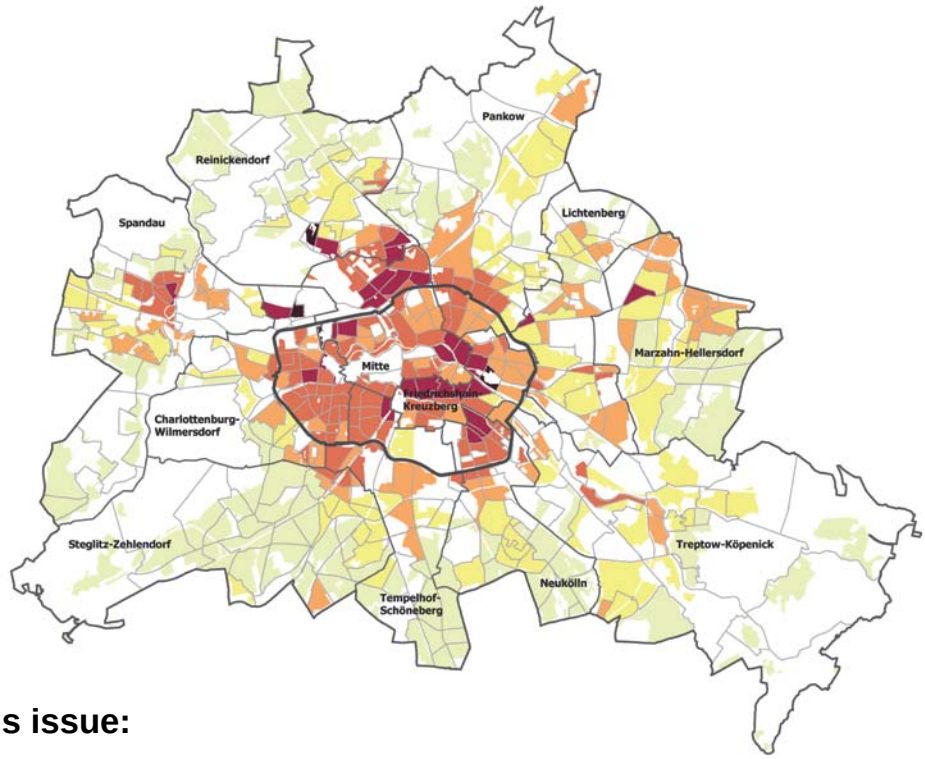
UMID
UMWELT und MENSCH – INFORMATIONSDIENST
Umwelt & Gesundheit • Umweltmedizin • Verbraucherschutz

Issue 2 • 2011 **June 2011**

SPECIAL ISSUE II
ENVIRONMENTAL JUSTICE



In this issue:

Bundesamt für Strahlenschutz
BfR Bundesinstitut für Risikobewertung
ROBERT KOCH INSTITUT
Umwelt Bundes Amt Für Mensch und Umwelt

Action Programme
Environment and Health
Germany

UMID

Issue 2 • 2011

SPECIAL ISSUE II
ENVIRONMENTAL JUSTICE

UMID: Umwelt und **M**ensch – **I**nformations**d**ienst* is a contribution to the Action Programme Environment and Health (APUG – German NEHAP) and forms part of its public relations activities.

** UMID: Environment and Human Health – Information Service*

Editorial Information

UMID: Umwelt und Mensch – Informationsdienst, No. 2/2011

ISSN 2190-1120 (Print), ISSN 2190-1147 (Internet)

Published by: Federal Office for Radiation Protection (BfS), Federal Institute for Risk Assessment (BfR), Robert Koch Institute (RKI), Federal Environment Agency (UBA)

Printed by: Federal Environment Agency

Editors of this Issue:

Christiane Bunge (Dipl. Soc.)
Kerstin Gebuhr M.A.
Federal Environment Agency
Secretariat of the Action Programme Environment and Health
Corrensplatz 1
D-14195 Berlin, Germany
Email: christiane.bunge[at]uba.de
kerstin.gebuhr[at]uba.de

Editors:

Dr. Suzan Fiack
Federal Institute for Risk Assessment
Thielallee 88-92
D-14195 Berlin, Germany
Email: pressestelle[at]bfr.bund.de

Dr. med. Ute Wolf
Robert Koch Institute
General-Pape-Straße 62-66
D-12101 Berlin, Germany
Email: u.wolf[at]rki.de

Dipl.-Ing. Dipl.-Soc. Helmut Jahraus
Federal Office for Radiation Protection
Ingolstädter Landstraße 1
D-85764 Oberschleißheim, Gemany
Email: hjahraus[at]bfs.de

Dr. phil. Dipl.-Ing. Hedi Schreiber
Federal Environment Agency
Corrensplatz 1
D-14195 Berlin, Germany
Email: hedi.schreiber[at]uba.de

English by: NP Services, npservices4u[at]gmail.com.

Please note that in order to stop spam emails, instead of using "@", all email addresses in UMID are given in the form "first name.surname[at]institution.de".

E-Mail for UMID: umid[at]uba.de
UMID website: http://www.umweltbundesamt.de/umid/index.htm
UMID in the ÖGD-Intranet: http://www.uminfo.de (area: literature)
UMID at apug.de: http://www.apug.de/risiken/umweltmedizin/umid.htm

This publication is printed on recycled paper using the "Blue Angel" eco-label.

Title photo: Dubach & Kohlbrenner designers (see p. 45 for map title and legends).

CONTENTS

INTERNATIONAL ISSUES

REPORTS FROM FEDERAL, STATE AND LOCAL AUTHORITIES

RESEARCH

PRACTICAL APPROACHES

Preface

One important goal of the Federal Environment Agency (UBA) is to minimise health risks for people which are caused by the environment or are indirectly attributable to it. The focus is on creating an environment which promotes health, thus contributing to an increase in the quality of life and well-being.

Particularly heavily trafficked urban areas are detrimental to our health because of particulate matter and noise pollution leading to respiratory and cardiovascular diseases. Moreover, affected areas also often lack open and green spaces that are accessible to all.

It has long been known that social status is a deciding factor for personal health and also impacts upon life expectancy. Above all, the level of education and income is crucial. Also decisive are social problems and beneficial aspects of the living environment.

In Germany, people with a lower income and a low educational level are more likely to be exposed to health risks resulting from environmental problems than those of a better social status. The Federal Environment Agency (UBA) is dedicated to the subject of (unequal) social distribution of environmental burdens and benefits as well as their respective health effects. “Environmental justice” is the proper term to be used in this context.

In August 2008, the first UMID special issue “Environmental justice – environment, health and social status” was published. For the first time, it provided an overview of current research projects and activities in Germany and raised a nationwide awareness of the topic. Shortly after it was published, the “Environmental justice – social distribution of health-related environmental pressures” conference of the Federal Ministry of the Environment (BMU) and the Federal Environment Agency (UBA) took place. It created a new communication platform for experts from a variety of disciplines ranging from environment, health, geography, social science and urban planning to jurisprudence to discuss environmental justice – still a new topic in Germany.

Lately, various technical and research disciplines have been looking into detection, causes, mechanisms and impacts of the (unequal) social distribution of environmental burdens and benefits. The pilot project “Environmental justice in the State of Berlin” for example, pursues a new methodological model for integrated reporting on environment, health, social issues and urban planning.

The second UMID special issue “Environmental justice” reports on the first findings of the pilot project conducted in Berlin. Beyond that, selected activities and research projects from Germany and Switzerland are presented. The large number and wide variety of articles show that an increasing importance is being attached to the issue – by decision makers, researchers and local stakeholders.

Due to the growing social polarisation in Germany, environmental justice will attain even greater importance – especially against the backdrop of climate change. In inner city areas where high levels of environmental stress and social problems are often concentrated, the negative health effects of climate change – for example from heat waves – will increase.

Environmental policy makers and their cooperating partners will increasingly focus on reducing environmental pressures in particularly affected residential areas and to support the creation of healthy and sustainable living environments. Environmental justice as an objective requires inter-departmental work, integrated approaches, joint actions from different policy fields and a broad range of stakeholders.

Jochen Flasbarth

President of the Federal Environment Agency

Towards environmental justice – fields of action for research, politics and practice

Christiane Bunge[1], Claudia Hornberg[2], Andrea Pauli[2]

Abstract: *There is evidence for an uneven socio-spatial distribution of environmental pressures and benefits in Germany. It is the responsibility of research, politics and all those who are otherwise involved in developing strategies to establish equal living conditions (German Constitution, § 72, 2). This article presents the key accounts of the paper "Strategies for environmental justice – fields of action for research, politics and practice" (Hornberg et al. 2011). The following topics are discussed which are considered pertinent: concept development, research, monitoring and reporting, impact assessment, residential interiors, living environment, mobility, health promotion through green areas, health promotion in urban development, targeted communication, and participation. The article gives recommendations for action and good practice examples.*

Introduction

Health problems as a consequence of environmental pressures are unequally distributed in Germany. Social and environmental epidemiological studies over recent years in Germany suggest that social status determines to what extent people are bothered by pollutants. Not only do factors such as education and income affect housing conditions and associated human health risks, but also other socio-economic factors such as the migration background, the social environment, lifestyles, and available resources. Most studies find that people with low social status are subject to a greater exposure to environmental stressors (Bolte, Kohlhuber 2008; Bunge, Katzschner 2009).

Given the fact that there is evidence of an unequal socio-spatial distribution of environmental pressures and benefits in Germany, researchers, politicians and practitioners are required to develop strategies for "establishing equal living conditions" (German Constitution, § 72, 2). New approaches to research and policy, but also good examples of implementation at local levels, which can enhance an efficient strategy development, can be found in various regions. Those strategies were conceived by stakeholders with very different kinds of scientific backgrounds. Often, however, those approaches are not designated with the term "environmental justice".

The conference "Environmental justice – social distribution of health-related environmental pollution" of the Federal Ministry of the Environment (BMU) and the Federal Environment Agency (UBA), organised by the "Environment and Health" Working Group of Bielefeld University, presented models in strategy development and policy recommendations. The conference also revealed that there is a great need for environmental justice research; however, the supporting conceptual discussion in Germany is still in its infancy (Hornberg, Pauli 2009). The following fields of action, relevant to a future strategic development of the environmental justice topic have been identified:

- concept development,
- research,
- monitoring and reporting,
- impact assessment,
- residential interior,
- living environment,
- mobility,
- promoting health through semi-natural green areas and open spaces,
- health promotion in urban development,

[1] Federal Environment Agency (UBA)
[2] Bielefeld University

- targeted communication,
- participation.

The specified fields of action will be explored in more detail in the following. Specific recommendations for action and good practices in Germany, in its European neighbouring countries and in the USA will be given.[3]

Fields of action

Concept development

In the current discussion on environmental justice, central questions remain unanswered: first of all the term ”environmental justice“ is being debated. Both ”environment“ and ”justice“ are terms that require a precise definition and a theoretical embedding. These are the key questions on which the discussions, objectives and last but not least, the stakeholders in policy, research and practice, depend.

Currently, respective studies and conceptual discussions refer to varying definitions of “environment” ranging from the term “environment” in the narrower, physical sense to a broad environmental concept that involves the physical, social and built environment. ”Justice“ with regard to ”environment“ has barely been addressed. In many cases the terms ”inequality“ or ”social disparities“ are used and a normative debate is being avoided. In addition, the term „environmental justice” fails to refer to human health. To account for the current state of the discussion, the triad of terms ”environment, health and social status“ is often used. A theoretical embedding and the definition of objectives require further extensive consideration. These aspects are discussed, partly implicitly and also explicitly, in the following sections.

Research

The data on environmental justice are currently unsatisfactory in Germany. The need exists first and foremost for a systematisation and regular conduct of studies into the social and spatial distribution of environmental pressures and benefits. There is also a particular need for primary data collection. Currently, mainly descriptive studies are available, which do not help identify causal relationships. In order to be able to observe and evaluate individual and regional exposures in a differentiated way, studies should increasingly be based on multi-level models. Geographical Information Systems (GIS) offer a good basis for establishing spatial references. Besides the study of exposure variation based on social factors, it is necessary to examine the effect modification in greater detail: what influences do social status and context of the living environment as well as age and gender specific aspects have on the susceptibility of different population groups to environmentally associated illnesses? A scientific answer to those questions allows an evaluation of social and spatial differences in environmental quality and the associated health risk (Bolte, Kohlhuber 2008; Bunge, Katzschner 2009).

A neglected topic is the investigation of the importance of health-promoting environmental factors in relation to social factors. Most studies focus only on health risks related to environmental pollution. The availability and access to green spaces – as health-promoting (salutogenic) factors – have rarely been studied in the past. Thus, important findings in public health research, which demonstrate that environmental resources can significantly increase health, well-being and quality of life, are ignored. At the same time, it implies that socio-economically entailed restrictions in the contribution to health-promoting environmental resources, may cause health inequalities by themselves.

To develop an interdepartmental strategy for environmental justice, a comprehensive research programme looking into environmental justice should be initiated. This would create synergies by bringing together competences and methodological expertise from various disciplines.

Monitoring and reporting

In order to identify the linkages between environment quality, health and social status, a basis for evaluation such as small-scale reporting and indicators is necessary so as to integrate all the relevant data. Reliable data are the foundation for strategic policy decisions, initiatives for social equity and sustainable urban development.

Reporting on the issues of environment, health and social problems currently takes place largely independently from each other. Difficulties arise when

[3] This paper presents the key accounts of the paper “Strategies for environmental justice – fields of action for research, politics and practice” (Hornberg et al. 2011).

trying to merge and jointly analyse different data sets and methodological approaches. Apart from that, another precondition for the consolidation of environmental, social and health data is the resolution of data protection concerns (e.g. avoid possibilities of identifying individuals and households).

Recommendations for actions

A systematic integrated reporting is a crucial step towards long-term monitoring (e.g. as a basis for the development of new and/or adjusted infrastructure in the capacity of transport/mobility) as well as in terms of reviewing objectives and proving effects of actions (e.g. noise action plans and environmental zones). For this purpose, new forms of communal cooperation between health, environmental and welfare authorities are necessary. Of special importance for local policy and administration is the use of an integrated interdepartmental reporting system. Therefore the reporting system should build on existing structures and expand them effectively. It can also benefit from GIS.

Practical approach

The pilot project "Environmental justice in the Federal State of Berlin" was launched, for the first time covering a whole State in Germany, offering an integrated review of all relevant environmental, health, and socio-spatial information. Data from the project "Social Urban Development Monitoring" have been linked to environment and health data as well as to findings about urban structural patterns. The results of the Berlin project show where social and environmental pressure hot spots lie and where the need for action is particularly high. The description of the socio-spatial distribution of environmental pressures provides an important basis for decision making in the implementation of environmental and health policy as well as urban design measures (see papers on p. 18-44).

Impact assessments

The legal basis of environmental impact assessments (EIA) and of strategic environmental audits (SEA) specifies the framework for the protection of the environment and human health in the case of construction projects and for plans and programmes. The so-called Health Impact Assessment (HIA) is explicitly aimed at health issues: its prime purpose is to estimate potential positive and negative health impacts of projects, new strategies or future policies within and outside the health sector at a very early stage. In this, different groups of the population and areas of life are considered during planning and proposals for improvements are developed (O´Reilly et al. 2006). Today, there exists an increasingly diversified "culture" of health impact assessments across several countries (e.g. Great Britain, the Netherlands, the USA, Australia) (Fehr 2010). In Germany, the systematic use of HIA is not common. For several years there have been isolated cases in which a study has tried to attach greater importance to health issues within environmental impact assessments (EIA) (see also paper on p. 107).

Recommendations for actions

Internationally the effectiveness of HIA is recognised – especially under the aspect of environmental justice (Walker et al. 2005). The introduction of an independent HIA for all project planning is a necessary step in order to take into account the health-related issues in connection with stronger social aspects. A legal safety should be achieved by that, as is the case for the environmental impact assessment. The use of a standardised procedure is also necessary for a good HIA.

Practical approach

In the USA, the Health Equity Impact Assessment model (HEIA) developed by the Environmental Protection Agency (EPA) addresses social conditions, environmental problems and location issues in municipalities (Harris-Roxas 2004). It provides the framework and tools for local planning guidance for a cross-sector assessment with particular reference to sensitive population groups. The "HIA Guidelines" of Greenspace Scotland, specifically take into account possible differences in the social and spatial distribution of environmental quality. They offer practical examples and suggestions for the strategic approach in the phase of planning and design of green areas (Greenspace Scotland 2008).

Residential interior

Pollution in the residential interior may pose a health risk. This is indicated by the results of the Children's Environmental Survey (Kinder-Umwelt-Survey) of the Federal Environment Agency (UBA), which also shows differences as a function of social status (Schulz et al. 2010). Indoor air pollution also affects schools or child day-care centres, where particularly vulnerable groups of children stay every day. The relationship between indoor air quality, social status and living environment has been insufficiently investigated and still falls short of being recognised as a proper action and intervention area.

Rising energy prices force many low-income households to reduce heating and ventilation. This can result in damage to homes of poor build quality due to dampness and mould infestation and cause health problems (e.g. infections, allergies). Energy poverty is therefore closely connected with interior space hygiene, however its causes and health effects have so far been inadequately addressed.

Recommendations for actions

People with low socio-economic status often live in deficient housing conditions (Krieger et al. 2002). A targeted raising of awareness for health risks (e.g. dampness and mould, pests, pesticide residues, tobacco smoke) is closely connected with the objective of reducing environmentally associated health inequalities. For the growing number of households in precarious living conditions, offers of outreach should be introduced. In the context of home visits, those offers do not only provide advice, but also deliver concrete practical help for everyday life. The co-operation of local stakeholders should be intensified, involving the Public Health Service (ÖGD), Youth Welfare Service, Social Services, housing and tenant's associations as well as general practitioners. Numerous measures and projects offer good approaches for problem solving in Germany, but each must be supported by wider political action on climate change while taking into account possible social effects.

Practical approach

The Federal Ministry of the Environment (BMU) and Federal Environment Agency (UBA) sponsored project "Environmental justice – from the beginning", Women in Europe for a Common Future (WECF NGO), involved free-of-charge services for expectant families and new parents for a health-supportive redesign of their homes for their newborn children. In co-operation with different institutions, the Association principally advised parents with low social status in socially disadvantageous districts of Berlin and Munich about health risks due to environmental factors (e.g. mould growth, use of environmentally-friendly household products and health). Additionally, training for health advisers (e.g. midwives) was carried out and bilingual information materials were produced. The project has already found followers in other cities (see paper on p. 121).

In recent years, some Federal States have established "mould consultation networks". The stakeholders of the network answer questions about particular building physics and provide legal advice concerning rents, name qualified renovators and offer assistance in the case of health problems. The support of low-income households is an urgent task of counselling centres. The low-threshold services, which means: no long-term appointments, generous opening hours and visits to the homes of those concerned, are important success factors (Lehmann et al. 2007; see paper on p. 68).

The campaign "Electricity Savings Check" for low-income households aims at reducing the energy consumption in these low-income households. It has been running since the end of 2008 within the context of the climate protection initiative of the BMU and in co-operation with the German Caritas Association and the Federal Association of the Energy and Climate Protection Agencies of Germany NGO. The pilot project, "Cariteam Energy Saving Service" of the Frankfurt/Main Caritas Association NGO, has trained the long-term unemployed to become "service advisers for energy and water saving technology". Their task is to advise low-income households on energy and water savings and render practical help in everyday life. One of the success factors is the interdepartmental co-operation of stakeholders in the social services, energy and environment sector.

Living environment

Noise

The relationship between noise pollution and health effects has already been studied since the early 19th century in the wake of urban hygiene improvements (Saul 1996). Urban development has focused on creating healthy living conditions through improvements in noise protection. However, only in the last two decades has it been generally accepted that construction activities require additional noise insulation in order to stop the spatial concentration of such emissions exacerbating social problems. In particular, socially disadvantaged people are exposed to high levels of noise pollution in their homes (Wicke 2008). Noise, in the context of social urban development, is therefore frequently cited as an indicator of socio-spatial shortcomings, and of undesirable trends in neighbourhoods.

In the European Union (EU), the European Parliament and Council Directive on Assessment and Management of Environmental Noise (Environmental Noise Directive) has been in effect since 2002. It has the objective of minimising harmful effects from environmental noise. The Member States are asked

to determine the noise levels, develop action plans based on noise maps and inform the public about environmental noise and its effects.

Recommendations for actions

Extensive public participation is central to the preparation of action plans. Project planners should consider sophisticated forms of participation in order to reach target population groups. The input of citizens, neighbourhood management, environmental groups, district initiatives, and health and social services can help to broaden viewpoints and raise awareness for the importance of social effects of traffic noise among the responsible stakeholders/polluters.

The European Academy for the Urban Environment prepared a manual for noise action planning within the "Silent City" project funded by the BMU and UBA. It provides help to municipalities in the implementation of the Environmental Noise Directive (Bonacker et al. 2008). Different population groups and their respective wants have not been considered in the manual, so it should be extended to cover social issues. In principle it is necessary to take a wide view and pursue noise reduction within integrated strategies, interdepartmental actions, and plan jointly with e.g. the air quality control or mobility management department.

