resolution for each of the four source categories – in total for 783 900 grid cells. Each source was assumed to be in the centre of a 40 x 40 km^2 grid for domestic wood combustion and 20 x 20 km^2 grid for road traffic emissions. Contributions from the more distant sources to the concentration in a grid cell were ignored. The iFs, and further the exposure and risk estimates for the populations and sources in each grid cell, were calculated using the actual source emission and population data with statistical computation and graphic system R version 2.7.0.

RESULTS

Because the high spatial resolution population statistics also include data on the sex, age and education level of each individual, the average exposures to the four $PM_{2.5}$ categories from the two traffic and two wood combustion sources, and thus the exposure differences between the different sociodemographic groups, could be estimated. These are shown in Fig. 7.

Females appear to experience slightly higher exposures to traffic $PM_{2.5}$ but equal exposures to wood combustion $PM_{2.5}$ compared to males. The difference is somewhat unexpected for traffic $PM_{2.5}$, but is small and statistically insignificant.

Children experience the lowest and adults the highest exposures to traffic particles. The elderly experience the lowest exposures to wood combustion particles. The differences, however, are small, and the presumably higher vulnerability of children may more than eliminate the advantage gained from lower exposure.

Those with high school and higher education experience significantly higher exposures to traffic $PM_{2.5}$ and also higher exposure to wood combustion $PM_{2.5}$ than those with lower levels of education. Regarding exposure to traffic $PM_{2.5}$, the average exposure level is highest for those with high school education, but the college/university educated also experience significantly higher exposure levels than those with vocational school education or less. The differences in the exposures to $PM_{2.5}$ from wood combustion are small in comparison, but increase consistently with the education level.

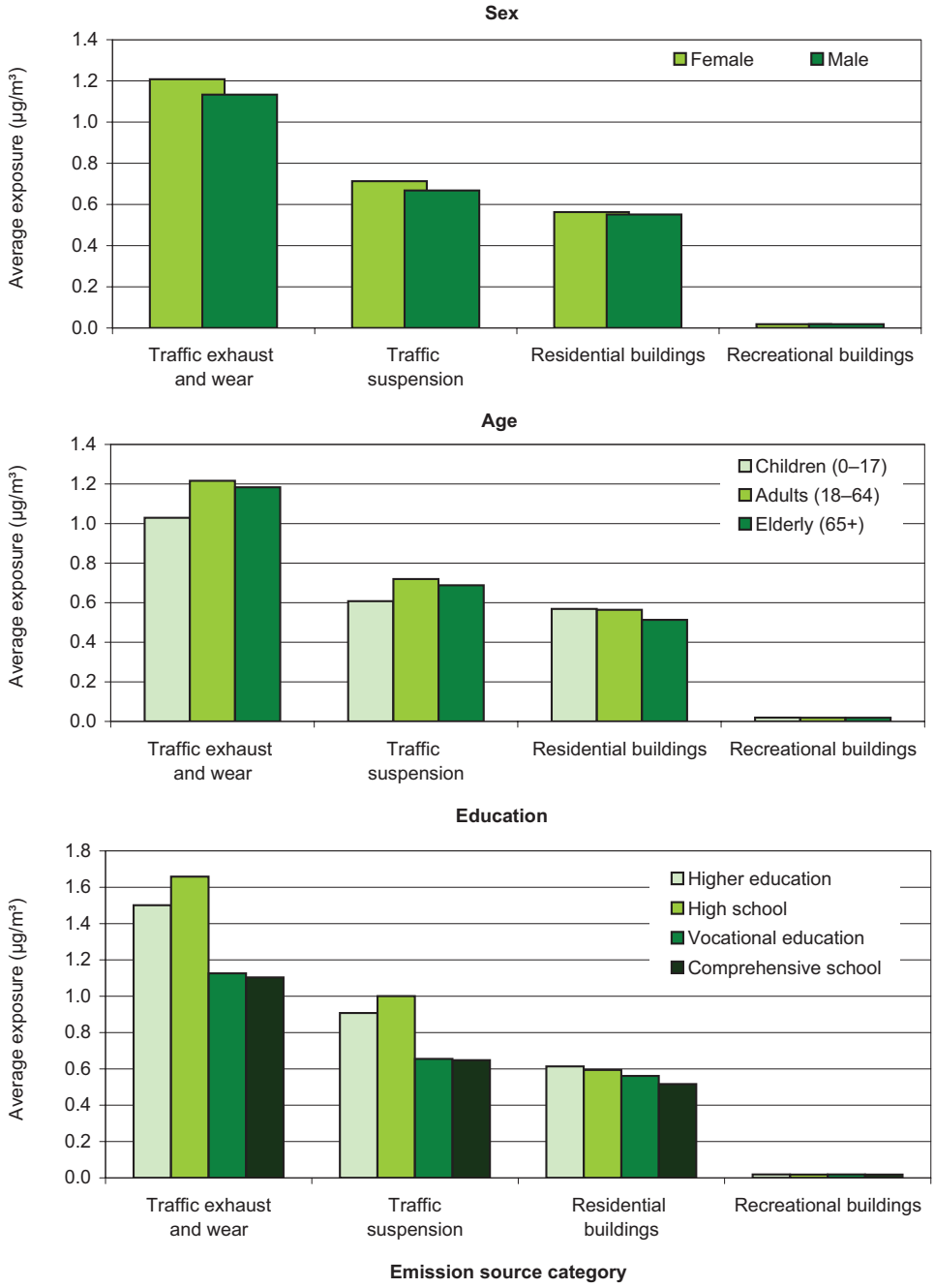
Compared to international studies, these findings could be considered unexpected, yet it is quite credible in the context of Finnish cities, where on the one hand the most expensive housing is often found in city centres close to the busiest traffic, and on the other hand wood combustion is a supplementary source of heat in the mostly electrically-heated suburban homes that lie outside of district heating networks. The lower socioeconomic groups, conversely, are more likely to live in suburban high-rise buildings, heated via district heating pipelines, with no equipment for wood burning, and distanced from the busiest

19 Karvosenoja N. (2008). *Emission scenario model for regional air pollution*. Helsinki, Finnish Environment Institute (Monographs of the Boreal Environment Research, No. 32; http://lib.tkk.fi/Diss/2008/isbn9789521131851/isbn9789521131851.pdf, accessed 26 September 2011).

traffic zones. The results highlight the fact that the impacts of many, if not most, SES parameters on pollution exposures are not universal, but are affected by local social, economic and urban development histories and cultures, and therefore require local analysis with local data.

Note that the exposure data were estimated from outdoor concentrations; the differences in the outdoor–indoor transportation of particles were ignored, the data on exposure to traffic particles do not include personal exposure while in transport, and the data on exposure to wood combustion particles do not include indoor exposure to particles emitted from fireplaces directly into indoor air. Taking into consideration the additional more direct fields of traffic and indoor sources would amplify the estimated differences.

Fig. 7. Average exposure (µg/m³) of different subpopulations to primary $PM_{2.5}$ from domestic wood combustion and traffic in Finland in 2000



Note: the levels are averages of exposure to $PM_{2.5}$ from specific sources; for example, the average exposure level of the high school-educated population to traffic generated $PM_{2.5}$ (exhaust, tyre and brake wear and road dust) is 1.7 + 1.0 = 2.7µg/m³. The total average $PM_{2.5}$ exposure from all sources is approximately 10 µg/m³.

CONCLUSIONS

While there are continuing national and EU-based policy actions to reduce exposure to traffic and heating generated $PM_{2.5}$, these results have not led to any actions for reducing the socioeconomic differences in exposure and risk. The reasons are the small and insignificant differences between the sex and age groups, the relatively low exposure of children, and the fact that the higher exposure of the more educated does not reflect social deprivation or lack of choice and is compensated by their generally better underlying health status. However, the data have been useful to confirm that no action is required due to a very low level of environmental health inequalities in the Finnish population.

The analysis method is in itself universally applicable, but requires individual level residential location, housing and sociodemographic data, which are available from the census data in Finland but not in all countries. It also requires data on wood heating in each building and traffic flows on each road link, which are prohibitively expensive to generate if not otherwise available.

ENVIRONMENTAL HEALTH INEQUALITY REPORT ON THE IMPACT OF SES ON THE PREVALENCE OF ALLERGIES AND RESPIRATORY DISEASES AND SYMPTOMS IN HUNGARIAN CHILDREN

INTRODUCTION

The aim of the National Children's Respiratory Health Survey was to assess the relationship between the prevalence of allergic and asthmatic symptoms and chronic bronchitis in third grade schoolchildren and social deprivation at the settlement level in Hungary. This representative study is the first attempt to assess the impact of social inequalities on respiratory health in Hungarian children at a community (settlement) level.

DATA AND METHODOLOGY

A national cross-sectional study was performed in autumn 2005.[20] All children in third grade classes with more than 10 children in any elementary school of Hungary were invited to participate. Questionnaires to be completed by the parents were sent to the head teachers of the schools, accompanied by a letter about the objectives of the study. The questionnaires served as sources of information on the children's present and past health status, perinatal conditions, the parents' respiratory health and smoking habits, the home environment and the SES of the family.

2726 schools were invited and 2160 schools (79.2%) participated in the survey. Out of the 82 082 questionnaires sent out to these schools, 62 711 were returned (76.4%). Based on the questionnaire information, combined data on variables including chronic bronchitic symptoms, asthmatic symptoms during the last 12 months and allergic symptoms were constructed. The presence of chronic bronchitic symptoms was based on at least one positive answer to three questions (whether the child usually coughs in the morning, during the day or at night in the autumn/winter season; whether the child coughed on most days for at least three months consecutively in the last autumn/winter season; whether the child usually coughs up phlegm when he/she does not have a cold). The assessment of asthmatic symptoms was based on at least one positive answer to five questions, all related to the last 12 months (whether the child's chest sounded wheezy or whistling; whether the child's chest sounded wheezy during or after exercise; whether the child was woken up by wheezing; whether the child suffered from a dry cough at night; whether the child was treated for asthma). There was a separate question about whether asthma had ever been diagnosed by a physician. Questions on allergies covered allergies to house dust, pets, pollen, mould, food, medicine or anything else, and whether an allergy had been diagnosed by a doctor.