Practical approach

The Berlin noise action plan is a good example of a noise action plan based on an interdepartmental cooperation that oversees many fields of activity and takes into account socio-spatial differences in noise levels. It illustrates the problem of social segregation due to high noise pollution. Even at the stage of planning, numerous stakeholders were involved such as the Senate Administration for Health, Environment and Consumer Protection and that for Urban Development, the districts, Local Public Transportation (BVG), interest associations (General German Automobile Association ADAC and General German Bicycle Association ADFC), the real estate industry, health insurance companies and environmental groups. The plan concentrates on areas in which neighbourhood management has been implemented, on neighbourhoods where social separation has occurred, on the promotion of ecomobility, transport control measures and on the reassessment of shared street space for example by the creation of play areas (SenGUV 2008).

The integration of the noise reduction plan into a district development model has been tested in the city of Bottrop. In addition to urban planning, the integrated action plan has also included transport, social, economic and ecological aspects. An interdepartmental co-operation between the urban renewal department, transport, urban land use and environmental planning has elaborated proposals for technological and urban transportation planning measures: for example the optimisation of vehicle technology, changes in the choice of transport ("modal split"), citywide reduction in goods traffic and small-scale approaches to traffic relocation (MUNLV NRW 2007).

Mobility

Social structure and economic developments in residential areas are closely connected with the access to means of transport. Residential areas with a concentration of social problems often have poor access to local public transport. In addition, they are often more troubled by noise and air pollution due to above-average traffic levels. At the same time, these areas have to cope with a concentration of difficult social situations (Braun-Fahrländer 2004; Mielck 2004; Kolahgar, Hoffmann 2006). The resident population is therefore disadvantaged in two respects: although the level of car ownership is low and access to mobility for low-income households often limited, they are exposed to high air and noise pollution and an increased accident hazard while the quality of their living environment is poor (Lehmbrock et al. 2007).

Social aspects of mobility have so far played a minor role in the development of transport policy programmes in Germany. Individual target groups (e.g. rural population, handicapped people) are not usually adequately considered.

Recommendations for actions

In the future, measures of emission and pollution control should take into account health and social interests more explicitly in the early planning phase. Integrated concepts and strategies which combine environmental health protection and (social-position based) prevention in the sense of exposure minimisation or avoidance are required for this. Regulatory measures should always be accompanied by other measures such as the expansion and adaptation of the public transport supply structure and the improvement of infrastructure for cycling and walking in terms of attractiveness, safety, usability and compatibility with other mobility services. More important approaches are differentiated, targeted mobility

management concepts (e.g. call-off order buses/ taxis), ensuring the provision of services and social infrastructure within walking distance as well as the redevelopment of vacant land to enhance the amenity value of public space.

Practical approach

A study on the "Leipzig Charter on the Sustainable European Cities" provides good practical examples in the section on "Sustainable urban transport and deprived urban areas of Europe" (Lehmbrock et al. 2007). The inclusion of social concerns in the examples of "Public transportation for special user groups" is especially exemplary (ibid.). Another good example is the Berlin city transportation plan which is geared to the goals of the joint Federal Government and its Federal States "Social City" programme. A key feature of the plan is the provision of access to local public transport for all population groups. Handicapped people, low-mobility senior citizens and those living in districts in need of refurbishment are considered special users groups (SenStadt 2010).

Promoting health through natural-like open and green spaces

Natural and semi-natural green spaces not only have micro-climatical (Kuttler 1997, Bruse 2003), cultural, economic and social importance (Fitzpatrick, LaGory 2000; Groenewegen et al. 2006), but also health-promoting capacities (Jackson 2003; Maas et al. 2006; 2006; Nielsen, Hansen 2007; Brei et al. 2010; Pauli, Hornberg 2010). They serve as exercise and recreation areas which can enhance mental and physical health of all age groups (Frumkin 2003) as they motivate a wide range of age groups to exercise (Maas et al. 2008). Green and open spaces have a high potential to counteract socio-spatial polarisation and social decline of urban areas and simultaneously increase health and quality of life of the resident population (Weeber et al. 2011).

Deficiencies in quantity and quality of semi-natural green spaces rank among the largest deficits in deprived districts (Franke et al. 2007). Size, condition and amenities of green areas are strongly associated with the subjective perception of safety in the living environment and the individual patterns of using such a space (Spitthöver 2000).

Recommendations for actions

Interdepartmental specialist planning is necessary to integrate open space and environmental planning as well as mobility management. An emphasis should be placed on the development of usable public community areas and on drafting uniform federal minimum standards for accessible green spaces for recreation and exercise close to residential areas. Tangible actions within integrated urban development are the design of connected open and green space structures (e.g. green belts, green havens) and the redevelopment of brownfield sites under the umbrella of new open space concepts (e.g. intercultural gardens).

Practical approaches

The project „From prefabricated housing to a green university district" of the city of Jena (Lobeda-West district) in Thuringia was dealing with a large housing estate with serious deficiencies in infrastructure, urban planning and transport. In addition to numerous interventions, much emphasis was attributed to the creation of green zones and lawns as play grounds. Community gardens and outdoor adventure gardens improved the supply of green space for the resident population. Excavated earth was then used to cap the motorway in a cost-efficient way and to build a "green bridge", which provides noise protection and connects the green areas of the district with the surrounding countryside (Kynast 2009).

As an initiative for sustainable urban development but also as integration projects, gardens have been spreading in many German cities. Terms such as "international gardens", "intercultural gardens", "residents' gardens", "community gardens" and "school gardens" usually stand for district or neighbourhood initiatives with different forms of participation and target groups (e.g. unemployed people, senior citizens or migrants). In most German cities the necessary political sanctioning needed for establishing community gardens has so far been missing. Berlin may serve as a model since a Senate resolution calls for two community gardens in each urban district. These are specifically designated for nature conservation and environmental protection and their benefits for the city, their value as spaces for social integration and as key elements of sustainable urban development should be emphasised.

Promoting health in urban development

Successful urban development is based on integrated concepts; it connects many fields of action with one another and affects multiple spheres of life. Thus successful urban development policy can combine the areas of environment, health and social issues via a skilful transport policy such as the reduction of private transport, the development of infrastructure for

walking and cycling as well as the reassignment of parking space in play areas and places for encounter.

The current planning practice is dominated by a rather pathogenic understanding – such as the combat of hazards and stress reduction – (Riedel 2008). It is often believed that mere reference to the Statutory Limits bill satisfies the precautionary principle, while health-promoting approaches are scarcely considered in conventional urban development planning. In contrast, integrated urban development and renewal programmes seem to have yielded development progress. The joint Federal Government and the States "Social City" programme for example brings health issues into urban developments and embodies neighbourhood health promotion as a cross-sectional task in the districts with special development needs. The increased focus of urban development planning on health promotion is an essential building block for a sustainable improvement in the environmental and living conditions in socially deprived areas. Urban development planning must have a stronger socio-spatial orientation, so that socio-structural aspects can be integrated into all planning as significant components.

Targeted communication

Knowledge and information about environmental health risks and health benefits must be communicated to specific target groups. The method of communicating those issues to different population groups should differ according to their social situation. Since environmental and health communication is chiefly oriented towards the middle class, it usually fails to establish a proper contact with the language, everyday life and information literacy of (some parts of) groups who are actually affected by environmental injustice.

Recommendations for actions

The most important factor in the communication of environmental health risks and benefits is the consideration of everyday life situations. A prerequisite to an effective approach is to focus on the needs of the target group, their subjective problem perception and to make use of their preferred communication channels and means. It is crucial to identify courses of action and enhance creative ability.

Practical approach

Successful examples can be found especially in situations where different fields of action intersect and environmental impacts together with social problems are handled through participation processes. Noteworthy, for example, are activities which were initiated under the Environment and Health Action Programme (APUG) Munich in the "Social City" areas (e.g. Berg am Laim). The projects in schools and central district facilities (e.g. after-school care centres, youth clubs), which addressed both parents and adolescents, drew primarily from the fact that they shared common experiences such as how to convey health-related content through the exploration of the district (Mertens 2010).

Participation

The greater the involvement of the target group(s) in all phases of a decision making and change process, the more effective the interventions are. The need for and benefits of a systematic involvement of target group(s) particularly at the local level in urban development programmes and neighbourhood projects have proved to be a prerequisite for success. The basis for an involvement is that participation is targeted. Involvement, as a strategic tool in planning, implementation, evaluation and assessment of interventions, usually goes beyond a formal legal claim, often with a symbolic nature (e.g. public participation in noise action plans). Involvement has been shown to facilitate socially acceptable solutions, create acceptance and trust through increased transparency and the personal responsibility to motivate action (Stephens 2007).

Recommendations for actions

Popular methods of involvement are often socially selective (Niedermeyer 2001) since willingness and ability to participate are determined primarily by the level of education. With regard to the target group of the socio-economically disadvantaged, it is important to note that the management of everyday problems often leaves little room for engagement. Therefore, the political and planning level must carefully consider the different opportunities and limitations of cooperation from different population groups.

Practical approach

Examples of successful public participation can be found in Germany in Local Agenda 21 activities, in the "Healthy Cities Network" and in projects of the joint Federal Government and the States "Social City" programme. One can also mention those local pilot projects on environment and health which were carried out within the framework of the Environment and Health Action Programme (APUG) sponsored by three Federal Ministries: Environment (BMU), Health (BMG) and Consumer Protection (BMELV).

The projects, which specifically addressed children from socially disadvantaged districts, have shown that the children have very clear ideas about shaping their living environment and bring a high level of motivation for involvement in implementing such changes.

Outlook

Environmental justice will gain an ever greater importance due to the increasing social polarisation in Germany. In order to be able to successfully handle the social inequality of environmental impacts and resources in Germany, a strategic union of public health, urban development and environmental policy, health and social politics, house building and transport planning is necessary – rather than isolated and department-specific individual solutions. This poses a great challenge and initially requires a better awareness of environmental justice.

Besides the reduction in existing sources of exposure, greater attention should be paid to the socio-economic causes of structural disadvantage and to discriminatory situations. Socially disadvantaged and discriminatory situations develop from social circumstances, which, together with psychosocial and behavioural factors, determine individual capabilities and limitations. Neither an isolated view of sources of exposure, nor the exclusive consideration of individual circumstances is appropriate for clarifying the interactions between the different levels. What is needed is a systemic perspective.

The next step is to formulate an integrated strategy on environmental justice, which may be in the form of a political program or a „guideline“ for research, policy and practice. Last but not least, efforts to introduce environmental justice into the political and public debate must be supported by an articulate commitment from civil society groups.

Literature

Bolte G, Kohlhuber M (2008): Untersuchungen zur Ökologischen Gerechtigkeit: Explorative Vorbereitungsstudie: Teilprojekt A: Systematische Zusammenstellung der Datenlage in Deutschland. Dessau-Roßlau: Umweltbundesamt.

Bonacker M, Heinrichs E, Schwedler HU (2008): Handbuch „Silent City“. Umweltbundesamt, Europäische Akademie für städtische Umwelt (eds.).

Braun-Fahrländer C (2004): Die soziale Verteilung von Umweltbelastungen bei Kindern in der Schweiz. In: Bolte G, Mielck A (eds.): Umweltgerechtigkeit. Die soziale Verteilung von Umweltbelastungen. Weinheim: Juventa Verlag: 155-173.

Brei B, Heiler A, Claßen T, Hornberg C (2010): Gesundheitsressource Stadtgrün – Gesundheitswissenschaftliche Implikationen für Stadtplanung und Landschaftsarchitektur. In: Stadt und Grün – Das Gartenamt, 59 (12): 17-22.

Bruse M (2003). Stadtgrün und Stadtklima – Wie sich Grünflächen auf das Stadtklima auswirken. In: LÖBF-Mitteilungen, 1: 66-70.

Bunge C, Katzschner A (2009): Umwelt, Gesundheit und soziale Lage: Studien zur sozialen Ungleichheit gesundheitsrelevanter Umweltbelastungen in Deutschland. Dessau-Roßlau: Umweltbundesamt.

Fehr R (2001): Ökologische Gesundheitsförderung: Analysen – Strategien – Umsetzungswege. Bern: Verlag Hans Huber.

Fitzpatrick K, LaGory M (2000): Unhealthy Places: The Ecology of Risk in the Urban Landscape, New York/London.

Greenspace Scotland (Ed.) (2008): Health Impact Assessment of greenspace. A Guide. Greenspace Scotland: Stirling.

Groenewegen PP, Berg AVD, de Vries S, Verheij RA (2006): Vitamin G: effects of green space on health, well-being, and social safety. In: BioMed Central Public Health, 6 (149): 1-9.

Harris-Roxas B, Simpson S, Harris L (2004): Equity-Focused Health Impact Assessment: A Literature Review. Sydney: Centre for Health Equity Training Research and Evaluation. http://chetre.med.unsw.edu.au/files/Harris-Roxas_B_(2004)_Equity_Focused_HIA.pdf (Accessed: 12. 03.2009).

Hornberg C, Bunge C, Pauli A (2011): Strategien für mehr Umweltgerechtigkeit – Handlungsfelder für Forschung, Politik und Praxis. Universität Bielefeld: Bielefeld.

Hornberg C, Pauli A (eds.) (2009): Umweltgerechtigkeit – die soziale Verteilung von gesundheitsrelevanten Umweltbelastungen. Dokumentation der BMU/UBA-Fachtagung vom 27. bis 28. Oktober 2008 in Berlin. Universität Bielefeld.

Jackson R (2003): The impact of the built environment on health: An emerging field. In: American Journal of Public Health, 93: 1382-1384.

Kolahgar B, Hoffmann, B (2006): Die soziale Verteilung von Umweltbelastungen und gesundheitlichen Folgen an industriellen Belastungsschwerpunkten in Nordrhein-Westfalen. Abschlussbericht.

Krieger J, Takaro TK, Allen C, Song L, Weaver M, Chai S, Dickey P (2002): The Seattle-King County Healthy Homes Project: implementation of a comprehensive approach to improving indoor environmental quality for low-income children with asthma. In: Environ. Health Perspect, 110 (Suppl. 2): 311-322.

Kuttler W (1997): Bewertungsmaßstäbe für Stadtklima und Lufthygiene. In: Geographische Rundschau, 10: 576-582.

Kynast B (2009): Jena-Lobeda: Von der Plattenbausiedlung zum grünen Universitätsstadtteil. In: Deutsche Umwelthilfe (ed.) (2009): Handlungsmöglichkeiten für mehr soziale Gerechtigkeit durch kommunalen Umweltschutz, Radolfzell. www.duh.de/umweltgerechtigkeit.html (Accessed: 21.04.2011).

Lehmann F, Geene R, Kaba-Schönstein L, Brandes S, Köster M, Kilian H, Steinkühler J, Bartsch G, Linden S (2007): Kriterien guter Praxis in der Gesundheitsförderung bei sozial Benachteiligten. In: Bundeszentrale für gesundheitliche Aufklärung (BZgA) (ed.). Gesundheitsförderung konkret Band 5. 3. erweiterte und überarbeitete Auflage. Köln: BZgA.

Lehmbrock M, Spott M, Beckmann KJ (2007): Sustainable Urban Transport and Deprived Urban Areas, Good Practice Examples in Europe. German Institut of Urban Affairs, Berlin.

Maas J, Verheij RA, Groenewegen PP, de Vries S, Spreeuwenberg P (2006): Green space, urbanity, and health: how strong is the relation? In: Journal of Epidemiology and Community Health, 60 (7): 587-592.

Mertens I (2010): Gesundheitsfördernde Stadtentwicklung: Akteure, Programme, Vernetzung – Praxisanalyse in einem Sanierungsgebiet in München. Blaue Reihe. Dortmunder Beiträge zur Raumplanung, 134. Dortmund.

Mielck A (2004): Unterschiede bei Lärmbelastung und Luftverschmutzung nach dem Haushaltseinkommen. In: Bolte G, Mielck A (eds.): Umweltgerechtigkeit – Die soziale Verteilung von Umweltbelastungen. Weinheim und München: Juventa: 139-153.

Niedermayer O (2001): Bürger und Politik: politische Orientierungen und Verhaltensweisen der Deutschen. Eine Einführung. Wiesbaden: Westdeutscher Verlag.

Nielsen TS, Hansen KB (2007): Do green areas affect health? Results from a Danish survey on the use of green areas and health indicators. In: Health and Place, 13: 839-850.

O'Reilly J, Truemann P, Redmond S, Yi Y, Wright D (2006): Cost Benefit Analysis of Health Impact Assessment. University of York.

Pauli A, Hornberg C (2010): Sozialräumliche und gesundheitsbezogene Implikationen des Klimawandels im Kontext von Klimaschutz und Klimaanpassung. In: Verhaltenstherapie & Psychosoziale Praxis, 42 (2): 313-329.

Riedel N (2008): Krankheitsprävention oder Gesundheitsförderung durch Stadtteilerneuerung – beispielhaft dargestellt am Arbeitsfeld „Umweltbeeinflusste Gesundheitsbelastungen". Unveröff. Diplomarbeit an der Technischen Universität Dortmund Fakultät Raumplanung.

Saul K (1996): Wider die „Lärmpest". Lärmkritik und Lärmbekämpfung im Deutschen Kaiserreich. In: Machule D, Mischer O, Sywottek A (eds.): Macht Stadt krank? Vom Umgang mit Gesundheit und Krankheit. Hamburg: Dölling und Galitz Verlag: 151-192.

SenGUV (Senatsverwaltung für Gesundheit, Umwelt und Verbraucherschutz) (2008): Lärmminderungsplanung für Berlin – Aktionsplan. Abt. III Umweltpolitik, Referat Immissionsschutz. Berlin. http://www.berlin.de/sen/umwelt/laerm/laermminderungsplanung/de/laermaktionsplan/index.shtml (Accessed: 21.02.2009).

SenStadt (Senatsverwaltung für Stadtentwicklung) (2010): Was ist ein Nahverkehrsplan? http://www.stadtentwicklung.berlin.de/verkehr/politik_planung/oepnv/nahverkehrsplan/download/nvp_handout.pdf, S. 4) (Accessed: 01.12.2010).

Schulz C, Ullrich D, Pick-Fuß H, Becker K, Conrad A, Seiwert M, Kolossa-Gehring M (2010): Kinder-Umwelt-Survey 2003/06 (KUS) Innenraumluft. Flüchtige organische Verbindungen (VOC und Aldehyde) in der Innenraumluft in Haushalten mit Kindern in Deutschland. Schriftenreihe Umwelt und Gesundheit, 3/2010. Dessau-Roßlau/Berlin: Umweltbundesamt.

Spitthöver M (2000): Geschlecht und Freiraumverhalten – Geschlecht und Freiraumverfügbarkeit. In: Harth A, Scheller SG, Tessin W (eds.): Stadt und soziale Ungleichheit. Opladen: Leske+Budrich: 217-231.

Stephens C (2007) Environmental justice: a critical issue for all environmental scientists everywhere. In: Environ. Res. Lett, 2(4): doi:10.1088/1748-9326/2/4/045001.

Walker GP, Fay H, Mitchell G (2005): Environmental justice impact assessment: an evaluation of requirements and tools for distributional analysis. A report for Friends of the Earth England and Wales (FoE), London.

Weeber R, Nothdorf P, Fischer R, Beiträge der Partnerstädte (2011): CoNet's Guide to Social Cohesion. Integrated Approaches in Disadvantaged Neighbourhoods. In: CoNet (eds.). Berlin Senatsverwaltung für Stadtentwicklung.

Wicke L (2008): Grundlagenuntersuchung über erfolgreiche Lärmschutzkonzeptionen: Ein kommunales Verkehrslärm-Sanierungskonzept für eine gesundheitsunbedenkliche Lärmbelastung und zur Verbesserung der kommunalen Lebensqualität. http://www.lubw.de/servlet/is/4287/studie_wicke.pdf?command=download Content&filename=studie_wicke.pdf (Accessed: 14.04.2009).

Contact

Christiane Bunge
Federal Environment Agency
Corrensplatz 1
D-14195 Berlin
Email: christiane.bunge[at]uba.de

Environmental justice in the Federal State of Berlin – development and implementation of a new a cross-cutting strategy

Heinz-Josef Klimeczek

Abstract: *There are hardly any studies in Germany which have examined the link between socio-economic status and health risks in the residential environment. The pilot project "Environmental justice in the Federal State of Berlin" is the first study in Germany to have determined the link between social structure and environmental quality on a small spatial scale. This provided the substantive basis for the development of a new cross-cutting topic area at the interface between health, urban development and design, and environment. The project focused on the health-relevant aspects air pollution, noise, bio-climate, provision of green spaces, and urban development. The environmental data from these fields were related to "living environment areas" („Lebensweltlich orientierte Räume", 447 planning areas). The latter represent the current spatial basis for planning, forecasting and monitoring demographic and socio-spatial developments in Berlin. As the last step, the spatially related findings were combined on a single (spatial) level of analysis. These initial investigations created the basis for an environmentally related urban monitoring system which complements the established monitoring procedures by generating health-relevant information.*

The pilot project "Environmental justice in the Federal State of Berlin" proceeds from the assumption that the conditions of housing and the residential environment that are detrimental to health, are most prevalent in areas with high levels of social problems. These areas are often additionally affected by environmental pollution. In order to examine this, several subprojects investigated the relationship between the social structures and environmental quality in Berlin on a small spatial scale. For the first time in Germany, neighbourhood-related environmental data for a whole city were combined with social data. The Berlin Senate Department for Health, the Environment and Consumer Protection (SenGUV) initiated the project in 2008 and has since then coordinated its implementation and managed it in terms of content. The Berlin Senate Department for Urban Development (SenStadt) as well as the Federal Environment Agency (UBA) provided technical support for the project. The four major topics were noise, air quality, bioclimate and green space provision. These topics are particularly relevant within the high population density in the city centre of Berlin. From an environmental health perspective, noise and air pollutants are of pivotal importance to human health. In the context of climate change, the topics of bioclimate and green area provision have become increasingly important.