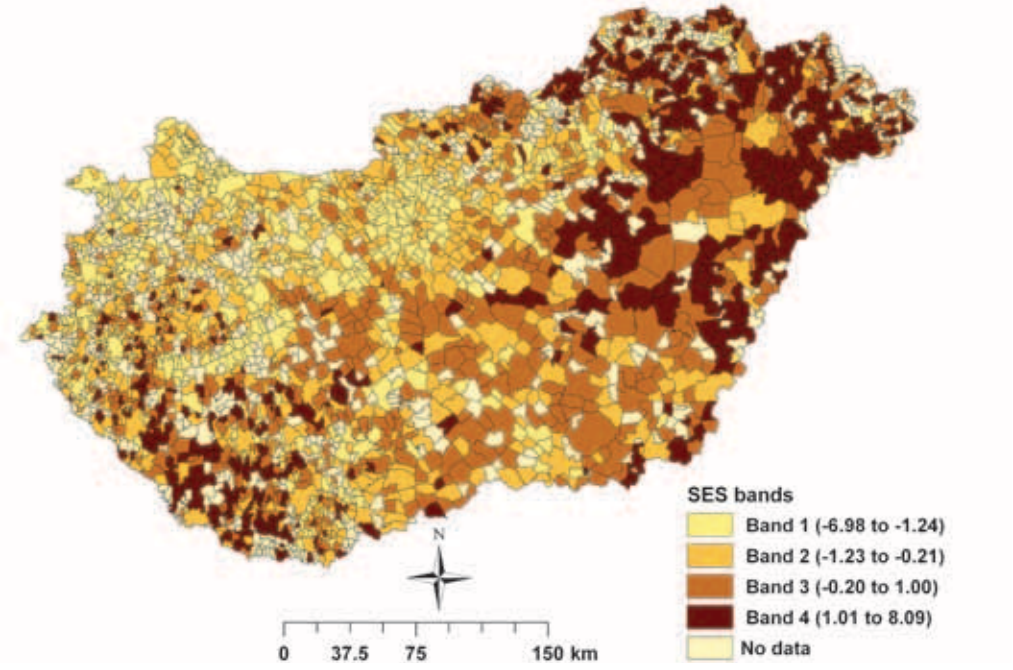
20 Paldy A et al. (2009). Impact of socioeconomic state on the prevalence of allergic and respiratory symptoms and diseases and in Hungarian children population. *Epidemiology,* 20(6):S178. The study was funded by European health and environment information system for risk assessment and disease mapping (EUROHEIS) project no. 2006126.

CHARACTERIZATION OF SES OF THE POPULATION AT THE SETTLEMENT LEVEL: DEVELOPMENT OF A DEPRIVATION INDEX

To develop the deprivation index, socioeconomic indicators were chosen at the settlement level from the Ministry of Local Government and Regional Development's regional informational system database. The data were derived originally from the Hungarian Central Statistical Office (2001 census) and the Hungarian Tax and Financial Control Administration. The selected indicators were:

- income (gross income serving as a basis of personal income tax per permanent head of population);
- low qualification level (proportion of the total population older than 15 years with only basic education or illiterate);
- unemployment (proportion of total population of working age);
- single-parent families (proportion of families with children);
- large families (proportion of families with three or more children);
- density of housing (number of people per room);
- car ownership (passenger cars per 100 inhabitants).

Fig. 8. Spatial distribution of SES in the settlements, banded by quartile



The variables were transformed using natural log transformation and standardization. Each variable was standardized as a z-score based on individual observations, the arithmetic mean of all observations, and the standard deviation. The weight of each indicator was determined from the statistical relationships between them. Individual weights were estimated using factor analysis. The area-specific index was calculated as a weighted sum of the z-scores, with higher values representing greater deprivation: a positive index indicates that the SES is lower than the average, and the converse was shown by negative index values.[21]

The descriptive ecological study was carried out using Rapid Inquiry Facility (RIF) software and the spatial inequality of morbidity was defined by the RIF "disease mapping" tool, expressed as relative risks obtained by using the empirical Bayes method. Investigation of the association between deprivation and

21 Juhász A et al. (2010). Development of a Deprivation Index and its relation to premature mortality due to diseases of the circulatory system in Hungary, 1998–2004. *Social Science & Medicine,* 70(9):1342–9.

the spatial distribution of morbidity from diseases of the respiratory system in Hungary was carried out using the RIF "risk analysis" tool. In the risk analysis module the settlements were grouped into deprivation quartiles, and morbidity rates and risks were calculated for each quartile. Chi-square tests for homogeneity and for linear trend were implemented to test global associations of the deprivation index and relative risk of morbidity from diseases of the respiratory system.

RESULTS

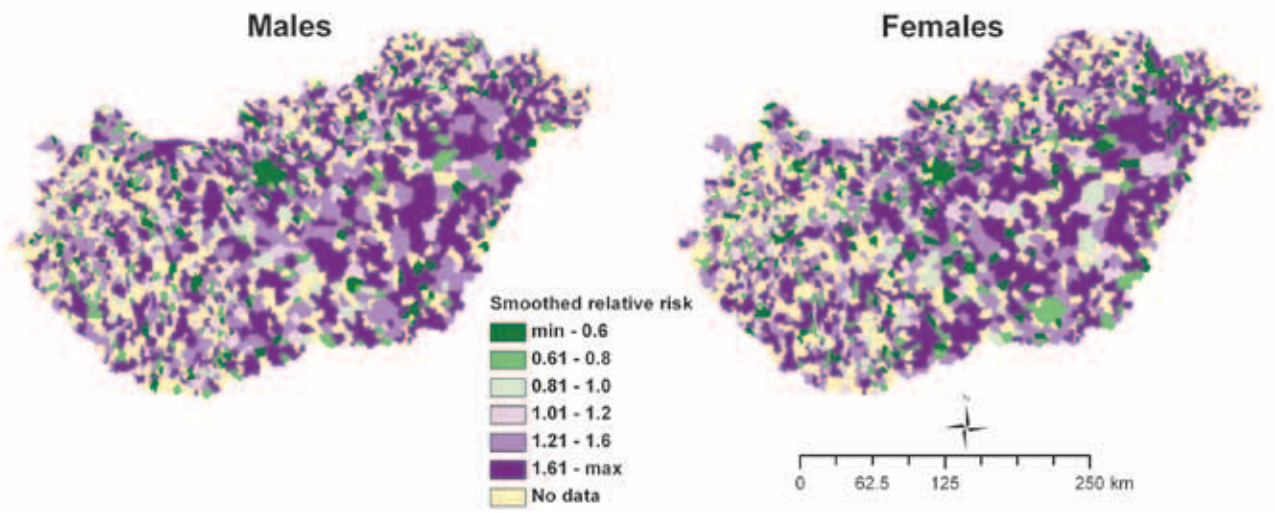
Distribution of socially disadvantaged areas

Two large deprived areas were identified in the north-eastern/eastern and south-western sections of Hungary. Parts of counties Borsod-Abaúj-Zemplén and Szabolcs-Szatmár-Bereg in the north-east proved to be the most deprived and underdeveloped parts of the country (see Fig. 8).