The staff of the University of Leipzig and the Centre for Environmental Research (UFZ) Leipzig have investigated the relationship between air quality and social structure (see paper on p. 28). A working group of the Berlin Technical University worked on the topics of bioclimate (see paper on p. 32) and green area provision (see paper on p. 35). A project group from the Berlin Humboldt University handled the topic of noise (see paper on p. 25) and integrated the data of all four topics (see paper on p. 41).

Combining the spatially referenced environmental and social data was carried out on the level of "living environment areas" (Lebensweltlich orientierte Räume (LEA)). This new spatial hierarchy was specified in 2006 by senatorial decree, as the new basis for interdepartmental planning and administration. The LEA form the current spatial basis for planning, prognosis and observation of demographic and socio-spatial developments in Berlin. The LEA are subdivided into three hierarchical levels: 60 prognosis areas, 138 district regions and 447 planning areas. The current study is the first to present data on the lowest level of the LEA, the 447 planning areas. In each case, the reference areas cover about 7,500 inhabitants and refer to a clearly defined area of life.

Central to the investigation of each of the topics were the following questions:

- Which sub-parts and/or living environment planning areas of the capital are affected by both high levels of social problems and health-related environmental pollution?
- How could the different information be combined meaningfully in a manner supporting practical approaches, and suitable for weighting in terms of health?
- Are the social and/or planning areas which are manifoldly burdened, also those parts of the city which will be additionally affected by climate change in future?
- How could small–spatial-scale information on health-related environmental burdens be integrated into Berlin's planning system and the work of ministerial as well as district urban planning administrations?

According to the Ottawa Charter (1986), every health promotion strategy should be geared towards protecting the natural and social environment, as well as conserving the existing natural resources. Beyond that, the Strategic Environmental Assessment and the Environmental Audit of Urban Planning are to take into consideration the protection of people (including human health) and their well-being. The integrated approach pursued by the "Environmental justice in the Federal State of Berlin" pilot project – which will also be further developed in future projects – is the key element of the above mentioned; health-related mechanisms and relevant political action areas in Berlin become apparent. This is of particular concern to policy areas which have an impact on environmental health protection – above all the health, social, urban planning, construction and environmental domains. These initial, pioneering investigations provide a basis for an environmental socio-spatial city monitoring system, which complements already existing monitoring systems with health-related information.

The results compiled between 2008 and 2010, in particular the integration of neighbourhood related information, are an important additional basis for decision making at the Berlin Government, district and local level regarding health-promoting urban planning and neighbourhood policies. The results at hand represent important contributions in the fields of noise, air quality, bioclimate, green space provision, and urban development – serving to develop integrative, departmental-cross-cutting approaches and solutions, practicable strategies and environmental policy goals.

Contact

Dr.-Ing. Heinz-Josef Klimeczek
Senate Department for Health, the Environment and Consumer Protection
Author and Director of the pilot project
"Environmental justice in the Federal State of Berlin"
Brückenstraße 6
D-10179 Berlin
Email: heinz-josef.klimeczek[at]senguv.berlin.de

Data sources of the Berlin pilot project: the Berlin Environmental Atlas and Social Urban Development Monitoring

Jörn Welsch[1], Hartmut Bömermann[2], Heidrun Nagel[1]

Introduction

All work within the individual topics of the Berlin pilot project on environmental justice requires comprehensive geo-data which is as up-to-date as possible, complete and as spatially resolved as possible and/or permitted by data protection requirements. For Berlin, the senate administration has compiled and maintains two data sources which meet these requirements: the digital Berlin Environmental Atlas and Social Urban Development Monitoring – they contain the majority of the underlying data of the Berlin pilot project (socio-structural data, bio climate, noise). In the following paragraphs, both information systems are described briefly and their contribution to the pilot project is outlined.

Environmental Atlas Berlin

The Environmental Atlas contains thematic maps for the classic environmental topics of soil, water, air, noise and climate. In the chapters on land use and traffic it also takes on topics relevant to urban planning, and meanwhile has been extended by a chapter on energy. All data have been available online for several years. Text, graphics and maps are available free of charge.

Figure 1 shows a portion of the urban climate planning reference map of the Environmental Atlas, which was used as data source for assessing the bioclimatic situation within the planning areas (see paper on p. 32). The assessment, which is based on a numerical climate model (VDI 2008) allows for a spatial subdivision of residential areas into polluted and bioclimatically unfavourable areas on the one hand, and bioclimatically favourable areas on the other. The block-based data were therefore directly usable for work in the pilot project.

In addition to the block reference, and depending on the data collection requirements, other spatial references are used. This means that the data are represented as accurately as they are measured, i.e. adapted to the available data, the topic or the purpose of the map. For the strategic noise maps for example, this signifies that several values per building are available and can be researched in the maps.

The availability of data in these databases also allows for their application in scientific models. Models for the assessment of urban climate, soil functions and water balance process a number of parameters from these databases.

For the individual fields, the Berlin Pilot Project used base data, which is described in more detail in the individual papers of this issue. In the bio climate (see paper on p. 32) and noise (see paper on p. 25) topics, data from the Environmental Atlas were directly applied:

- Bio climate: Planning reference map – climate (map 04.11.2),
- Noise: Night-time total noise pollution map (map 07.05.15, 22:00 - 06:00).

For work in the fields of air (see paper on p. 28) and open spaces (see paper on p. 35) the following input data were used, made available by the

[1] Senate Department for Urban Development
[2] Berlin-Brandenburg Office for Statistics

respective technical departments of the Berlin State administration:

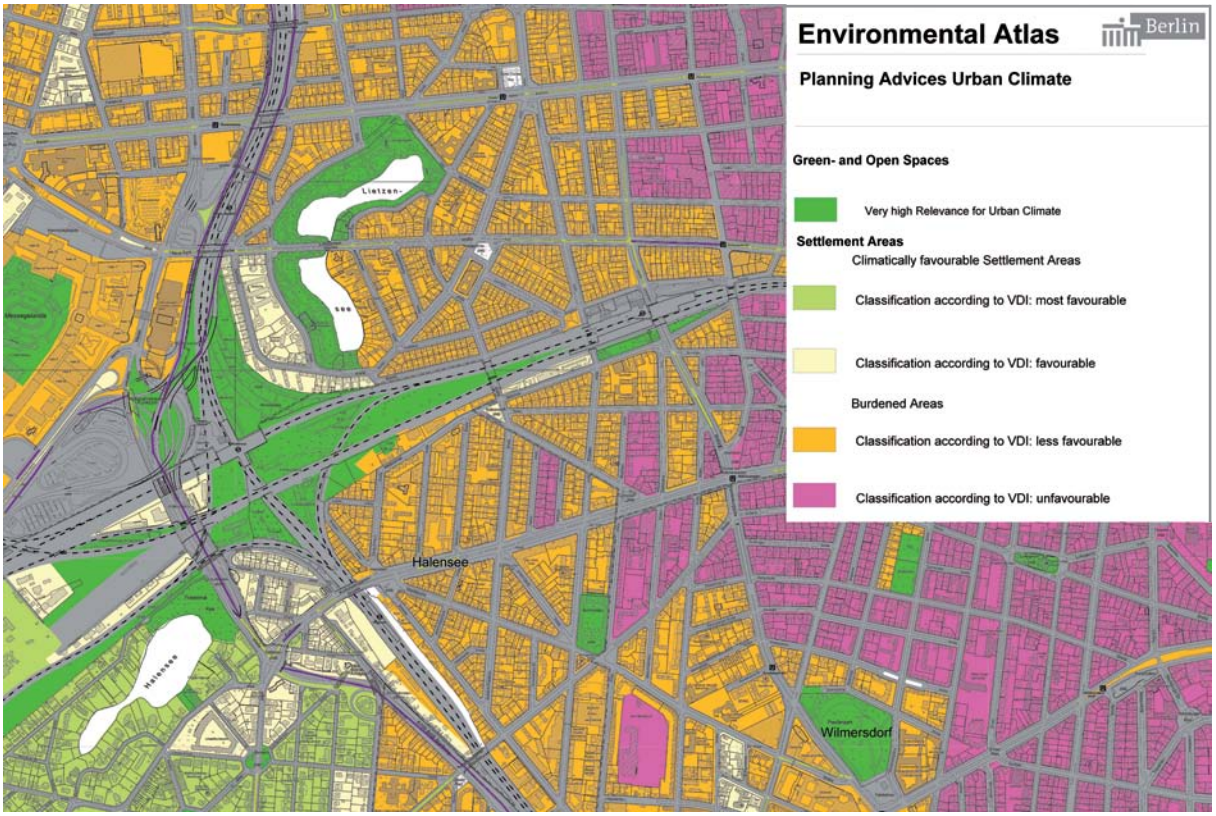
- Air: ambient air quality values
  - PM_{10}, $PM_{2.5}$ levels,
  - NO_X levels per 1 km² grid cell,
  - PM_{10} background levels;
- Air: selected reference data of particular monitoring stations,
- Open spaces: Analysis open space provision (2008/2009).

Social Urban Development Monitoring

For the analysis of socio-spatial distribution of health-related environmental pollution, the Berlin Pilot Project uses data from the Environmental Atlas as well as data from Social Urban Development Monitoring. As a continuous city tracking system of socio-spatial development on the specific area level "Living Environment Areas" (LEA) ("Lebensweltlich orientierte Räume", LOR) Social Urban Development Monitoring has been provided since 1998 on behalf of the Senate Department for Urban Development. It serves as an early warning system for determining spatial-oriented needs for action of social urban development. Social Urban Development Monitoring provides small-scale information about changes in the socio-structural and socio-spatial development in subdivisions of the city of Berlin. Based on the monitoring results, concrete area level recommendations for applying urban development policy instruments for prevention and intervention are formulated. The results are also used in the budgeting process of selected products of social infrastructure as a balancing instrument (SenStadt 2009).

In the course of its evolution, Social Urban Development Monitoring has been developed further in accordance with changing conditions (e.g. changes in social legislation). A significant modification is the conversion of the spatial level to 447 planning areas as the smallest scale unit of the new spatial hierarchy of LEA. Under a 2006 Senate decree, the LEA were specified as the new spatial basis for planning, forecasting and monitoring of demographic and social developments in Berlin. They were jointly and uniformly co-ordinated by the Senate and District

Figure 1: Excerpt from the urban climate planning reference map (04.11.2) of the Environmental Atlas, Edition 2009.



Administration as well as the Berlin-Brandenburg Office for Statistics on the basis of the social areas already defined by the youth welfare service.

The goal was to represent living area homogeneity while maintaining comparability of the planning area units. The criteria used for defining the LEA were therefore uniform urban structure types and/or local environment, large roads and traffic arteries as well as natural barriers, but also limiting the number of inhabitants, or the provision not to cut statistical blocks. The spatial hierarchy previously available for small area statistics was very much dominated by traffic planning (e.g. traffic grids), which above all regarded traffic arteries as the centre, and not as the boundaries of areas – and was therefore rather unsuitable for socio-spatial planning.

The new LEA spatial hierarchy is part of the Regional Reference System (Regionales Bezugssystem, RBS) which is relevant for all data acquisition and planning. This provides Berlin with an improved analysis, forecasting and planning basis for urban planning, playground planning, youth welfare service planning, health and social planning. This is an important prerequisite for interdepartmental socio-spatial orientation which will be used for more targeted and socially fair allocation of public resources at the planning area level – serving to better adapt resource allocation to the actual living conditions of the residents. The LEA in Berlin are hierarchically divided into the levels specified in **Table 1**.

For Berlin, Social Urban Development Monitoring is a proven and nationally well-recognised tool for urban monitoring and urban development policy. All Social Urban Development Monitoring information is also available online.

The so-called Development Index of Social Urban Development Monitoring was selected for the analyses in the context of the Berlin Pilot Project. It is based on the "dynamics" and "status" indices. First the 12 indicators of Social Urban Development Monitoring are combined into two groups:

- six indicators describe the social situation of the residents in a neighbourhood ("status"),
- six indicators describe the changes of total population level and the social situation in a neighbourhood ("dynamics").

Table 1: Hierarchical structure of "Living Environment Areas" (LEA) in Berlin.

Area unit	Number of units	Average size (arithmetic average)	
		Area in km²	Population
Prognosis Area	60	14.8	56,161
District Region	138	6.4	24,418
Planning Area	447	2.0	7,538

First, using a gradated index calculation method, the status and dynamic indicators were each combined into a "status" and "dynamics" index. Subsequently, the development index of Social Urban Development for each planning area was determined by the summation of status and dynamic index in a ratio of 3:2. A larger value in the development index then corresponds to a larger problem density. In a next step, the 447 planning areas were divided into four groups according to the values calculated for the development index (**Figure 2**). For this purpose, the values were first ranked and then divided into deciles. The two deciles with the lowest values form Group 1, with the smallest problem density. This group is therefore labelled "high development index". The two deciles with the highest values and therefore the highest problem density respectively form the groups "very low development index" (Group 4, tenth decile) and "low development index" (Group 3, ninth decile). The six deciles between the top two and bottom deciles together form Group 2 "medium development index". The development index for the planning areas is updated annually.

Websites

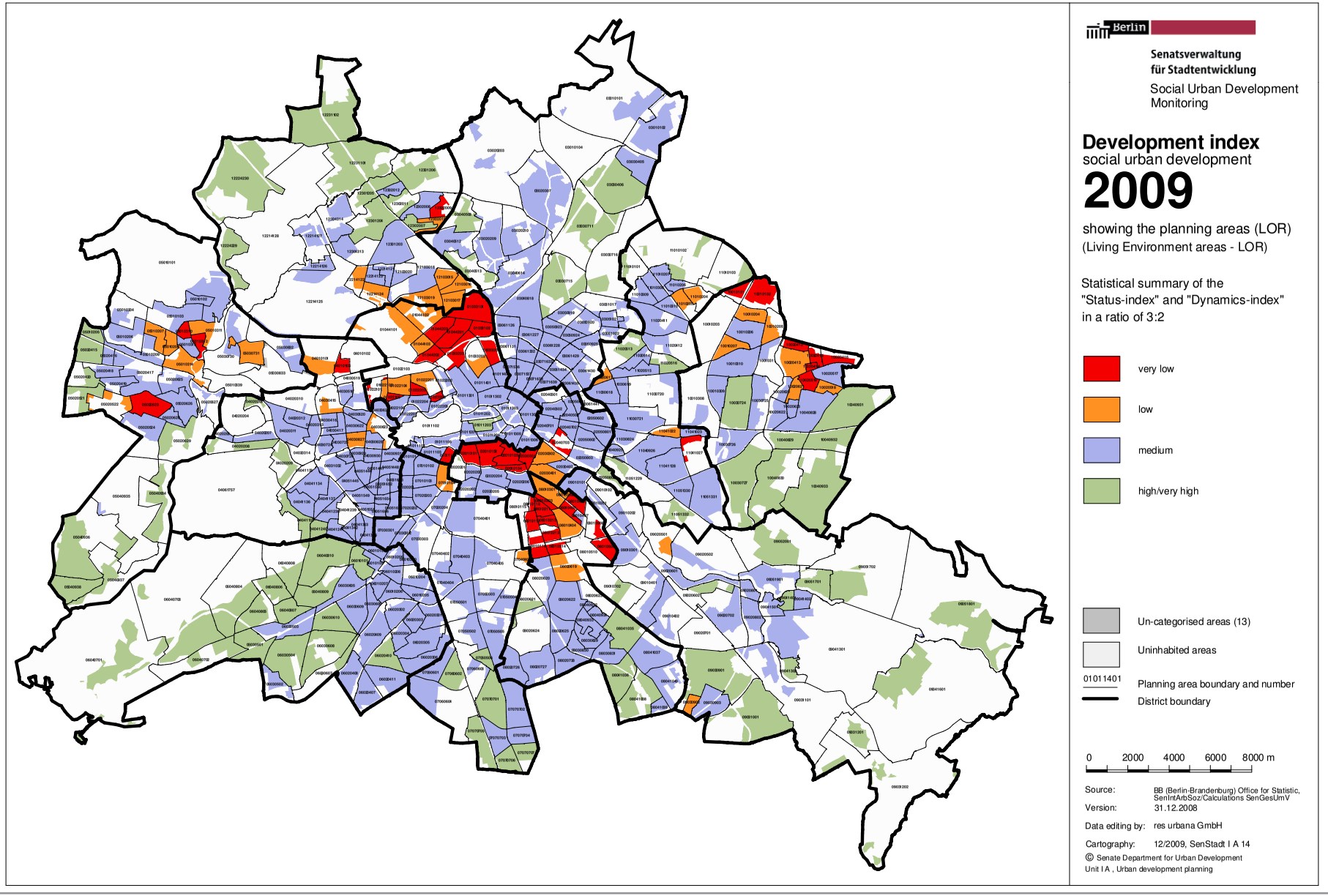
Environmental Atlas Berlin: http://www.stadtentwicklung.berlin.de/umwelt/umweltatlas/index.shtml (Accessed: 22.03.2011).

Climate model Berlin (Environmental Atlas): http://fbinter.stadtberlin.de/fb/index.jsp?loginkey=showAreaSelection&mapId=k04_11_2plan_stadtklima2005@senstadt&areaSelection=address (Accessed: 22.03.2011).

Strategic noise maps (Environmental Atlas): http://fbinter.stadtberlin.de/fb/index.jsp?loginkey=showAreaSelection&mapId=k07_05_15verkehr_gesN2008@senstadt&areaSelection=address (Accessed: 22.03.2011).

Social Urban Development Monitoring: http://www.stadtentwicklung.berlin.de/planen/basisdaten_stadtentwicklung/monitoring/index.shtml (Accessed: 22.03.2011).

Figure 2: Development index social urban development 2009 showing the planning areas (Living Environment areas (LOR).



Literature

Bömermann H, Nelius K, Jahn S (2006): Lebensweltlich orientierte Räume im Regionalen Bezugssystem (Teil 1). Werkstattbericht zum Projekt „Vereinheitlichung von Planungsräumen. In: Monatsschrift des Statistischen Landesamtes Berlin, H. 8: 366-371.

SenStadt (Senatsverwaltung für Stadtentwicklung Berlin) (ed.) (2009): Monitoring Soziale Stadtentwicklung Berlin.

VDI (Verein Deutscher Ingenieure) (2008): Richtlinie VDI 3785, Blatt 1, Methodik und Ergebnisdarstellung von Untersuchungen zum planungsrelevanten Stadtklima, Düsseldorf. http://www.vdi.de/ (Accessed: 09.03.2011).

Contact

Jörn Welsch
Senate Department for Urban Development Berlin
III F 12 („Environmental Atlas“)
Fehrbelliner Platz 1
D-10707 Berlin
Email: joern.welsch[at]senstadt.berlin.de

Heidrun Nagel
Senate Department for Urban Development Berlin
I A 11 („Social Urban Development Monitoring“)
Am Köllnischen Park 3
D-10173 Berlin
Email: heidrun.nagel[at]senstadt.berlin.de

Hartmut Bömermann
Berlin-Brandenburg Office for Statistics
(„Living Environment Areas“)
Alt-Friedrichsfelde 60
D-10315 Berlin
Email: hartmut.boemermann[at]statistik-bbb.de

Socio-spatial distribution of noise exposure in Berlin

Tobia Lakes and Maria Brückner

Introduction

Next to air pollution, noise is deemed one of the most significant environmental factors impacting health and quality of life in German cities (Niemann et al. 2005; EU 2002). In this context, noise is defined as "disruptive or damaging sound" (Maue 2009). Berlin has long been addressing this multi-layered environmental problem with political and planning measures – for example the Noise Abatement Plan (SenGUV 2008). In the context of the Berlin Pilot Project for Environmental Justice, the objective of this noise study is to assess the socio-spatial distribution of noise exposure levels in Berlin residential areas. The question is: are there identifiable areas in which social disadvantage and high levels of noise pollution overlap?

Methodology

In order to investigate the socio-spatial distribution of noise pollution in all of Berlin's residential areas, the Strategic Noise Map L_N Total Traffic Noise (night) (SenStadt 2008) and the development index from Social Urban Development Monitoring (SenStadt 2009) were used (see paper on p. 20). First, the noise data at the planning area level had to be aggregated. For this purpose, a city-wide noise index (L) was calculated, which shows the area-weighted noise pollution of residential areas by road, rail and air traffic noise in a planning area (PLA) in dB(A) (**Figure 1**).