Distribution of respiratory diseases

Budapest proved to be the have the lowest risk of respiratory disease in Hungary. High-risk areas were observed in the north-east for chronic bronchitis (see Fig. 9) and asthmatic symptoms in both sexes, and in the central Hungarian region for allergies.

Fig. 9. Territorial inequalities of acute bronchitis symptoms in the settlements

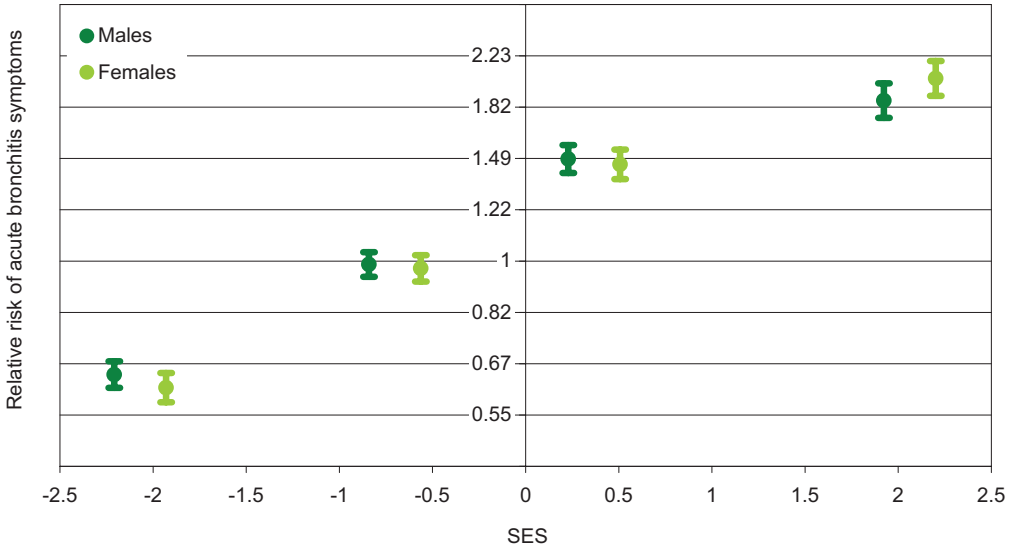


Combination of social statistics and disease risk

As a result of ecological risk analysis, a significant association was detected between the SES quartiles and the relative risk of the diseases and symptoms investigated. An upward trend was observed in the risk of morbidity from diseases of the respiratory system by the degree of deprivation (see Fig. 10).

This study indicated that allergic and asthmatic symptoms in children, as well as symptoms of bronchitis, are more frequent in socially deprived areas of the country. The findings also contradict previous evidence that allergic diseases are more common among wealthier populations.

Fig. 10. The impact of SES on acute bronchitis



CONCLUSIONS

The data show that low levels of education, unemployment, low income and high rates of exposure to passive smoking (supported by the questionnaire data) significantly contribute to the respiratory morbidity of children.

Based on the results of this and other similar inequality-driven surveys, specific and regionally-targeted measures should be taken to decrease social inequalities in Hungary in order to lower the risk of respiratory diseases in deprived areas of the country. The regional "closing-up" programmes of the National Development Plan should also tackle this issue. Health promotion campaigns should focus on raising parental awareness, drawing attention to the impacts of passive smoking.

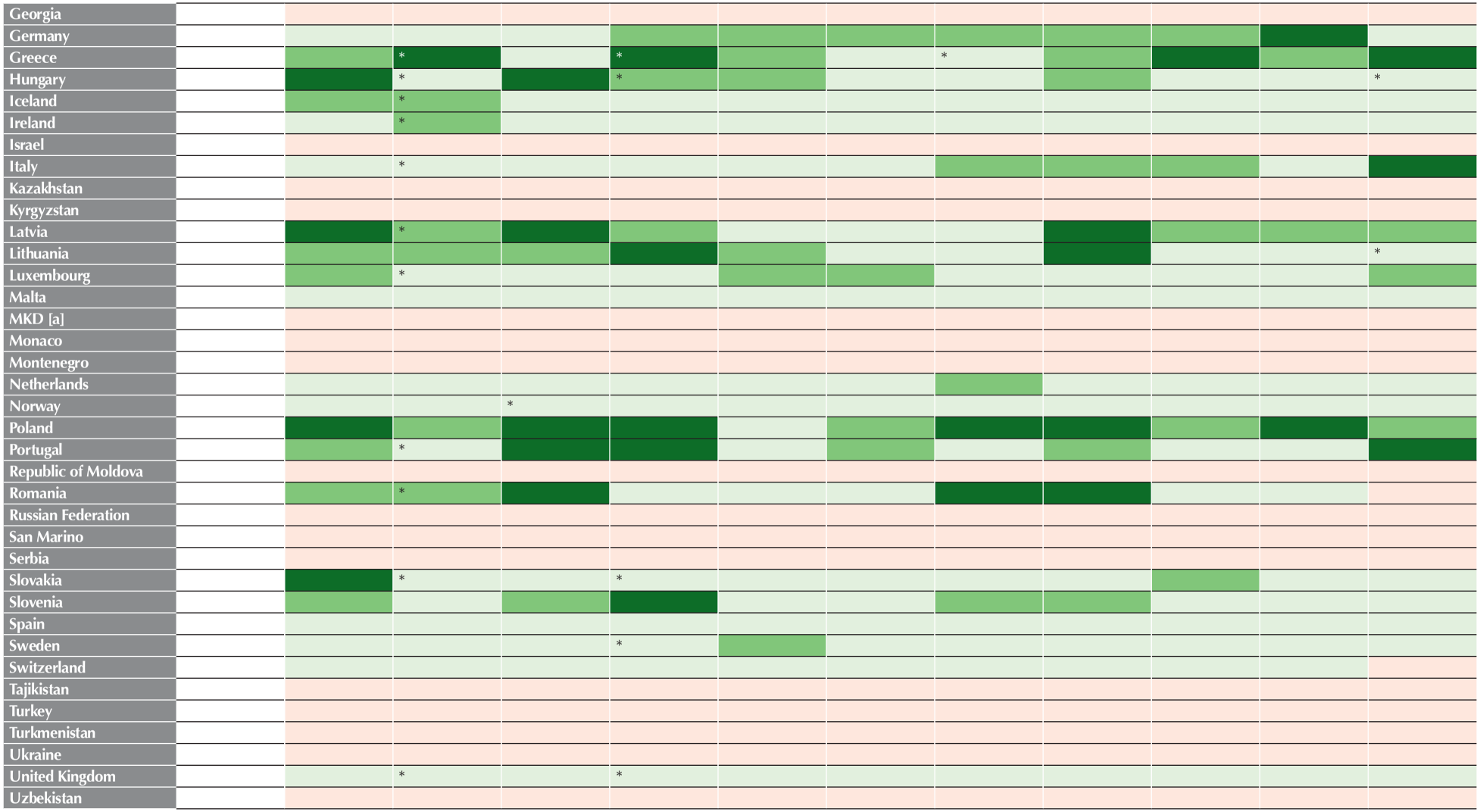
ANNEX 3

ASSESSMENT OF PRIORITY AREAS FOR NATIONAL ACTION

ANNEX 3. ASSESSMENT OF PRIORITY AREAS FOR NATIONAL ACTION

HOUSING-RELATED INEQUALITIES

Indicator	Inadequate water supply	Lack of flush toilet in dwelling		Lack of bath or shower in dwelling		Overcrowding		Dampness in the home		Inability to keep home warm in winter		Inability to keep home cool in summer
	Fig. 3	Fig. 5	Fig. 6	Fig. 9	Fig. 10	Fig. 11	Fig. 12	Fig. 13	Fig. 14	Fig. 15	Fig. 17	Fig. 19
Inequality dimension	By urban/rural population	By relative poverty level	By household type	By income quintile	By household type	By household type	By income quintile	By household type	By income quintile	By relative poverty level	By household type	By income quintile
Comments on calculation of inequality ranking	Impossible due to large number of countries with full coverage	Inequality ratio: income below/above relative poverty threshold	Inequality ratio: single-parent households/all households	Inequality ratio: lowest/ highest income quintile	Inequality ratio: single-parent households/ all households with children	Inequality ratio: single-parent household/all households	Inequality ratio: lowest/ highest income quintile	Inequality ratio: single-parent household/all households	Inequality ratio: lowest/ highest income quintile	Inequality ratio: income below/above relative poverty threshold	Inequality ratio: highest/ lowest prevalence rate of three household types	Inequality ratio: lowest/ highest income quintile
Disadvantaged group	Rural areas	Below relative poverty level (all reporting countries)	Balanced: single-parent households in 14, all households in 16 countries	Lowest income quintile (29 of 30 countries)	Single-parent households (24 of 30 countries)	Single-parent households (29 of 30 countries)	Lowest income quintile (all reporting countries)	Single-parent households (28 of 30 countries)	Lowest income quintile (all reporting countries)	Below relative poverty level (all reporting countries)	Single-parent households (23 of 30 countries)	Lowest income quintile (25 of 27 countries)
Albania												
Andorra												
Armenia												
Austria			*									
Azerbaijan												
Belarus												
Belgium												
Bosnia and Herzegovina												
Bulgaria			*					*				
Croatia												
Cyprus			*			*						
Czech Republic			*									
Denmark												
Estonia			*									
Finland												
France					*							