Analogous to Social Urban Development Monitoring, the assessment of noise level for each PLA was performed based on deciles: very high (10th decile: $52 \leq x < 57$ dB(A)), high (9th decile: $51 \leq x < 52$ dB(A)), medium (3rd – 8th decile: $44 \leq x < 51$dB(A)) and low/very low (1st – 2nd decile: <44 dB(A)). Then the noise index was correlated with the development index at the PLA level to obtain environmental justice data which covered the entire area.

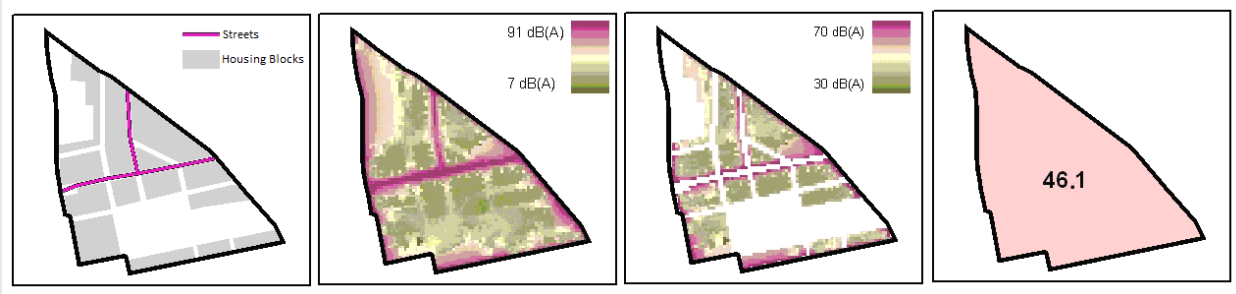
Results

The results of this preliminary analysis show a heterogeneous pattern of socio-spatial distribution of noise pollution levels in Berlin's planning areas. A statistically significant relationship between noisy residential areas and the social structure at the planning area level cannot be established at the citywide level. However, there are areas which carry a double burden (high noise level, low social status), as well as areas with low noise levels and high social status (**Figure 2**).

Conclusion

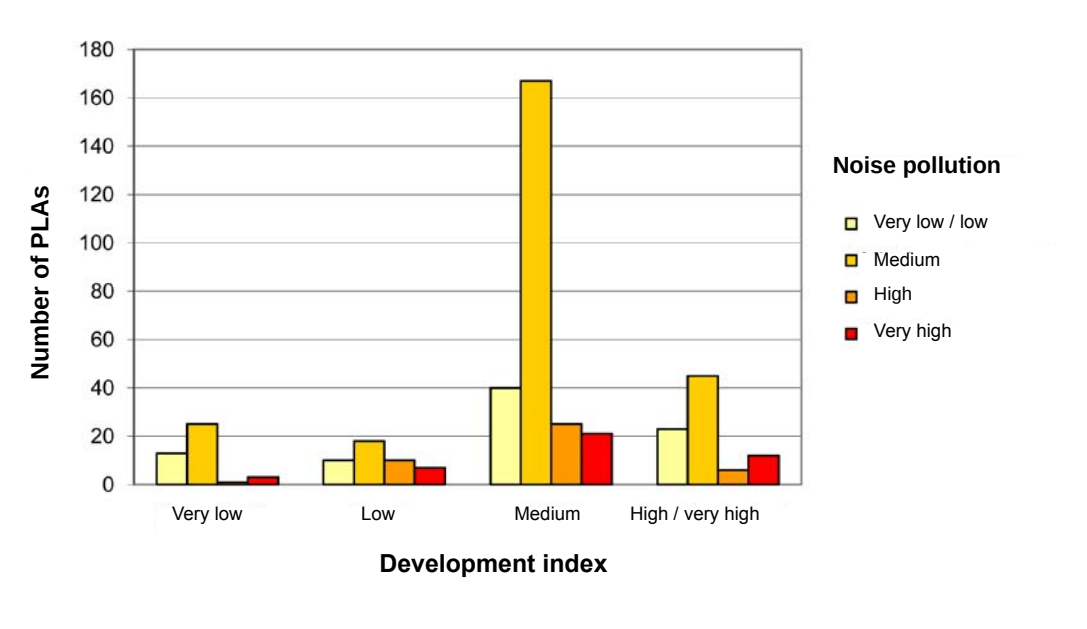
This preliminary study showed that, while Berlin exhibits no citywide environmental injustice as far as noise is concerned, individual inner city planning areas carry a double burden of high noise level and low social status (**Figure 3**). The results therefore

Figure 1: Determination of the noise index, using the example of a planning area.



From left to right: Surface areas of residential blocks, strategic noise map L_N, noise pixel only in residential built-up areas, surface-weighted aggregation of the mean value of the noise pixels on residential built-up areas for each planning area (data in dB(A)).

Figure 2: Number of PLAs according to noise level and development index.



confirm existing available noise pollution studies in other Central European cities (Kruize 2007; Köckler et al. 2007) from an environmental justice perspective. In future, a more differentiated view of the noise sources and specific vulnerable groups, and more detailed analysis can contribute to a deeper understanding of socio-spatial distribution of exposure to noise.

Literature

EU (Europäische Union) (ed.) (2002): Richtlinie über die Bewertung und Bekämpfung von Umgebungslärm (2002/49/EG) des europäischen Parlaments und des Rats.

Köckler H, Katschner L, Kupski S, Katschner A, Pelz A (2007): Umweltbezogene Gerechtigkeit und Immissionsbelastungen am Beispiel der Stadt Kassel. Center for Environmental Systems Research, CSER–Paper 1, Kassel University press. Kassel.

Kruize H (2007): On environmental equity: Exploring the distribution of environmental quality among socio-economic categories in the Netherlands. in: Journal of Economic and Social Geography, 99 (5): 641-643.

Maue JH (2003): 0 Dezibel + 0 Dezibel. Einführung in die Grundbegriffe und die quantitative Erfassung des Lärms. Berlin: Erich Schmidt Verlag.

Niemann H, Maschke C, Hecht K (2005): Lärmbedingte Belästigung und Erkrankungsrisiko. Ergebnisse des paneuropäischen LARES-Survey. In: Bundesgesundheitsbl – Gesundheitsforsch – Gesundheitsschutz, 3: 315-328.

SenGUV (Senatsverwaltung für Gesundheit, Umwelt und Verbraucherschutz) (ed.) (2008): Lärmminderungsplanung für Berlin – Aktionsplan. Senatsverwaltung für Gesundheit, Umwelt und Verbraucherschutz Berlin. Abt. III Umweltpolitik, Referat Immissionsschutz.

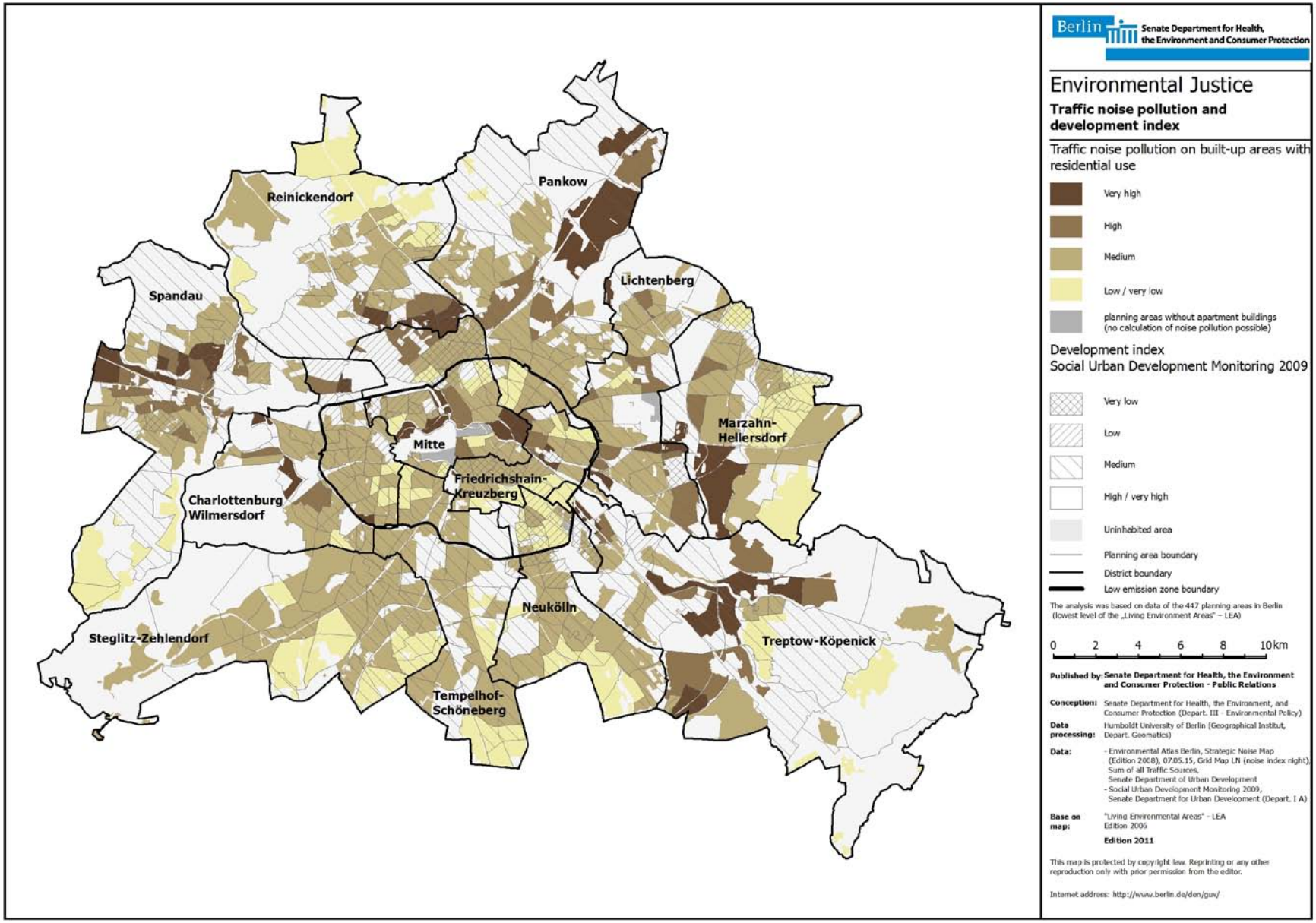
SenStadt (Senatsverwaltung für Stadtentwicklung) (ed.) (2008): Strategische Lärmkarten, Gesamtlärmpegel, Rasterkarte L_N (Nacht-Lärmindex) Gesamtlärm Summe Verkehr (Nacht) (07.05.15). Senatsverwaltung für Stadtentwicklung Berlin.

SenStadt (Senatsverwaltung für Stadtentwicklung) (ed.) (2009): Monitoring Soziale Stadtentwicklung. Senatsverwaltung für Stadtentwicklung Berlin.

Contact

Prof. Dr. Tobia Lakes
Humboldt-Universität zu Berlin
Geography Department
Geomatics
Unter den Linden 6
D-10099 Berlin
Email: Tobia.Lakes[at]geo.hu-berlin.de

Figure 3: Traffic noise pollution and development index (Edition March 2011).



Socio-spatial distribution of ambient air exposure in Berlin

Annegret Kindler[1], Ulrike Weiland[2], Ulrich Franck[1]

Introduction

The term air quality describes the condition of air relative to the level of air pollutions. Significant European Union regulations are specified in Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe (European Union 2008). Particulate matter and nitrogen dioxide are particularly significant types of air pollution in cities. Particulate matter (PM) is often categorised according to its aerodynamic diameter into the following size groupings: PM_{10} ($\leq$ 10 µm, non-respirable), $PM_{2.5}$ ($\leq$ 2.5 µm, respirable), UFP (ultrafine particles, $\leq$ 0.1 µm). Particle size depends on the particle source and is therefore related to chemical composition. Particulate matter that has been inhaled can adversely affect human health. It can, for example, cause respiratory and cardio-vascular disease. The smaller the particles, the deeper they can penetrate into the respiratory tract, hence the risks of disease are influenced too. Past environmental epidemiological studies (Leitte et al. 2011; Franck et al. 2011; Arhami et al. 2010; Leitte et al. 2009; Zanobetti et al. 2009; Brunekreef et al. 2005; Franklin et al. 2007; Massolo et al. 2002; Pope et al. 2002; Schwartz 1993) indicate that even small amounts of particulate matter can lead to health impairment. This means that there is no known threshold value below which no effects are to be expected (NOE). Epidemiological studies (Leitte et al. 2009; Jerret et al. 2009; Felber et al. 2008; Pattenden et al. 2006; Samoli et al. 2006; Forastiere et al. 2005) showed that nitrogen oxides (NO_x) in the air we breathe can likewise damage health. Furthermore, nitrogen oxides contribute to particulate matter formation (particle formation). Especially in urban areas, traffic is a significant source of both airborne pollutants.

Methodology

The PM_{10} and NO_x concentrations, additional reference data for selected characteristic monitoring stations and for street sections, were provided by the Berlin Senate Administration for Health, Environment and Consumer Protection (see paper on p. 20) – the area weighted annual average values for all planning areas (PLAs) for 2005 were calculated from this data.

$PM_{2.5}$ and NO_2 air pollution was mathematically determined from the PM_{10} and/or NO_x values. In order to investigate socio-spatial distribution of $PM_{2.5}$ and NO_2 air pollution at the PLA level in the context of the Berlin Environmental Justice Pilot Project, air pollution was statistically and spatially correlated with the development index (SenStadt 2009; see paper on p. 20). In order to classify $PM_{2.5}$ and NO_2 pollution, the values were ranked within deciles, according to pollutant concentrations. Analogous to the socio-spatial categorisation of the development index, the two lowest deciles were categorised as low level pollution. The deciles with the highest and second highest pollution were classified as very high and high levels of pollution. All other deciles were classified as medium level pollution. The contribution of urban traffic to air pollution has been assessed by means of percentages of areas used by traffic within the planning areas. The values were calculated according to the IMMIS^{em}/IMMIS^{air} V3.0 program (IVU Umwelt GmbH).

Results

Air pollution analysis shows that, citywide, there is air pollution from a combination of particulate matter ($PM_{2.5}$) and nitrogen dioxide (NO_2), but, at the planning area level (PLA) it varies greatly. 69 PLAs

[1] Helmholtz Centre for Environmental Research – UFZ, Leipzig
[2] Universität Leipzig, Institute for Geography

(15 %) out of a total of 447 PLAs, were classified as polluted at a low level. 263 PLAs (59 %), more than half of all PLAs, are categorised as medium polluted level. 54 PLA (12 %), the smallest PLA group, exhibit high levels of air pollution. Very high levels of air pollution occur in 61 PLAs (14 %).

Regarding the socio-spatial distribution of air pollution it can be noted that PLAs with a high/very high development index (DI) are only exposed to low or medium levels of air pollution. In more than half of the PLAs with a medium DI, medium pollution levels occur, about a third of these PLAs exhibit very high and high pollution levels. PLAs with a low and very low DI predominantly exhibit medium levels of $PM_{2.5}$ and NO_2 air pollution, but some high level and very high level pollution also occurs (**Figure 1**).

Analysis and assessment of combined $PM_{2.5}$ and NO_2 air pollution for the entire city of Berlin shows significant concentrations of highly or very highly affected PLAs within the low emission zone and adjoining PLAs to the west, southwest and north. Air pollution decreases from the centre towards the outskirts of the city. Areas with low air pollution are in PLAs located on the periphery (**Figure 2**).

Considering the population as a whole, it turns out that about 10 % of Berlin's population live in PLAs with a very low or low development index and also very high or high air pollution levels, they are therefore doubly disadvantaged. Generally, the following is true: The lower the development index in a PLA, the greater the proportion of the population with increased air pollution.

Conclusion

Analysis and assessment of combined $PM_{2.5}$ and NO_2 air pollution and the development index for the entire city of Berlin mirrors the spatial differentiation of the characteristics observed. A high and very high level of air pollution occurs mainly inside the environmental zone. It also becomes clear that planning areas (PLAs) with a medium, low and very low development index are more exposed to $PM_{2.5}$ and NO_2 air pollution than PLAs with a high/very high development index.

Literature

Arhami M, Minguillón MC., Polidori A, Schauer JJ, Delfino RJ, Sioutas C (2010): Organic Compounds Characterization and Source Apportionment of Indoor and Outdoor Quasi-Ultrafine PM in Retirement Homes of the Los Angeles Basin. In: Indoor Air, vol. 20, pp. 17-30.

Brunekreef B, Janssen NA, de Hartog JJ, Oldenwening M, Meliefste K, Hoek G et al. (2005): Personal, indoor, and outdoor exposures to $PM_{2.5}$ and its components for groups of cardiovascular patients in Amsterdam and Helsinki. In: Res.Rep.Health Eff.Inst., 127: 1-70.

European Union (ed.) (2008): Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe. Official Journal of the European Union L152/1 11.6.2008.

Figure 1: Number of PLAs according to combined $PM_{2.5}$ and NO_2 air pollution and development index (n_{total} = 434).

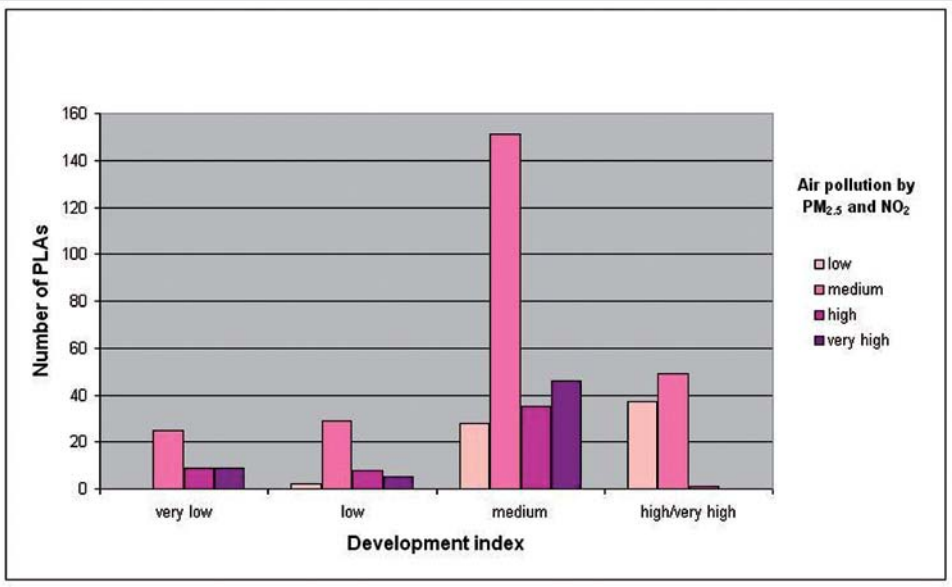
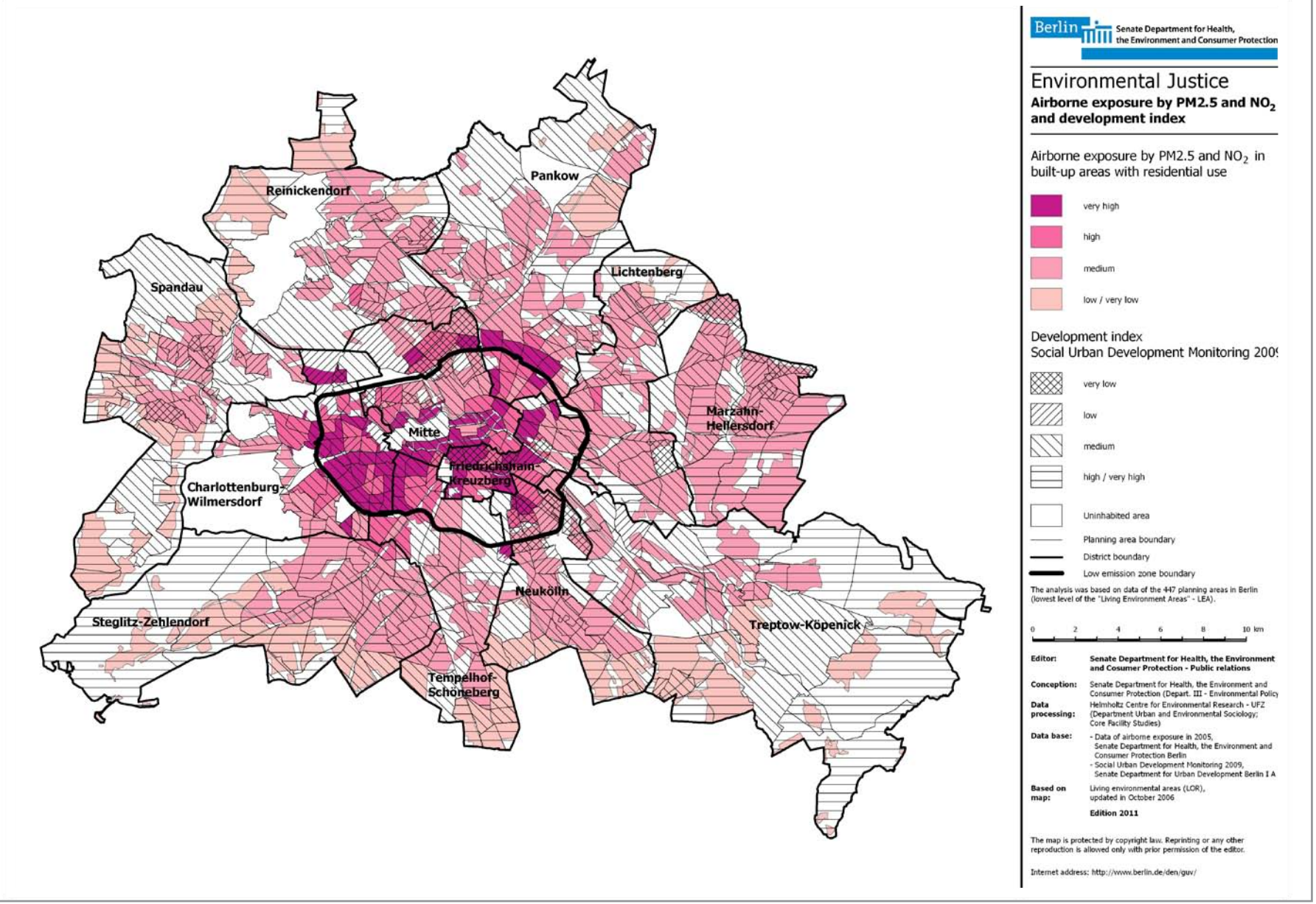


Figure 2: Airborne exposure by $PM_{2,5}$ and NO_2 in built-up areas with residential use (Edition March 2011).