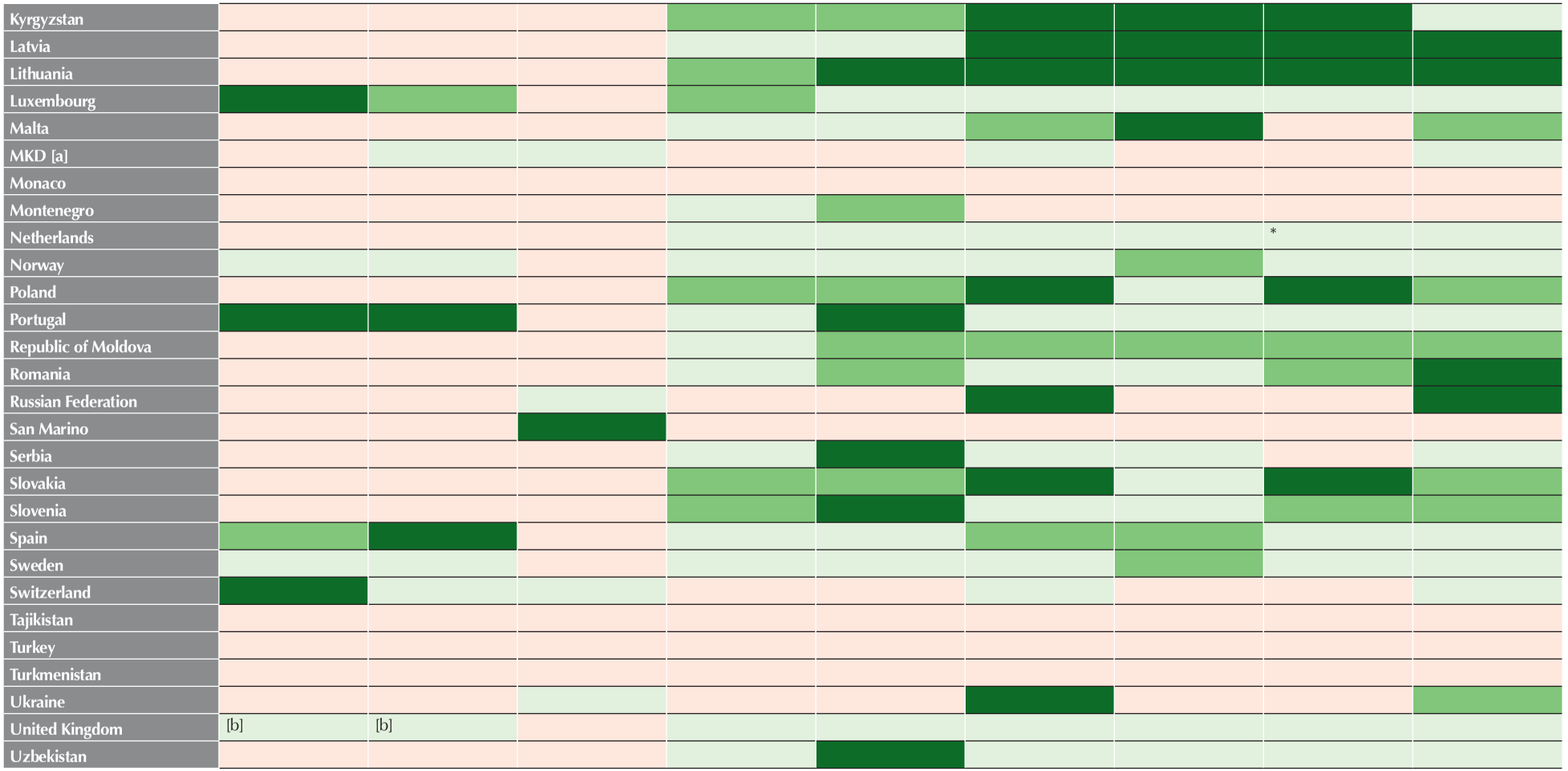
Legend:
For details, please see method example in Chapter 6.

Countries with suggested priority for national action (defined as countries being in the fourth quartile for both the absolute and the relative inequality dimensions, or in the third quartile for one and in the fourth quartile for the other inequality dimension)
Countries that would be classified as having a suggested priority for national action if they fell into a higher quartile for just one of the two inequality dimensions
Countries with no suggested priority for national action
Missing data

Notes: * Inequality ratio reversed; [a] ISO code for the former Yugoslav Republic of Macedonia.

INJURY-RELATED INEQUALITIES

Indicator	Work-related injuries		Fatal transport-related injuries			Unintentional fatal poisoning			Fatal falls
	Fig. 21	Fig. 23	Fig. 25b	Fig. 25a	Fig. 26	Fig. 29	Table 6	Table 6	Fig. 32
Inequality dimension	By sex	By age group	Mortality rate of all transport injuries by age group	RTI mortality rate by age group	RTI mortality rate by sex	Poisoning mortality rate (all causes) by sex	Poisoning mortality rate (excluding alcohol poisoning) by sex	Alcohol poisoning mortality rate by sex	Fall mortality rate by sex
Comments on calculation of inequality ranking	Inequality ratio: male/female	Inequality ratio: highest/lowest incidence of three age groups	Inequality ratio: highest/lowest mortality rate of four age groups	Inequality ratio: highest/lowest mortality rate of four age groups	Inequality ratio: male/female	Inequality ratio: male/female	Inequality ratio: male/female	Inequality ratio: male/female	Inequality ratio: male/female
Disadvantaged group	Males (all reporting countries)	Varies strongly	Varies strongly	Varies strongly	Males (all reporting countries)	Males (all reporting countries)	Males (all reporting countries)	Males (27 of 28 countries)	Males (all reporting countries)
Albania									
Andorra									
Armenia									
Austria									
Azerbaijan									
Belarus									
Belgium									
Bosnia and Herzegovina									
Bulgaria									
Croatia									
Cyprus									
Czech Republic									
Denmark									
Estonia									
Finland									
France									
Georgia									
Germany									
Greece									
Hungary									
Iceland									
Ireland									
Israel									
Italy									
Kazakhstan									