Felber DD, Gemperli A, Gaspoz JM, Schindler C, Liu LJ, Gold DR et al. (2008): Differences in heart rate variability associated with long-term exposure to NO_2 In: Environ.Health Perspect; 116 (10): 1357-1361.

Forastiere F, Stafoggia M, Picciotto S, Bellander T, D'Ippoliti D, Lanki T et al. (2005): A case-crossover analysis of out-of-hospital coronary deaths and air pollution in Rome, Italy. In: Am.J.Respir.Crit Care Med.; 172 (12): 1549-1555.

Franklin M, Zeka A, Schwartz J (2007): Association between $PM_{2.5}$ and all-cause and specific-cause mortality in 27 US communities. In: J.Expo.Sci.Environ.Epidemiol.; 17 (3): 279-287.

Jerrett M, Finkelstein MM, Brook JR, Arain MA, Kanaroglou P, Stieb DM et al. (2009): A cohort study of traffic-related air pollution and mortality in Toronto, Ontario, Canada. In: Environ.Health Perspect.; 117 (5): 772-777.

Leitte AM, Petrescu C, Franck U, Richter M, Suciu O, Ionovici R et al. (2009): Respiratory health, effects of ambient air pollution and its modification by air humidity in Drobeta-Turnu Severin, Romania. In: Sci.Total Environ.; 407 (13): 4004-4011.

Leitte AM, Schlink U, Herbarth O, Wiedensohler A, Pan XC, Hu M et al. (2011): Size Segregated Particle Number Concentrations and Respiratory Emergency Room Visits in Beijing, China. In: Environ Health Perspect.; 119 (4): 508-513.

Massolo L, Müller A, Tueros M, Rehwagen M, Franck U, Ronco A et al. (2002): Assessment of mutagenicity and toxicity of different-size fractions of air particulates from La Plata, Argentina, and Leipzig, Germany. In: Environ.Toxicol.; 17 (3): 219-231.

Pattenden S, Hoek G, Braun-Fahrländer C, Forastiere F, Kosheleva A, Neuberger M et al. (2006): NO_2 and children's respiratory symptoms in the PATY study. In: Occup.Environ.Med., 63 (12): 828-835.

Pope CA, Burnett RT, Thun MJ, Calle EE, Krewski D, Ito K et al. (2002): Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution. In: Jama-Journal of the American Medical Association; 287 (9): 1132-1141.

Samoli E, Aga E, Touloumi G, Nislotis K, Forsberg B, Lefranc A et al. (2006): Short-term effects of nitrogen dioxide on mortality: an analysis within the APHEA project. In: European Respiratory Journal; 27(6): 1129-1137.

Schwartz J (1993): Particulate air pollution and chronic respiratory disease. In: Environ.Res.; 62 (1): 7-13.

SenStadt (Senatsverwaltung für Stadtentwicklung) (ed.) (2009): Monitoring Soziale Stadtentwicklung 2009.

Zanobetti A, Franklin M, Koutrakis P, Schwartz J (2009): Fine particulate air pollution and its components in association with cause-specific emergency admissions. In: Environ.Health: 8-58.

Contact

Dr. Annegret Kindler
Helmholtz Centre for Environmental Research – UFZ
Permoserstr. 15
D-04318 Leipzig
Email: annegret.kindler[at]ufz.de

Socio-spatial distribution of bioclimatic conditions in Berlin

Birgit Kleinschmit, Gesa Geißler, Robert Ahrberg

Introduction

The term bioclimate encompasses the entirety of climatic parameters affecting people. A central point for investigation is the thermal effect complex which is used for the bioclimatic assessment of the residential areas in Berlin. The linkage between thermal stress and the increase in mortality rate among the affected population has already been examined and proved in several studies (Kosatzky 2005; Robine et al. 2007). A synergistic effect of socio-demographic factors has also been proven (Rey et al. 2009; Vandentorren et al. 2006).

Methodology

To evaluate the bioclimatic situation within the Berlin planning area, urban climate data of the Berlin Senate Department for Urban Development (SenStadt 2009b, see paper on p. 20) were used in the Berlin pilot project on environmental justice. In these, the individual residential areas were classified based on the PMV value (predicted mean vote). The PMV value is a dimensionless quantity and describes the thermal perception of a larger number of people affected by different climatic parameters (VDI 2008). The classification of the residential areas into four categories was based on the medium standardised PMV value of the respective area (**Table 1**). To investigate the relationship between social status and bioclimatic assessment, these were statistically and spatially analysed using the development index (DI) (see paper on p. 20). Before combining the two data sets, the bioclimatic data at the level of statistic blocks were aggregated to the level of the planning areas (PLA) by determining the weighted mean value.

Results

The result of the spatial combination of bioclimatic assessment and development index (DI) at the planning area level (PLA) are illustrated in **Figures 1** and **2**. The uneven distribution of the bioclimatic assessment among the individual DI categories is noticeable.

Thus 76 of an overall 87 PLA with a high DI (approx. 87 %) show a favourable or very favourable bioclimatic assessment (Category 1 and 2), while an unfavourable or less favourable bioclimate (Category 3 and 4) is present in only about 13 % of PLA with a high DI (**Figure 1**). Among PLA with a low DI there is only one out of 44 PLA (approx. 2 %) with a favourable or very favourable bioclimatic assessment (Category 1 and 2). 98 % of the PLA with a low DI, however, have an unfavourable or less favourable bioclimate (Category 3 and 4). At a very low DI, this tendency is even more pronounced. There is no single PLA with a favourable or very favourable bioclimate (Category 1 and 2).

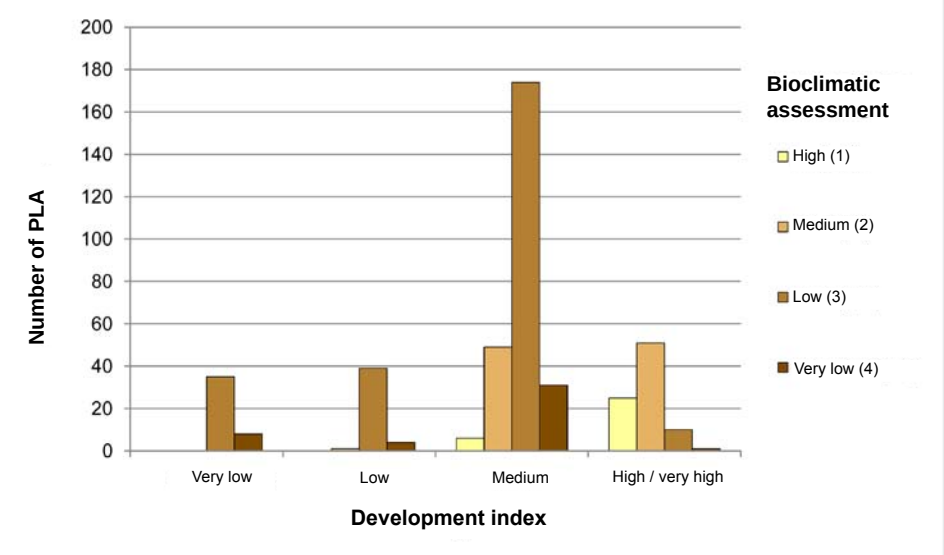
The spatial analysis shows a significant concentration of bioclimatically stressed PLA with a very low to low DI within the city centre. PLA, rated in the climatic comfort range, are found exclusively in the peripheral areas and exhibit a medium to high DI (**Figure 2**).

In order to quantify that part of the population living at risk, in addition to the level of the PLA, the population of each PLA were used. Despite very different population densities in the individual PLA, a similar pattern occurs as in the previous analysis of the PLA. Altogether over 75 % of the population of Berlin live in a PLA with an unfavourable or less favourable bioclimatic assessment (Category 3 or 4). 23 % of the inhabitants live in a PLA with a low to

Table 1: Categories of bioclimatic assessment.

Category	Estimate	Standard PMV value
1	high / very high (not stressed or climatic comfort range)	< -1
2	medium (low stress)	< 0 to -1
3	low (low, in individual cases moderate stress)	+1 to 0
4	very low (moderate, in individual cases high stress)	> +1

Figure 1: Number of PLA after bioclimatic assessment and development index (n_{total} = 434).



very low DI, all of which exhibit an unfavourable or less favourable bioclimate (Category 3 or 4). This compares to 21 % of the population of Berlin who live in a PLA with medium to high values both in terms of DI and bioclimate.

Conclusion

The combination of bioclimatic assessment and the social development index indicates a very low number of socially highly rated planning areas, while at the same time no socially deprived planning area with a positive category 1 or 2 bioclimate exists. Thus it can be concluded that in Berlin a socio-spatially unequal distribution of the bioclimatic situation exists at the level of PLA.

Literature

Kosatzky T (2005): The 2003 European heat waves. In: Eurosurveillance, 10(7-9): 148-149.

Robine JM, Cheung SL, Le Roy S, Van Oyen H, Herrmann FR (2007): Report on excess mortality in Europe during summer 2003. In: G. A. EU Community Action Programme for Public Health (Ed.) (pp. 13).

Rey G, Fouillet A, Bessemoulin P, Frayssinet, P, Dufour A, Jougla E, Hémon D (2009): Heat exposure and socio-economic vulnerability as synergistic factors in heat-wave-related mortality. In: European Journal of Epidemiology, 24: 495-502.

SenStadt (Senatsverwaltung für Stadtentwicklung) (ed.) (2009a): Methode zur Bewertung der Siedlungsräume bei 04.11 Klimamodell Berlin – Bewertungskarten (Ausgabe 2009). http://www.stadtentwicklung.berlin.de/umwelt/umweltatlas/da411_03.htm#A3 (Accessed: 22.05.2010).

SenStadt (Senatsverwaltung für Stadtentwicklung) (ed.) (2009b): Karte 04.11.2 Planungshinweise Stadtklima (Ausgabe 2009). http://www.stadtentwicklung.berlin.de/umwelt/umweltatlas/karten/pdf/04_11_2_2005.pdf (Accessed: 22.05.2010).

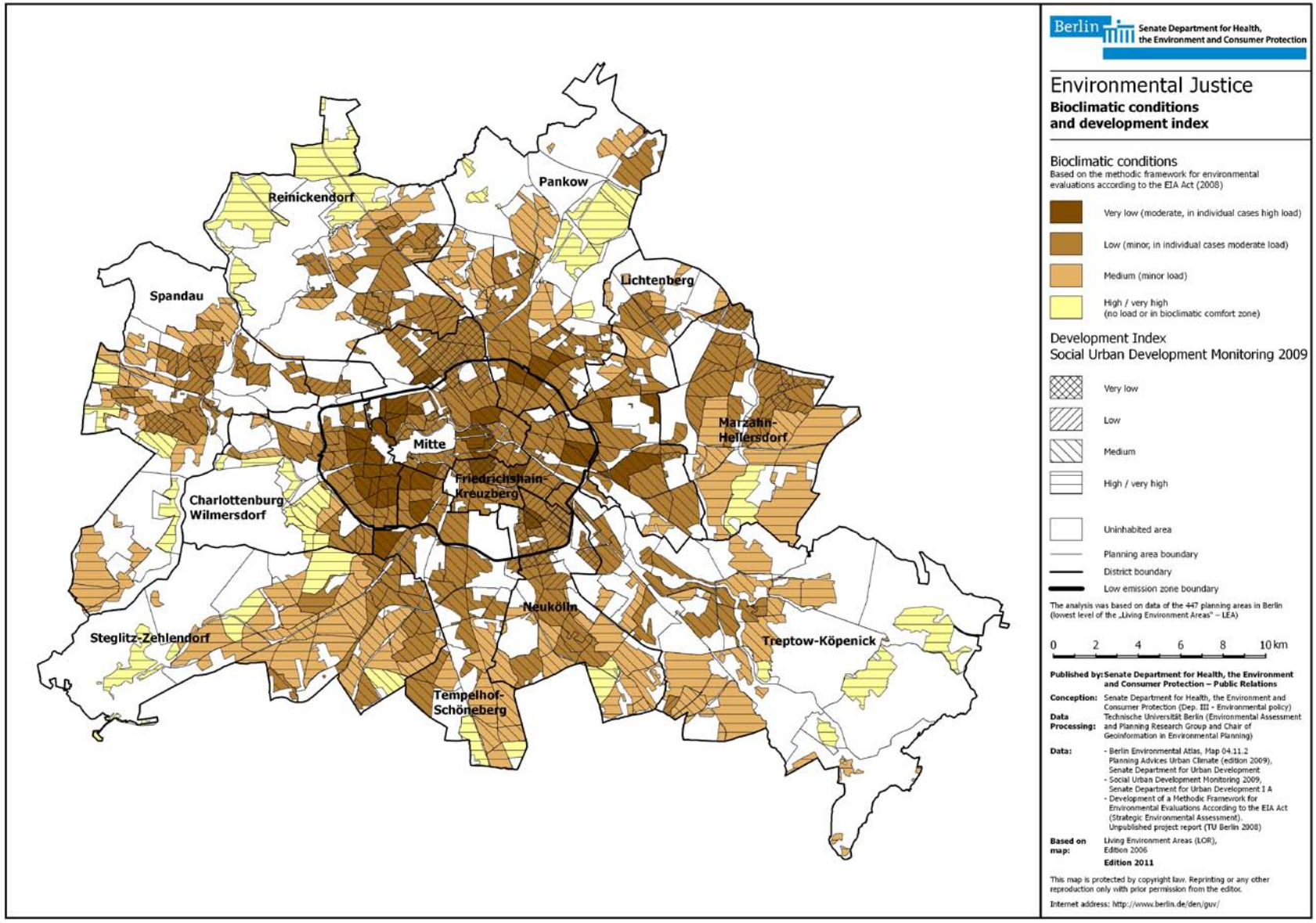
Vandentorren S, Bretin P, Zeghnoun A, Mandereau-Bruno L, Croisier A, Cochet C, Ribéron J, Siberan I, Declercq B, Ledrans M (2006): August 2003 heat wave in France: risk factors for death of elderly people living at home. In: The European Journal of Public Health, 16(6): 583-591.

VDI (Verein Deutscher Ingenieure) (2008): Richtlinie VDI 3785, Blatt 1, Methodik und Ergebnisdarstellung von Untersuchungen zum planungsrelevanten Stadtklima, Düsseldorf. http://www.vdi.de/ (Accessed: 09.03.2011).

Contact

Prof. Dr. Birgit Kleinschmit
Technische Universität Berlin
Department for Landscape Architecture and Environmental Planning
Geoinformation in Environmental Planning
Straße des 17. Juni 145
D-10623 Berlin
Email: birgit.kleinschmit[at]tu-berlin.de

Figure 2: Bioclimatic conditions and development index (Edition March 2011).



Socio-spatial distribution of green spaces in Berlin

Birgit Kleinschmit, Gesa Geißler, Hendrikje Leutloff

Introduction

Green spaces are generally considered as undeveloped areas with a high proportion of green space in an urban area. In order to have a recreational value, they must be publicly accessible and as "multi-functional" as possible. In addition to large green areas, this includes parks and agricultural areas, as well as city squares, cemeteries, nursery gardens, sport and leisure facilities (SenStadt 2008). Green spaces function as regeneration and recreation areas for the public (Köckler et al. 2008). They are especially important in urban areas for climate-change, noise abatement, local recreation and general appearance. Recent studies also suggest that green spaces have a positive effect on the health and psychological well-being of the population (Ellaway et al. 2005; Groenewegen et al. 2006; Mitchell, Popham 2008).

Methodology

In order to assess the provision of green spaces (PGS) in the context of the Berlin Environmental Justice Pilot Project, two standardised parameters were used by the State of Berlin: the provision of green spaces analysis and the Development Index (DI) (SenStadt 2009; see paper on p. 20). The PGS identifies an area's supply of green and open spaces. Green spaces are areas of at least 0.5 hectares, located within a radius of approximately 500m from a residence. The PGS analysis does not consider the quality of the spaces, but rather size, shape, accessibility and noise and air pollution. The PGS guideline for Berlin is that citizens should have access to 6 m² of green space close to their residence (SenStadt 2009). According to this supply guideline, the individual planning areas (PLA) are divided into four categories (**Table 1**).

Results

The spatial overlay of PGS on the Development Index (DI) at the planning area (PLA) level shows a relationship between green space supply and the social situation of the population of a PLA. 17 % of all PLA (78 PLA) show both a high DI and a very good supply of green spaces. Out of a total of 87 PLA with a high development index, 90 % also have a good supply of green spaces. There are hardly any PLA with a high DI and a very low or even low supply. Only one PLA has a DI of 1 (high) and a PGS of category 4 (low). Out of a total of 43, PLA in the lowest DI category (4), 22 (approx. 51 %) have a very low (4) to low (3) GSS, and only about 49 % show a medium (2) to high (1) PGS (**Figure 1**).

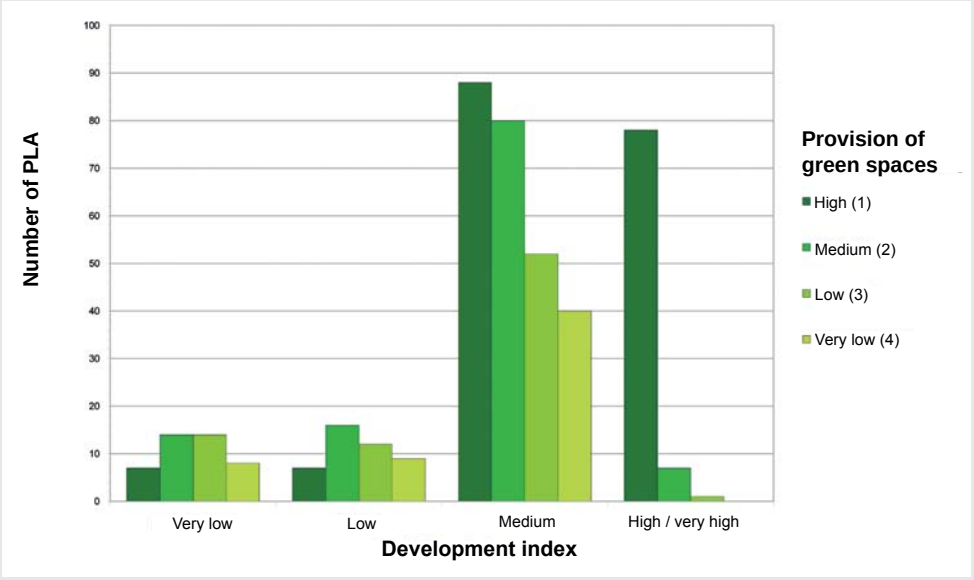
The results show that in Berlin, especially in inner city areas, there is a lack of green space which partly extends into adjoining areas to the south (Tempelhof-Schöneberg) and north (Mitte, Pankow). These areas tend to have more PLA with residents of lower social status. In the suburbs, which on average have a very good supply of green spaces, the PLA have a rather high social status. Only the large housing estates in Marzahn, Hellersdorf and Gropiusstadt deviate from this and are characterised by a low social status (**Figure 2**).

When considering each of the affected populations, a picture similar to the distribution of the PLA emerges. However, the social inequality of the distribution of the population into areas with a good and a bad PGS is more pronounced. Approximately 16 % of Berlin's population live in a PLA with a high social status and an equally high PGS. Zero percent of the population live in a PLA with a high DI but a low PGS. In contrast to this, 9 % of the population live in a PLA with a low to very low DI, showing at the same time a low to very low provision of green spaces.

Table 1: Supply classes of the PGS analysis (SenStadt 2009).

Category	Assessment	Green space [m²/resident]
1	high/very high (provided/ well provided)	> 6.0
2	medium (underprovided)	≤ 6.0 – 3.1
3	low (poorly provided)	3.0 – 0.1
4	very low (not provided/ strongly underprovided)	< 0.1

Figure 1: Number of PLA according to provision of green spaces (PGS) and development index (n_{total}= 431).



Conclusion

Altogether the results show that people in planning areas (PLA) with a very high development index (DI) are generally very well or well provided with green spaces. However, from the opposite perspective, a very low DI is not necessarily associated with a poor provision of green spaces. Overall, these areas are characterised by an above average under provision of green spaces. 51 % of the PLA with a very low or low DI have a low to very low PGS, as opposed to 1 % of the PLA with a high DI.

Therefore, a slight socio-spatial distribution inequality of PGS at the PLA level can be detected for the total urban area. Clearly, there are PLA which are characterised by a lack of green space while having a low DI.

Literature

Ellaway A, Macintyre S, Bonnefoy X (2005): Graffiti, greenery, and obesity in adults: secondary analysis of European cross sectional survey. In: Br Med J, 331: 611-2.

Groenewegen PP, van den Berg AE, de Vries S, Verheij RA (2006): Vitamin G: effects of green space on health, well-being, and social safety. In: BMC Public Health 6: 149. DOI: 10.1186/1471-2458-6-149.

Köckler H, Katzschner L, Kupski S, Katzschner A, Pelz A (2008): Umweltbezogene Gerechtigkeit und Immissionsbelastungen am Beispiel der Stadt Kassel. Center for Environmental Systems Research, CSER–Paper 1, Kassel University press. Kassel.

Mitchell R, Popham F (2008): Effect of exposure to natural environment on health inequalities: an observational population study. In: Lancet, 372: 1655-60.

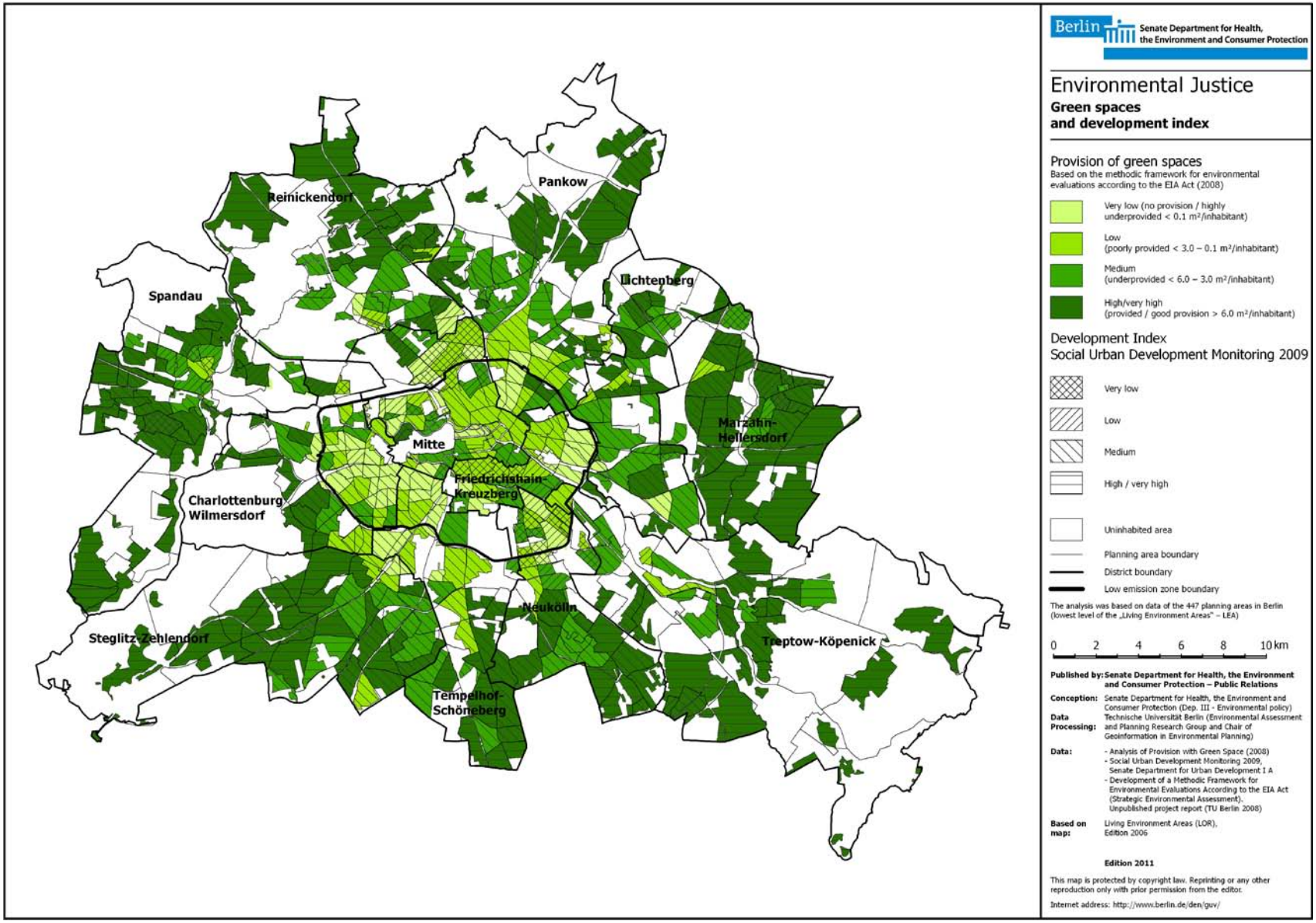
SenStadt (Senatsverwaltung für Stadtentwicklung) (ed.) (2008): Kartenbeschreibung 06.02 Grün- und Freiflächenbestand (Ausgabe 2008).

SenStadt (Senatsverwaltung für Stadtentwicklung) (ed.) (2009): Kartenbeschreibung 06.05 Versorgung mit Grün- und Freiflächen (Ausgabe 2009).

Contact

Prof. Dr. Birgit Kleinschmit
Technische Universität Berlin
Department for Landscape Architecture and Environmental Planning
Geoinformation in Environmental Planning
Straße des 17. Juni 145
D-10623 Berlin
Email: birgit.kleinschmit[at]tu-berlin.de

Figure 2: Green spaces and development index (Edition March 2011).



Socio-spatial distribution of residential areas in Berlin

Udo Dittfurth[1], Gabriele Gruber[2], Hartmut Bömermann[2]

Introduction

Conservation and/or creation of healthy living and working conditions have long been a major theme for urban construction and architectural design. The pilot project "Environmental justice in the State of Berlin" has made a major contribution to the integration of health and environmental issues into urban development and renewal.

Different architectural structures may strengthen or weaken effects on health conditions, well-being and housing satisfaction. When considering environmental factors and possible implications on detailed design, urban planning conditions must be included in processes when setting priority actions. This applies equally to the number of those actually affected and the social structures. Furthermore, this gives guidance for the assessment of residential areas.

Residential areas

A residential area assessment takes into account the wider community in which a dwelling is situated for the Berlin rent index (§ 558d BGB). In addition to the categories 'construction age', 'building type', 'house size' and 'standard fittings', the location likewise affects the amount of rent. The Berlin rent index distinguishes basic, intermediate and good neighbourhoods. The following characteristics are entered into the distinction:

- surrounding use,
- density,
- infrastructure,
- accessibility of public transport,
- access to recreation areas,
- demand and image,
- inner city / suburb.

The Berlin rent index is compiled annually by a team of experts from representatives of the Senate Administration for Urban Development, a scientific institute, the landlords' and tenants' associations, the Berlin Brandenburg Office of Statistics and other institutions. The original residential area classification is based on a secondary statistical analysis as well as by field inspection: block by block in the western part of the city and for each transport cell in the eastern part. Necessary adjustments and/or checks on the residential areas can be carried out by a co-ordinated assessment procedure.

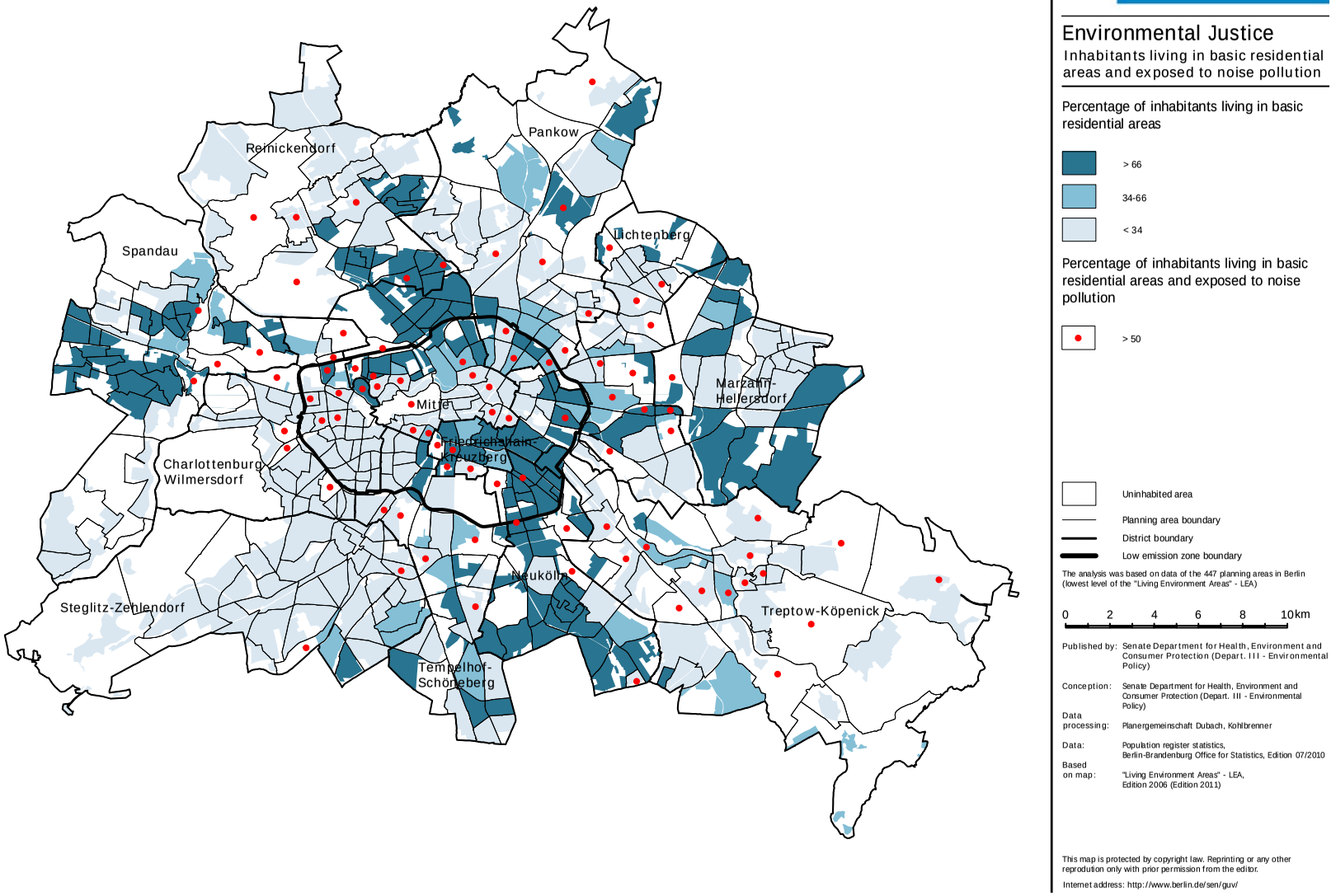
Using the residential area, a complex description can be mapped onto a three-point scale, which is supplemented by other descriptive characteristics and can contribute to a more sophisticated small-scale approach. One example is shown in **Table 1**, the description of a basic residential area.

High traffic noise (road, rail, air) is an additional characteristic for residential areas. This should be recognised as a total noise index over 24 hours $L_{DEN} > 65$ dB(A) and/or a total noise index by night $L_N > 55$ dB(A) (from 22:00 to 6:00 hours) on at least one section of the façade of one of the buildings corresponding to the address. Rent index 2009 was the first to use data calculated for Berlin based on the European Union Environmental Noise Directive, thus the number of addresses affected by noise increased in comparison to earlier rent indices. The reported noise level at a given address is neither complete nor is it mandatory for all homes located there in equal measure. Therefore it is not included in the residential area categorisation in the qualified rent index.

In December 2010, 42 % of the 3.37 million inhabitants of Berlin lived at addresses belonging to a basic, 41 % to a medium and 17 % to a good residential area. About 960,000 inhabitants (28 %) lived at an address with high traffic noise at the end of 2010,

[1] Dubach & Kohlbrenner Urban Planners
[2] Berlin Brandenburg Office of Statistics

Figure 1: Percentage of inhabitants living in basic residential areas in relation to the total number of inhabitants in LEA planning areas in Berlin and percentage of inhabitants exposed to noise pollution (data source: population register 31.12.2010; as registered at principal place of residence) (Edition March 2011).



Berlin Senate Department for Health, the Environment and Consumer Protection

Environmental Justice

Inhabitants living in basic residential areas and exposed to noise pollution

Percentage of inhabitants living in basic residential areas

- > 66
- 34-66
- < 34

Percentage of inhabitants living in basic residential areas and exposed to noise pollution

- > 50

- Uninhabited area
- Planning area boundary
- District boundary
- Low emission zone boundary

The analysis was based on data of the 447 planning areas in Berlin (lowest level of the "Living Environment Areas" - LEA)

0 2 4 6 8 10 km

Published by: Senate Department for Health, Environment and Consumer Protection (Depart. III - Environmental Policy)

Conception: Senate Department for Health, Environment and Consumer Protection (Depart. III - Environmental Policy)

Data processing: Planergemeinschaft Dubach, Kohlbrenner

Data: Population register statistics, Berlin-Brandenburg Office for Statistics, Edition 07/2010

Based on map: "Living Environment Areas" - LEA, Edition 2006 (Edition 2011)

Internet address: http://www.berlin.de/sen/guv/

Table 1: Area-describing characteristics of basic residential areas in Berlin (Sources: Mietspiegel 2009; SenStadt 2009).	
Basic residential area	In **inner city** areas with predominantly closed, high-density housing and very little green and open space, with predominantly untended streetscape and/or poor building conditions (e.g. facade damage, non-refurbished residential areas). Strong impairment by industry and commerce.
	In **suburban** areas with significant high-density housing.
	In **suburban** areas with predominantly open design, often poor building conditions (e.g. facade damage, non-refurbished residential areas), with untended streetscape (e.g. unpaved roads), poor transport links and poor shopping facilities.

out of them 46 % were in a basic, 37 % in a medium and 17 % in a good residential area. For statistical representation the residential areas can be aggregated on the level ”living area environment“ (LAE, Lebensweltlich orientierten Räume) (see paper on p. 20). **Figure 1** shows the distribution of the inhabitants in LAE planning areas that live in a basic residential area.

Conclusion

In addition to housing related aspects, different urban and functional criteria are included in the evaluation of residential areas. Methodologies for considering health factors can be further extended and systematised based on the findings of the Berlin pilot project.

Literature

Senatsverwaltung für Stadtentwicklung (ed.) (2009): Mietspiegel 2009, www.stadtentwicklung.berlin.de/wohnen/mietspiegel/de/download/Mietspiegel2009.pdf (Accessed: 01.03.2011).

GEWOS (2009): Endbericht zum Berliner Mietspiegel 2009 Grundlagendaten für den empirischen Mietspiegel, Aktualisierung des Wohnlagenverzeichnisses, www.stadtentwicklung.berlin.de/wohnen/mietspiegel/de/download.shtml (Accessed: 01.03.2011).

Contact

Udo Dittfurth
Dubach & Kohlbrenner Urban Planners
Lietzenburger Straße 44
D-10789 Berlin
Email: u.dittfurth[at]planergemeinschaft.de

Environmental justice in the Federal State of Berlin: an initial integrated analysis of the socio-spatial distribution of environmental burdens and resources

Tobia Lakes[1] and Heinz-Josef Klimeczek[2]

Introduction

Environmental justice in a city can only be dealt with when it is considered as a multi-dimensional topic because it requires an integrated analysis and representation of different environmental stressors and resources in their socio-spatial distribution (Wheeler 2004). The environmental analysis carried out for "Living Environment Areas" (LEA) („lebensweltlich orientierte Räume", LOR) in Berlin, provided area-wide data for the capital for the first time which supplemented the existing environmental, urban design and urban planning indicators and enabled an interdepartmental investigation of urban neighbourhoods and residential areas. In this preliminary investigation four variables were initially selected based on the Strategic Environmental Assessment (SEA), whose extensive health-related effects in urban areas have been demonstrated in different studies: noise and air pollution, bioclimate and green space supply (Niemann et al. 2005; Rey et al. 2005; Groenewegen et al. 2006). The large-scale results obtained for each environmental topic were combined at a planning level and their (urban) spatial distribution was depicted. The results of the environmental burden analysis in the planning areas were linked with the findings of the Social Urban Development Monitoring (see paper on p. 20) and thus the socio-spatial distribution of the various environmental burdens and resources was mapped (see papers on pp. 25-38).

Methodical procedure

The health reference was crucial in selecting the environmental indicators (Wheeler 2004; Niemann et al. 2005; Rey et al. 2005; Groenewegen et al. 2006). First, the health-related multiple exposures to environmental burdens were determined for 426 Berlin planning areas. For this purpose the classes showing the highest burden (Category 3 and 4) of the individual indicators (noise and air pollution, bioclimate and green space supply) were combined and presented as those having two, three or four stressors. This information was superimposed on the social development index data.

Results

The high importance of the health-related multiple exposures to environmental burdens for the urban area, and the spatial concentration in Berlin's inner city area can be clearly recognised. While nearly all planning areas (PLA) within Berlin's environmental zone have three stressors, PLAs without multiple stressors are predominantly situated in the suburban area near the Berlin city boundary (**Figure 1**). The correlation of this multiple exposure to environmental variables with the development index gives insights into the degree of environmental injustice in Berlin. Thus PLAs with low and very low development index values contain a much higher percentage of PLAs with two, three or four environmental stressors. In contrast, PLAs without environmental stress are characterised by very high/high development index values (**Figure 2**).

The analysis of the spatial distribution of this environmental injustice shows a concentration within the inner city area of Berlin, for example the high multiple exposure to environmental burdens and the coincidence with a low social status in the northern part of the district Friedrichshain-Kreuzberg, in Wedding, the southern part of the district Reinickendorf and in Nordneukölln. On the other hand, very low or low environmental stress and a very high or high social status can be seen mainly in the suburban area (**Figure 1**).

[1] Humboldt-Universität zu Berlin
[2] Berlin Senate Department for Health, Environment and Consumer Protection

Figure 1: Integrated Environmental Exposure (Editon March 2011).