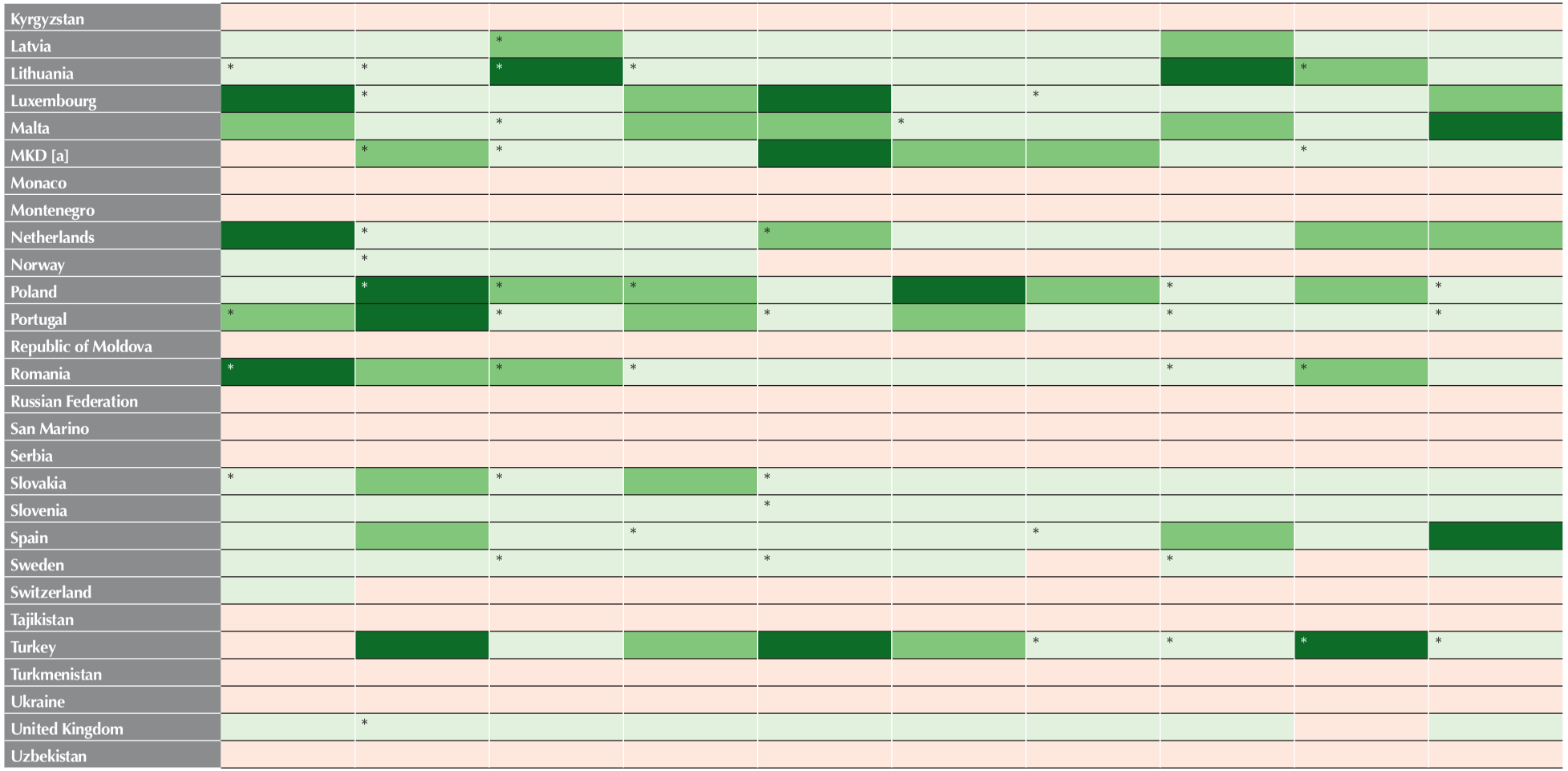
Legend:
For details, please see method example in Chapter 6.

- **Countries with suggested priority for national action (defined as countries being in the fourth quartile for both the absolute and the relative inequality dimensions, or in the third quartile for one and in the fourth quartile for the other inequality dimension)**
- **Countries that would be classified as having a suggested priority for national action if they fell into a higher quartile for just one of the two inequality dimensions**
- **Countries with no suggested priority for national action**
- **Missing data**

Notes: * Inequality ratio reversed; [a] ISO code for the former Yugoslav Republic of Macedonia; [b] data for work injuries are based on values for Great Britain as UK data are not available.

ENVIRONMENT-RELATED INEQUALITIES

Indicator	Noise exposure at home	Lack of access to recreational or green areas			Second-hand smoke exposure at home			Second-hand smoke exposure at work		
	Fig. 34	Fig. 36	Fig. 36	Fig. 37	Fig. 39	Fig. 39	Fig. 40	Fig. 42	Fig. 42	Fig. 43
Inequality dimension	By relative poverty level	By sex	By income quartile	By difficulty paying bills	By sex	By self-assessed social position	By difficulty paying bills	By sex	By self-assessed social position	By occupation
Comments on calculation of inequality ranking	Inequality ratio: income below/ above relative poverty threshold	Inequality ratio: female/male	Inequality ratio: lowest/highest income quartile	Inequality ratio: difficulty paying bills most of time/ no difficulty	Inequality ratio: female/male	Inequality ratio: low/high social position	Inequality ratio: difficulty paying bills most of time/ no difficulty	Inequality ratio: male/female	Inequality ratio: low/high social position	Inequality ratio: manual worker/ manager
Disadvantaged group	Below relative poverty level (24 of 30 countries)	Females (19 of 31 countries)	Highest income quartile (18 of 31 countries)	Difficulty paying bills most of time (23 of 31 countries)	Balanced: females in 16, males in 14 countries	Low social position (26 of 30 countries)	Difficulty paying bills most of time (24 of 28 countries)	Males (25 of 30 countries)	Low social position (21 of 28 countries)	Manual workers (25 of 30 countries)
Albania										
Andorra										
Armenia										
Austria		*	*		*				*	*
Azerbaijan										
Belarus										
Belgium		*								
Bosnia and Herzegovina										
Bulgaria			*	*						
Croatia		*	*	*	*					
Cyprus		*	*			*			*	
Czech Republic					*					
Denmark			*							
Estonia	*		*			*				
Finland					*	*				
France			*		*					
Georgia										
Germany					*					
Greece	*	*	*	*	*		*			
Hungary			*	*	*				*	*
Iceland										
Ireland					*					
Israel										
Italy										
Kazakhstan										



Legend:
For details, please see method example in Chapter 6.