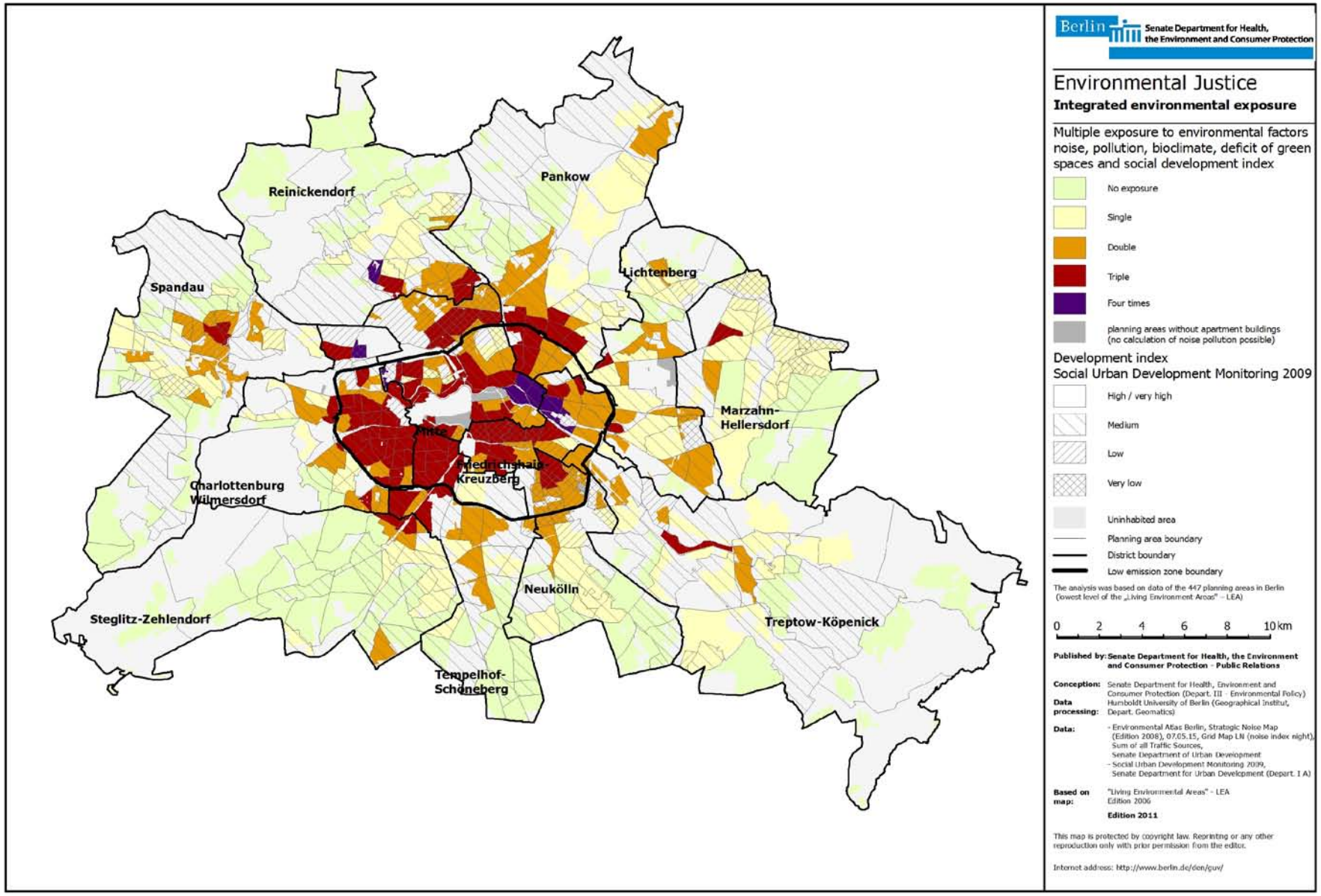
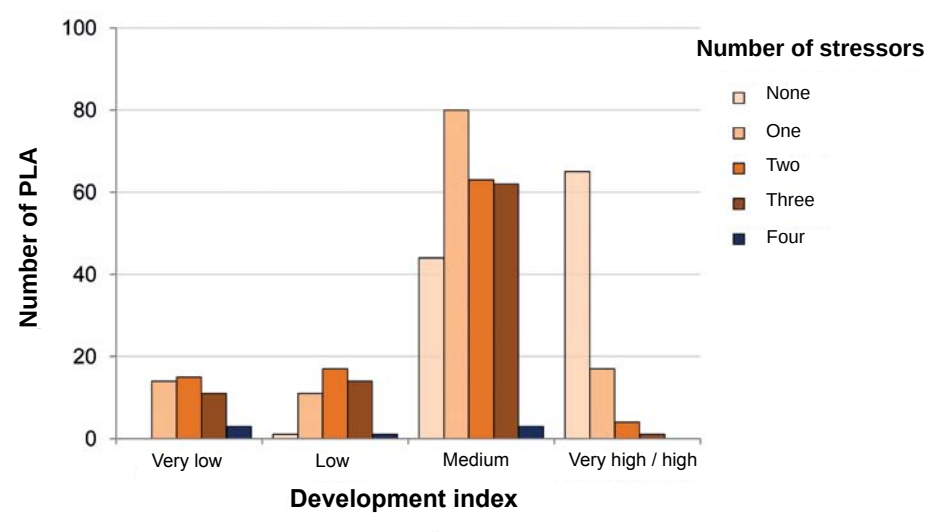


Figure 2: Number of PLAs with multiple environmental stressors (Category 3 and 4) as a function of development index.



Conclusion and outlook

On the basis of these initial results it can be seen that the topic of environmental justice is highly relevant since a strong socio-spatial distribution of environmental burdens in the city can be clearly identified. While obviously increased multiple exposure to environmental burdens and simultaneously low development indices occur in the planning areas, particularly in the inner city area, the trend is opposite in the suburban area. The results shown here for the first time an integrated approach and thus open a new perspective on the multi-dimensional nature of the socio-spatial distribution of environmental burdens and resources in an urban area using the Berlin example. This methodical approach enables the disparity of planning areas with multiple pressures to be identified. It focuses on the representation of environmental justice at the planning area level, as, contrary to environmental burdens and resources, socio-economic data are available only at this aggregation level. Building on the preliminary screening of the Berlin-wide situation, further detailed analyses should follow. At the same time this model provides the basis for developing an indicator which can quantify environmental justice as one single value at large scale. The presented results allow further enhancement to a supplemental environmental management tool in order to develop specific environmental and urban development policies. Another objective is to develop a city-wide interdepartmental framework strategy to underpin the social-spatial aims and measures. This is particularly true in view of the development areas of urban renewal and the political goal of equality of living conditions in a city with regard to the principal subject of protection of the most important commodity, the health of the population.

Literature

Groenewegen PP, van den Berg AE, de Vries S, Verheij RA (2006): Vitamin G: effects of green space on health, well-being, and social safety. In: BMC Public Health, 6: 149.

Niemann H, Maschke C, Hecht K (2005): Lärmbedingte Belästigung und Erkrankungsrisiko. Ergebnisse des paneuropäischen LARES-Survey. In: Bundesgesundheitsbl – Gesundheitsforsch – Gesundheitsschutz, 3: 315-328.

Rey G, Fouillet A, Bessemoulin P, Frayssinet P, Dufour A, Jougla E, Hémon D (2005): Heat exposure and socio-economic vulnerability as synergistic factors in heat-wave-related mortality. In: European Journal of Epidemiology, 24: 495-502.

Wheeler BW (2004): Health-related environmental indices and environmental equity in England and Wales. In: Environ Plan A 36: 803-822.

Contact

Prof. Dr. Tobia Lakes
Humboldt-Universität zu Berlin
Geography Department
Geomatics
Unter den Linden 6
D-10099 Berlin
E-Mail: tobia.lakes[at]geo.hu-berlin.de

Environmental justice in the Federal State of Berlin – perspectives for a new socio-spatially orientated environmental policy

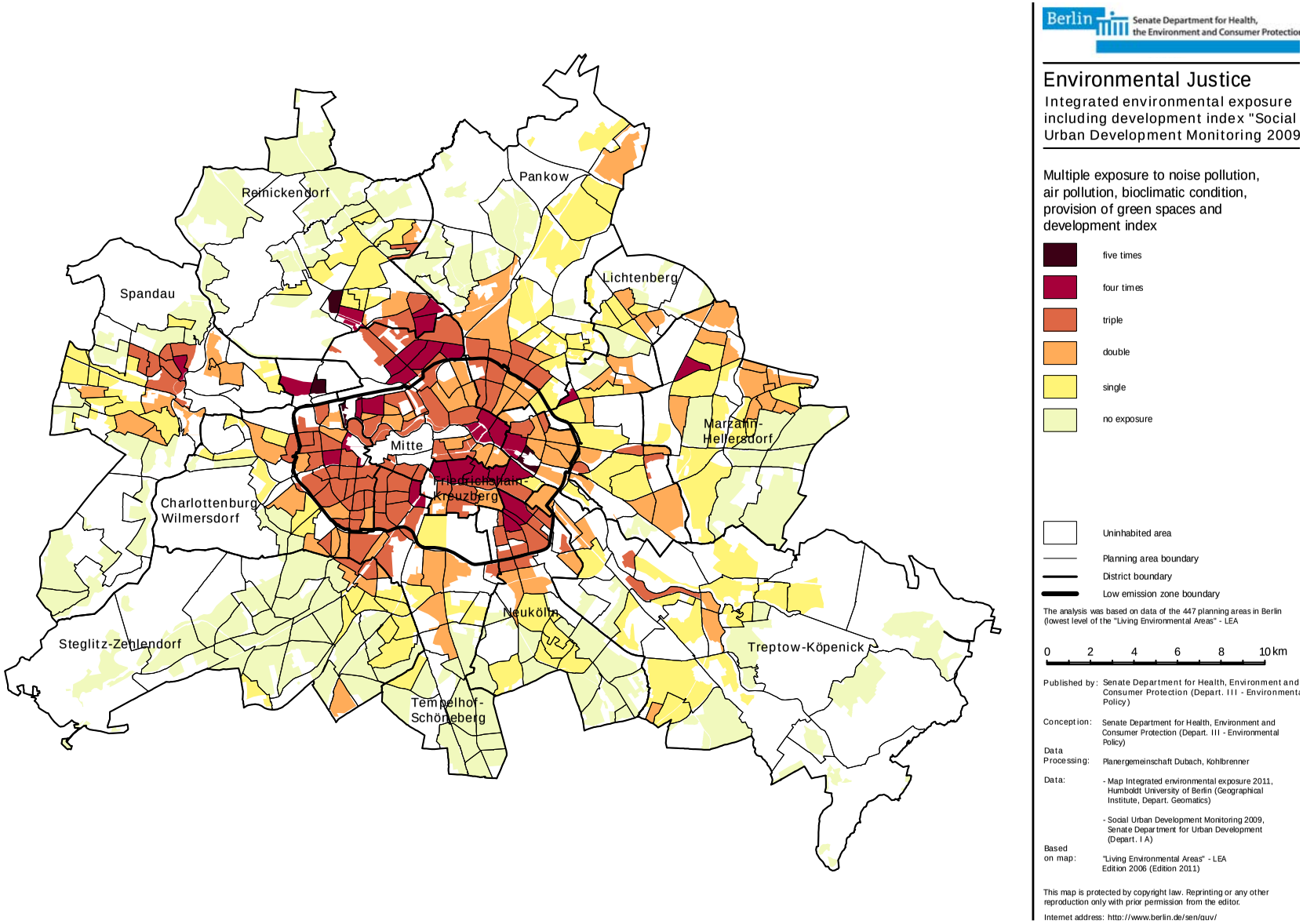
Benjamin-Immanuel Hoff

By signing the "Charter of Aalborg" and the "Charter of Valencia" the Federal State of Berlin committed itself to ensuring a sustainable and future-oriented development in the sense of Agenda 21. Against this backdrop, the Senate Department for Health, the Environment and Consumer Protection initiated the theme "Environmental justice in the Federal State of Berlin" with the aim of developing new environmental policy instruments and options for action. The objective was to develop a socio-spatial environmental impact analysis as the basis for interdepartmental strategies and measures at the interface of the health related areas of urban development, urban architecture and environment. At the same time, a foundation for discussing the development of a mission statement for socio-spatial environmental politics should be formulated for the Berlin Government and district administrations, and particularly for those living in highly polluted neighbourhoods, in order to give a perspective to the capital's environmental policies for a small-scale and resident friendly approach. Thus, it will be clear that Berlin's environmental policy will be aligned to the mission statement of sustainable development and the perception of responsibility for maintaining living spaces. The small-scale stress analysis now available (**Figure 1**) and the new specialist findings contribute to improving the work and decision-making basis so that the different areas of the capital can adapt more decisively to the challenges of future changing conditions.

This methodical approach will enter uncharted territory in many respects nationwide. For the first time, health related environmental impacts were presented and combined with social data for the spatial hierarchy of the 447 "Living Environment Areas" (LEA) ("Lebensweltlich orientierte Räume", LOR) in Berlin. As an early warning planning system and/or an overview of the overall urban situation, the new model provides an initial assessment as well as important information and arguments in advance of decisions, and detailed planning procedures. The specialist planning administrations of the Federal State of Berlin have thus obtained a new socio-spatially based management tool which becomes particularly relevant in the development of strategic concepts in realistic scenarios – in terms of modelling possible developments for differently stressed areas of the city. The selection and weighting of health in the areas, noise, air quality, bioclimate and green space provision have led to a clarification of the vague legal concept of "health", which is thus supposed to gain relevance for urban development processes and environmental planning.

These initial results show that the area of the densely populated city centre is the largest part of the areas affected by several components. This illustrates the need for developing new instruments and sustainable management options. The first exploratory studies indicate that the majority of the socially disadvantaged areas are also affected by strong health related environmental pressures. The small-scale environmental justice analyses will become especially important in the context of the integrated interaction of strategies and measures of urban development and environmental planning. This is particularly valid for the establishment of new planning and environmental law implementation instruments. In this context, the awareness of stakeholders is of paramount importance, in particular with regard to the necessity for a stronger pooling of the different health-related strategies and health-promoting models of other specialist departments. With regard to the environmental and health-policy objectives of the Federal State of Berlin, it is especially clear that integrated strategies and concepts of the ministerial policy areas of health, social welfare, urban development, urban planning and environment need to be stronger than previously considered and managed through interdepartmental processes. In the context of further development, it is necessary to interlink the areas in terms of an integrated approach to public health more effectively. Only then can we succeed with sustainability in view of health in urban development and strengthen urban and environmental planning. An important objective of the coming legislative period will be the implementation of this new

Figure 1: Integrated environmental exposure including development index „Social Urban Development Monitoring 2009“ (Edition March 2011).



informal evaluation and level of consideration into the overall urban and district administration management in terms of structure and procedural organisation.

It is already apparent that the several inner city areas identified as stressed will also be particularly affected by climate change – the main challenge that Berlin will have to face in future. Socio-structurally disadvantaged neighbourhoods which are already particularly affected by environmental burdens, will experience additional pressure in future due to climatic consequences. In order to be able to more confidently assess the effects of environmental impacts regarding human health and develop reasonable interdepartmental health strategies, it will be necessary to acquire systematic small-scale health data in the next legislative period. With regard to the new socio-spatially based environmental mission statement, it will be a major task of health reporting to issue scientifically based and well-founded statements. This is also the prerequisite for other specialist departments to integrate the themes of health and environmental health protection into their work. The available analyses are the results of the first tentative investigations, which should be systematically developed further. In 2012, the latest data will be available on the key themes of bioclimate, noise, air quality, green space provision, residential situation and social structure. This will also open the opportunity to further develop the analyses towards small-scale environmental impact monitoring and combining the statements with Social Urban Development Monitoring more strongly than before. In this context, it must also be verified as to what extent the existing urban development and environmental planning instruments will be suitable to support and legally back the new political field of environmental justice. Key features include instruments of informal planning and environmental testing. The results are also likely to underpin the discussion on the integrated approach for a number of individual development areas (e.g. Social City) by small-scale health-related environmental data.

The new theme „Environmental justice in the Federal State of Berlin“, which, for the first time, has made available environmental data for the entire city at a planning area level, is an important basis for devising strategies and measures for health-promoting and ecologically sound urban, spatial and environmental planning, for overcoming disciplinary communication barriers and for creating interdepartmental strategic alliances. With the overarching mission statement ”Socio-spatially Aligned Environmental Policy“, the theme is linked with the international debate on ”Sustainable Development“ and the “Charter of Leipzig“. By introducing the topic „Environmental Justice in the Urban Space“ into the Environmental Research Plan 2011 of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), the Berlin environmental justice analyses gained an additional (federal political) importance as a new policy model. At the same time, opportunities have arisen to pursue scientifically supported implementation of this complex theme as a pilot project of national importance.

„In order to be able to decide whether the nature of a city is healthy or unhealthy, its development plan must be studied“ – said architect Fritz Schumacher in 1929 referring to the health situation of big cities. With regard to the great challenges which Berlin will have to face in the coming decades, this sentence should serve as guidance. The current socio-spatial environmental analyses provide an important basis for sustainable environmental health promotion which can guarantee the sustainable development of urban areas. They contribute to improving the quality of life and health in the Federal State of Berlin and to make the new socio-spatially based environmental policy more effective and resident-oriented.

Contact

Prof. Dr. Benjamin-Immanuel Hoff
Secretary of State for Health, the Environment and Consumer Protection
Brückenstraße 6
D-10179 Berlin

Environmental health inequalities in Europe

Matthias Braubach

Abstract: *Environmental health inequalities have received increasing attention in recent years. However, there is a critical lack of information on the magnitude of inequalities and the most affected population subgroups. Responding to this lack of evidence, the WHO Regional Office for Europe aims at compiling the available evidence on environmental health inequalities, developing a set of inequality indicators, and producing a European status report on environmental health inequalities. A compilation of inequality data for 16 environmental risk factors has been prepared in 2010 based on the review of national and international data sources. The identified data were reviewed at an expert meeting (October 2010), resulting in a suggested core set of 14 environmental health inequality indicators covering housing-, injury- and environment-related inequalities. Based on the core indicator set, WHO will develop the European status report on environmental health inequalities to be available by end of 2011.*

Introduction

Environmental and health inequalities have received more attention in recent years. Social and gender inequalities concerning the exposure to environmental risk factors and the unequal distribution of environment-related diseases were therefore an important topic at the Fifth Ministerial Conference on Environment and Health in Parma, Italy, in March 2010. During the conference a keynote paper, „Social and gender inequalities in environment and health", was produced (WHO 2010a), in which the most important inequalities and their political relevance were presented. This document has been supplemented by the report, „Environment and health risks: a review of the influence and effects of social inequalities" (WHO 2010b; see also European Journal of Public Health 2010, Vol. 20 (1)). In the report the European situation regarding various environmental factors (e.g., air quality, housing conditions, accidents, occupational safety, climate change, waste disposal) and risk groups (characterised by sex, age and income inequalities) were described. It was found that there is surprisingly little information available on this topic.

Policy makers and, in particular, health and environmental protection authorities, as well as social services, are aware that specific measures are necessary for the protection of disadvantaged and vulnerable groups from environmental risks. However, it is often unclear which groups are the most severely affected by individual environmental pressures and what mechanisms lead to their disadvantage. The identification of disadvantaged and vulnerable population groups – which can be very different depending on risk factor – is, therefore, a necessary first step in setting priorities for policy measures.

WHO's implementation priorities

Due to the increasing importance of the topic and the current lack of sufficient data, it can be foreseen that the topic of social inequalities will remain an important challenge in the fields of environmental health and health-related information systems over the coming years. Previously, there was little to no reference being made to the potential inequalities within the populations concerned. In response to the WHO Parma Declaration (WHO 2010c), this key issue is now being addressed within a project for the development of inequality indicators for environment and health with the objective of integrating it into the WHO coordinated information system for environment and health (known as the Environment and Health Information System; ENHIS).

Under the scope of health-related environmental inequalities, the WHO has the following objectives which need to be achieved by the inter-ministerial conference in 2014 when the implementation of the Parma Declaration and the action plan will be evaluated:

- to provide a summary of available environmental inequalities data at a European level,

- to develop a plan for the provision and testing of a set of indicators for the estimation of environmental inequalities in the Member States and

- to produce a preliminary report on environmental inequalities for the WHO Europe Region based on these indicators.

At the same time indicator-based reporting should be completed for the Parma action plan targets (improving the indoor air conditions in schools by 2015 or improving water supply in homes by 2020) in the context of ENHIS.

Environmental inequalities in Europe – project status

The project was launched in 2010 and is funded by the German Federal Ministry of the Environment (BMU). In cooperation with selected WHO Member States, it aims to investigate data availability for 16 different risk factors (e.g. noise, air quality, humidity in housing, water supply, sanitation facilities in the home, transport safety, housing safety, chemical exposure, distance to green spaces, distance to landfills, lack of housing space, extreme indoor temperatures). The possibility of whether these data can be stratified according to six sociodemographic factors (age, sex, income, education, employment and nationality/ethnicity) was also explored. Available data were compiled by national experts who investigated and summarised the availability of the selected information for a total of 18 Member States. The WHO secretariat investigated international databases of WHO, other UN organisations, the EU and other international organisations and compiled the available international data on sociodemographic inequalities in terms of environmental risks.

While compiling the data it became clear that consistent data are actually only available through international databases. For example, a number of inequality parameters related to the living environment are available for EU countries in EU databases which can be differentiated according to several sociodemographic characteristics. Inequalities in accident injuries at an international level are best available through the WHO mortality database, although these include only age and sex as sociodemographic characteristics. The problem, however, is related to the detection of environmental exposure (noise, air pollution, chemical exposure etc.), since for many Member States data are rarely available in an objective form and separated by sociodemographic characteristics. Further problems arose in the context of national data, particularly due to the large diversity of studies and indicators, which made it extremely difficult to compare thematically-related studies from different countries.

The information collected was discussed and evaluated at a meeting of experts in the WHO European Centre for Environment and Health in Bonn in October 2010, where emphasis was placed on the availability of data for the largest possible number of Member States of the WHO Europe Region (a total of 53 countries). The assessment of the data confirmed that comparable and relevant information on environmental inequalities available at an international level is inadequate at best. In particular, environmental pressures strongly related to health, such as air pollution or chemical exposure, are areas where reliable data are available only in very few countries. Apart from the expected problem of quantitative data availability, there were also a number of qualitative aspects which made the estimation of the situation difficult at the international level. The main restrictions for an assessment of the European environmental inequalities situation were:

- Sociodemographic information on people or households such as age, sex, income, education, and nationality are frequently not included in the environmental statistics and cannot be integrated into such databases or can be done so only with great difficulty.

- In several countries (e.g. Denmark, France) it is not permitted to collect and process some of the individual's most important social and political information (e.g. ethnicity) in studies regarding inequality and injustice.

- Environmental exposure data are frequently available with regard to spatial units (streets, districts, postal code areas, etc.); however, they cannot be evaluated according to sociodemographic factors of households or individuals.

- In many cases the available data refer only to the perception of environmental conditions by individuals or households, and are therefore based on self-reported, and not on objectively measured, information.

- Often there are few objective data on the different health effects, so that the estimation of injustice

caused by environmental health inequalities is not possible in different social classes.