- **Countries with suggested priority for national action (defined as countries being in the fourth quartile for both the absolute and the relative inequality dimensions, or in the third quartile for one and in the fourth quartile for the other inequality dimension)**
- **Countries that would be classified as having a suggested priority for national action if they fell into a higher quartile for just one of the two inequality dimensions**
- **Countries with no suggested priority for national action**
- **Missing data**

Notes: * Inequality ratio reversed; [a] ISO code for the former Yugoslav Republic of Macedonia.

ANNEX 4

COUNTRY ABBREVIATIONS

ANNEX 4. COUNTRY ABBREVIATIONS

ALB	Albania
AND	Andorra
ARM	Armenia
AUT	Austria
AZE	Azerbaijan
BLR	Belarus
BEL	Belgium
BIH	Bosnia and Herzegovina
BUL	Bulgaria
CRO	Croatia
CYP	Cyprus
CZH	Czech Republic
DEN	Denmark
EST	Estonia
FIN	Finland
FRA	France
GEO	Georgia
DEU	Germany
GRE	Greece
HUN	Hungary
ICE	Iceland
IRE	Ireland
ISR	Israel
ITA	Italy
KAZ	Kazakhstan
KGZ	Kyrgyzstan
LVA	Latvia
LTU	Lithuania
LUX	Luxembourg
MAT	Malta
MON	Monaco
MNE	Montenegro
NET	Netherlands
NOR	Norway
POL	Poland
POR	Portugal
MDA	Republic of Moldova
ROM	Romania
RUS	Russian Federation
SMR	San Marino
SRB	Serbia
SVK	Slovakia
SVN	Slovenia
SPA	Spain
SWE	Sweden
SWI	Switzerland
TJK	Tajikistan
MKD	The former Yugoslav Republic of Macedonia (ISO code)
TUR	Turkey
TKM	Turkmenistan
UKR	Ukraine
UNK	United Kingdom
UZB	Uzbekistan

ANNEX 5

ABBREVIATIONS

ANNEX 5. ABBREVIATIONS

APAT	Environmental Protection Agency (of Italy)
CO	carbon monoxide
CSDH	Commission on Social Determinants of Health
DALY	disability-adjusted life year
dB(A)	A-weighted decibels
DMDB	European detailed mortality database
EHESP	School of Public Health (of France)
ENHIS	Environment and Health Information System
EQLS	European Quality of Life Survey
EU	European Union
EU-SILC	EU Statistics on Income and Living Conditions
EU15	the 15 countries belonging to the EU before May 2004
EU27	the 27 countries belonging to the EU after January 2007
EWD	excess winter death
FEANTSA	European Federation of National Organisations working with the Homeless
GBD	global burden of disease
GerES IV	German Environmental Survey 2003/6 for Children
GIS	geographical information system
HiAP	Health in all policies
ICD-10	WHO International Statistical Classification of Diseases and Related Health Problems, tenth revision
iF	intake fraction
INERIS	National Institute for Industrial Environment and Risks (of France)
INSEE	National Institute of Statistics and Economic Studies (of France)
ISO	International Organization for Standardization
JMP	Joint Monitoring Programme (for Water Supply and Sanitation)
KiGGS	German Health Survey for Children and Adolescents
MDB	European mortality database
MKD	ISO code for the former Yugoslav Republic of Macedonia
MTL1	mortality tabulation list 1
NEHAP	National Environmental Health Action Plan
NMS12	the 12 new Member States which joined the European Union in 2004 and 2007
NUTS	Nomenclature of Units for Territorial Statistics
OECD	Organisation for Economic Co-operation and Development
OHCHR	Office of the High Commissioner for Human Rights
$PM_{2.5}$	particulate matter with an aerodynamic diameter smaller than 2.5 µm
PRTR	Pollutant Release and Transfer Register
PTSD	post-traumatic stress disorder
RIF	Rapid Inquiry Facility (software)
RTI	road traffic injury
SES	socioeconomic status
SLC	Survey of Living Conditions (of Norway)
SNIFFER	Scottish and Northern Ireland Forum for Environmental Research
SR	sex ratio
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe

Recent debate on the social determinants of health has indicated that the unequal distribution of health and well-being in national populations is a major challenge for public health governance. This is equally true for environmental health conditions and for exposure to environmental risk, which varies strongly by a range of sociodemographic determinants and thus causes inequalities in exposure to – and potentially in disease resulting from – environmental conditions.

Interventions tackling such environmental health inequalities need to be based on an assessment of their magnitude and on the identification of population groups that are most exposed or most vulnerable to environmental risks. However, data to quantify the environmental health inequality situation are not abundant, making comprehensive assessments difficult at both national and international levels.

Following up on the commitments made by Member States at the Fifth Ministerial Conference on Environment and Health in Parma, Italy (2010), the WHO Regional Office for Europe has carried out a baseline assessment of the magnitude of environmental health inequality in the European Region based on a core set of 14 inequality indicators. The main findings of the assessment report indicate that socioeconomic and demographic inequalities in risk exposure are present in all countries and need to be tackled throughout the Region. However, the report also demonstrates that each country has a specific portfolio of inequalities, documenting the need for country-specific inequality assessments and tailored interventions on the national priorities.

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