- Available data in individual countries are often not comparable to one another since they were collected in different studies using different methodologies. On the other hand, international studies based on a uniform methodology can better ensure data comparability.

A summary of the available data at national and international levels and the discussion in the context of the WHO Experts Meeting can be found as Annexes 2 and 3 of the report, „Towards Environmental Health Inequality Reporting“ (WHO 2010d).

WHO indicators for environmental inequalities

After the assessment of the data and against the backdrop of the restrictions described above, a total of 14 environmental (in)justice indicators have been selected (**Table 1**) which reflect different dimensions of unequal exposure and are available in a comparable form for as many countries as possible.

Discussion and restrictions

Due to the poor comparability of national data, the selected indicators are based wholly on international studies. This significantly reduces the number of the Member States in which data are available. An example is the use of EU databases which provides an outstanding data source for EU Member States and some countries with EU candidate status for the representation of income-related differences. However, it is not available in a comparable form for other countries. **Figure 1** shows the example of the risk factor, „dampness problems in the home“, which is associated with mould growth and health consequences such as asthma, allergies and other respiratory effects. In almost all countries, low-income households are disproportionally affected by dampness problems. The most important exception can be found in Nordic countries where this is not an income-related inequality.

Compared with the above-mentioned databases, UN-databases (e.g. the WHO Mortality Database or the Joint Monitoring Programmes of WHO and UNICEF on the availability of clean drinking water), which

Table 1: WHO indicators for environmental inequalities.

Inequality dimension	Indicator	Sociodemographic partitioning	Data source
Housing-related inequalities	Insufficient water supply	Urban-rural	WHO / UNICEF
	Lack of bath/shower	Age, sex, income, household type	EUROSTAT
	Lack of flush toilet	Age, sex, income, household type	EUROSTAT
	Lack of living space / crowding	Age, sex, income, household type	EUROSTAT
	Problems with damp	Age, sex, income, household type	EUROSTAT
	Problems to keep home warm in winter	Income, household type	EUROSTAT
Accident-related inequalities	Transport-related mortality	Age, sex	WHO Mortality Database
	Mortality by poisoning	Age, sex	WHO Mortality Database
	Mortality by falls	Age, sex	WHO Mortality Database
	Serious work-related injuries	Sex	EUROSTAT
Environment-related inequalities	Noise exposure at home	Income	EUROSTAT
	Lack of access to green and recreational areas	Age, sex, income	EUROFOUND
	Tobacco smoke exposure at home	Age, sex, income, education, occupational status	Eurobarometer
	Tobacco smoke exposure at the workplace	Age, sex, income, education, occupational status	Eurobarometer

cover nearly all Member States, can provide only limited information on sociodemographic inequalities. Therefore, they are often not suitable to show environmental inequalities. Regarding the data on drinking water supply – which in some European Union countries are no longer collected at a national level due to an alleged „full coverage“ of the population – only an urban-rural distinction is possible. Another example are fatal injuries which can only be differentiated according to sex and age groups, but not according to income.

Another important restriction is the lack of data based on exposure measurements, which are especially needed for air pollution or chemical exposure. Even reliable data based on perceived contamination are not available for these two environmental pollutants.

Finally, it should be noted that the available information rules out the estimation of the health effects of environmental inequalities. No international data source was found which contained information, apart from sociodemographic data, on both environmental exposure and health effects. This applies equally to the EU databases, which contain environmental risks but no health effects, and the WHO mortality database, which specifies deaths caused by accidents but does not combine these with environmental risk.

Outlook

In the second project year, 2011, a European environmental inequalities report will be produced on the basis of the 14 environment inequality indicators. The report will discuss the respective context for each indicator, evaluate and compile the most important data, and list the most strongly/frequently affected population groups. Additionally, the report will describe the possible health effects of the respective environmental inequalities and specify the policies needed which can help reduce inequality.

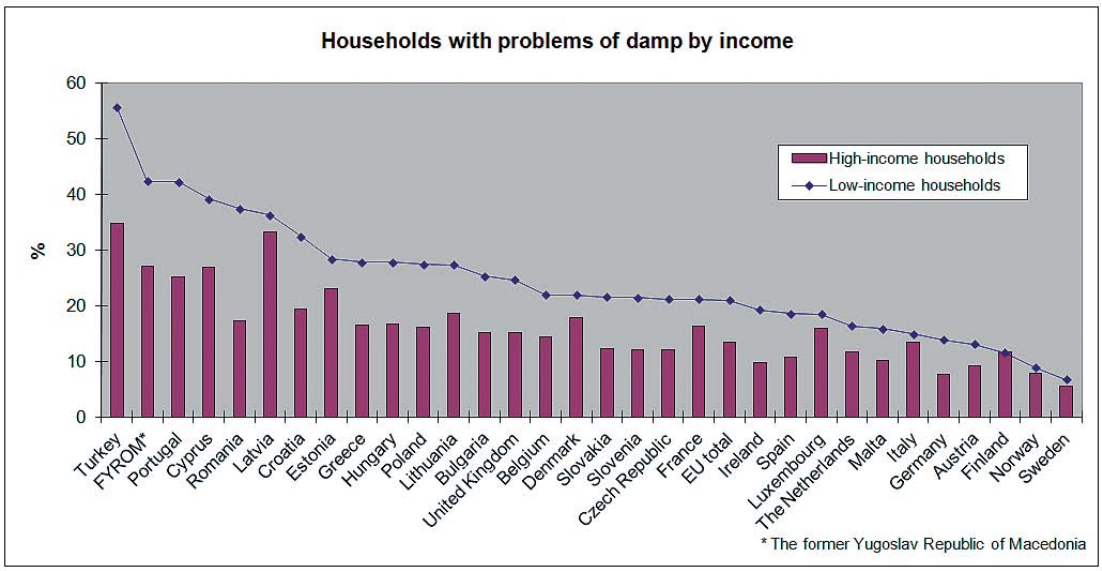
The objective of the European environmental inequalities report is to document the current status of environmental inequalities and identify disadvantaged groups. The report will also show which data are not available at the European level despite their relevance to human health. This will serve to highlight the challenges associated with adequately addressing environmental health injustice at the international level. The report is seen primarily as a first assessment, the extension and completion of which – both in terms of the number of countries where data are available and the lack of relevant risk factors – should be the subject of future and larger projects.

Websites

ENHIS: Environment and Health Information System. http://www.euro.who.int/en/what-we-do/data-and-evidence/environment-and-health-information-system-enhis/publications/2009/enhis-fact-sheets-2009 (Accessed: 13.04.2011).

Social inequalities in environment and health. http://www.euro.who.int/en/what-we-do/health-topics/environmental-health/social-inequalities-in-environment-and-health (Accessed: 13.04.2011).

Figure 1: Households with problems of damp by income. Source: Data from European Quality of Life Survey 2007 (EQLS2007). European Foundation for the Improvement of Living and Working Conditions.



Literature

European Journal of Public Health (Vol. 20(1)): Special section: Environmental inequalities: 12-42. http://www.euro.who.int/en/home/conferences/fifth-ministerial-conference-on-environment-and-health/documentation/background-documents/series-of-articles-on-environmental-inequalities (Accessed: 13.04.2011).

WHO (2010a): Soziale und geschlechtsbezogene Ungleichheiten im Bereich Umwelt und Gesundheit. Copenhagen, WHO Regional Office for Europe. http://www.euro.who.int/__data/assets/pdf_file/0003/76521/Parma_EH_Conf_pb1_ger.pdf (Accessed: 13.04.2011).

WHO (2010b): Environment and health risks: a review of the influence and effects of social inequalities. Copenhagen, WHO Regional Office for Europe. http://www.euro.who.int/__data/assets/pdf_file/0003/78069/E93670.pdf (Accessed: 13.04.2011).

WHO (2010c): Parma Declaration on Environment and Health. Copenhagen, WHO Regional Office for Europe. http://www.euro.who.int/__data/assets/pdf_file/0011/78608/E93618.pdf (Accessed: 13.04.2011).

WHO (2010d): Towards Environmental Health Inequality Reporting. Development of a core set of indicators for reporting and assessing environmental health inequalities in the WHO European Region. Report of an expert group meeting. Bonn, Germany, 25-26 October 2010. Copenhagen, WHO Regional Office for Europe. http://www.euro.who.int/__data/assets/pdf_file/0013/130243/e94628.pdf (Accessed: 13.04.2011).

Contact

Matthias Braubach
WHO Regional Office for Europe
WHO European Centre for Environment and Health,
Bonn Office
Hermann-Ehlers-Str. 10
D-53113 Bonn
Email: mbr[at]ecehbonn.euro.who.int

Environmental stress, socio-economic status and behavioural problems of children and adolescents in KiGGS

Dieter Helm (†) and Detlef Laußmann

Abstract: *One aspect of the German Health Interview and Examination Survey for Children and Adolescents (KiGGS 2003-2006, Principal publication 2007) was to investigate the relationship between social status and health. Socio-economic status, often expressed as an index (e.g. Ducan's SEI or Winkler's Index), is known to correlate with health outcomes such as behavioural problems. We constructed a new index that encapsulated not only economic and social but also environmental stressors (ESES), using data of the German Health Interview and Examination Survey for Children and Adolescents. Different factors were selected to account for socio-economic stress (low parental education, low household income, low occupational status of the householder), domestic stress (living in large cities, exposure to tobacco smoke at home, crowded housing, mouldy walls), and prenatal stress (maternal smoking during pregnancy, drinking alcohol during pregnancy). Prior to the calculation of ESES, the different factors were multiplied by weights which were estimated by multivariate linear regression on a number of health outcomes. ESES was then used to predict emotional and social problems (SDQ scores). The resulting ORs were compared with those obtained for an established socio-economic index (SEI). ESES was superior to SEI as it could more clearly identify children and adolescents with emotional or social problems. Different types of stressors (i.e. socio-economic stress, domestic stress and prenatal stress) contributed independently to emotional and social problems.*

Introduction

One objective of the German Health Interview and Examination Survey for Children and Adolescents (Kinder- und Jugendgesundheitssurvey, KiGGS), carried out nationwide by Robert Koch Institute (RKI) in 2003 to 2006 was to analyse health risks and disease risks of the children and adolescents in Germany from the perspective of social inequalities (KiGGS Basispublikation 2007). A relationship between social class and health has been demonstrated in numerous epidemiological studies. The social status is frequently fashioned using one of the indicators for education, occupation and income, or these indicators are combined into one common score (Grittner, Bloomfield, Kramer et al. 2006).

Measurements for socio-economic factors such as Duncan's SEI (Socio-economics Index, Duncan 1961) or Winkler's Social Class Index (Winkler, Stolzenberg 1999) correlate with certain health problems, for example children and adolescents with behavioural disorders. While Duncan's SEI and Winkler's Social Class index only consider socio-economic variables without including additional environmental stressors, the environment-related evaluation of the KiGGS data revealed that there was a need to develop a new index that not only included socio-economic factors but potential environmental stressors as well. This new index called ESES (Economic, Social and Environmental Stressors) was used for the first time when evaluating the KiGGS data (Helm et al. 2010). In KiGGS a total of 17,641 children and adolescents between 0 and 17 years were assessed and interviewed. For younger children, their parents completed the questionnaires. The ESES index could be determined for 13,887 children and adolescents (**Table 1**).

This paper discusses the basis for calculation of the new ESES index and an overview of the results of a correlation between the measured behavioural problems of KiGGS study participants and the ESES index. In addition, a comparison will be shown with Winkler's Social Class Index – important and widespread in German-speaking countries.

Calculation of ESES

The following socio-economic stressors have been selected according to Duncan:

- low education level of parents (only medium secondary school or no vocational training)

Table 1: Percentage of children and adolescents considered 'conspicuous' based on SDQ criteria, classified according to their individual stress situation.

SDQ scale	Non-stressed	Simply stressed			Twice as stressed	Three times as stressed
		Socio-economic stress only	Domestic stress only	Prenatal stress only		
	(n = 2,847)	(n = 2,471)	(n = 2,046)	(n = 762)	(n = 4,169)	(n = 1,592)
Total problem value (n = 13,887)	3.2%	6.3%	5.1%	3.7%	8.4%	14.5%
Emotional problems	6.1%	7.4%	7.4%	6.8%	10.2%	15.3%
Behavioural problems	8.8%	12.8%	12.9%	12.3%	16.2%	25.4%
Hyperactivity	4.7%	7.3%	5.3%	6.0%	9.0%	14.0%
Peer problems	7.2%	10.9%	10.6%	8.3%	13.0%	16.6%
Prosocial deficits	3.0%	3.6%	3.1%	2.5%	3.9%	5.0%

- low household income (< € 1,750 per month; derived from an empirical 20th KiGGS percentile)
- low occupational status of the head of household (farmer, semi-skilled or unskilled worker)

The potential environmental stressors were selected following other authors (Hoffmann et al. 2009; Oakes, Rossi 2003; Robin et al. 2007; Taylor et al. 1998) and divided into two groups:

a) home/neighbourhood: living in large cities (> 100,000 inhabitants), smoking in the home, cramped living conditions (< 21 m^2 per person; derived from empirical 20th KiGGS percentile) and mouldy walls or ceilings,

b) intrauterine environment: smoking and alcohol consumption of the mother during pregnancy (at least ‚occasionally').

For each component, adverse development has been coded with ‚1'; and normal with ‚0'. Multiplied by specific weights, the component values were added, i.e. sum score calculated, and graded on a range from 1 to 25. The weights have been empirically determined by regression of each component on a number of illnesses and disorders (details are described in Helm et al. 2010).

Applying the ESES index and comparison with Winkler's index

For this purpose the odds ratios (ORs) have been determined for the individual scales and the total problem value of the strengths and difficulties questionnaire (SDQ). The SDQ is an established tool for the detection of behaviour problems in children and adolescents (Goodman et al. 2000). ESES yielded basically similar results to Winkler's Social Class index (also scaled from 1 to 25). The ESES index however identified the children and adolescents with behavioral problems much more clearly than Winkler's index. For example, at identical scores, the risk for disorders of prosocial behaviour in the ESES index was about twice that for Winkler's index (**Figure 1**).

A comparison of test subjects from the German Health Interview and Examination Survey for Children and Adolescents, who were exposed to socio-economic stress only, prenatal stress only or domestic stress only, indicates that these stressors contribute to behavioural disorders independently of each other (**Table 1**).

For any one of the stressors among those considered, those within the socio-economic area seem to have the most unfavourable effect in terms of potency since they almost always identify higher percentages of 'conspicuous' than the stressors pertaining to the environment. An exception is behavioural disorders in which the stress of the residential area or its surroundings reaches 12.9 % 'conspicuous', the highest value in the presence of a single stress. A comparison of the environmental stressors contained in prenatal ESES, shows they are apparently less effective than those from the residential area or its surroundings.

In addition, the combined effect of a number of stressors seems to be stronger than the sum of the effects. 3.2 % of children and adolescents considered as 'non-stressed' were identified as 'conspicuous' (total problem value according to SDQ criteria). The respective figures were 6.3 %, 5.1 % and 3.7 % among children

with one stressor. In the transition from 'non-stressed' to 'one stressor', the number of 'conspicuous' as each SDQ rose by 0.5 to 2.6 percentage points. In the transition from 'only one stressor' to 'two stressors' the increase was between 2.1 and 4.7 percentage points; while in the transition from 'two stressors' to 'three stressors' the increase was as high as 6.1 percentage points. The increase is thus not linear (**Figure 2**). It seems as though the effect of additional stressors is higher in synergy rather than in cumulative individual components. An explanation for this cannot yet be offered. It is merely a reminder of similarities from toxicology, where for example a noxious substance increases the effect of a second by facilitating

Figure 1: Comparison of the results on conspicuous behaviour of KiGGS study participants based on the calculation using the new ESES index and Winkler's index.

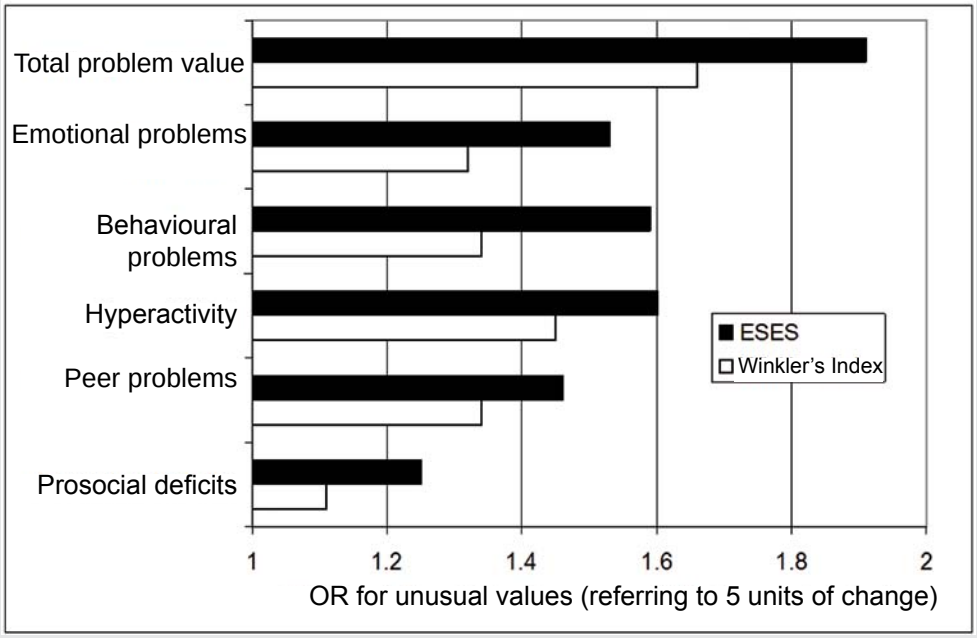
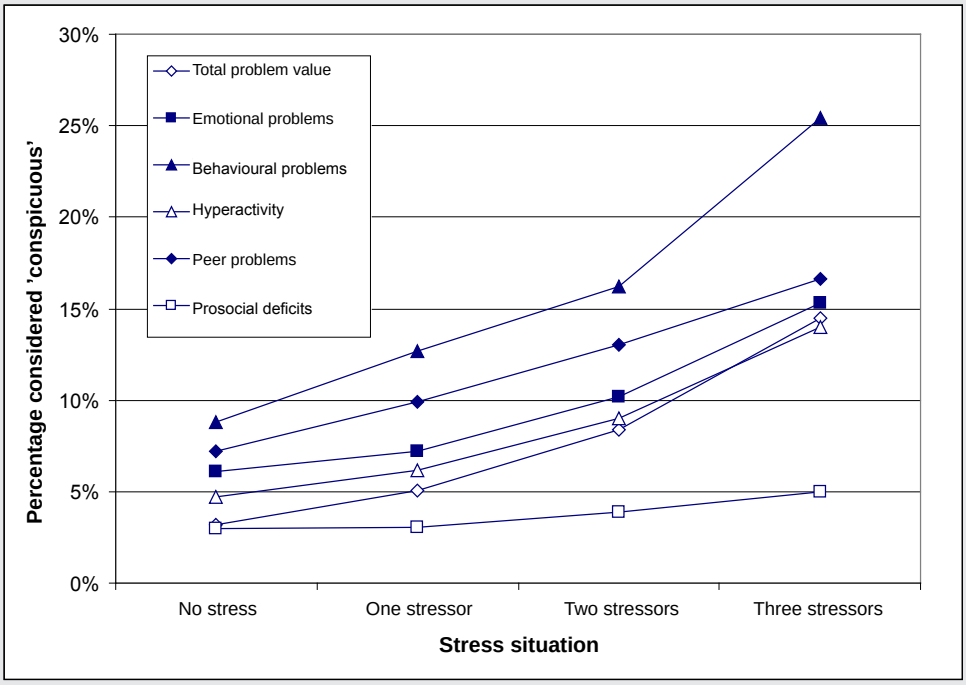


Figure 2: Increase of percentage of children and adolescents considered 'conspicuous' as a function of the number of stress factors.



its attack on the target organ, with the outcome that the effect of the two combined is stronger than the sum of the individual effects.

Conclusion

Environmental impacts must be taken into account when determining stress indices, since they may be associated with conspicuous behaviour independently of other stressors.

Literature

Duncan OD (1961): A socioeconomic index for all occupations. In: Reiss Jr AJ (ed.): Occupations and social status. New York: Free Press: 109-138.

Goodman R, Ford T, Simmons H, Gatward R, Meltzer H (2000): Using the Strengths and Difficulties Questionnaire (SDQ) to screen for child psychiatric disorders in a community sample. In: The British Journal of Psychiatry, 177: 534-9.

Grittner U, Bloomfield K, Kramer S et al. (2006): Die Konstruktion eines empirisch bestimmten Sozialschichtindexes mittels optimaler Skalierung am Beispiel Deutschland. In: Gesundheitswesen, 68 (2): 116-122.

Helm D, Laußmann, D, Eis D (2010): Assessment of environmental and socio-economic stress. In: Cent Eur J Public Health, 18 (1): 3-7.

Hoffmann B, Kolahgar B, Rauchfuss K et al. (2009): Childhood social position and associations between environmental exposures and health outcomes. In: Int J Hygiene Environ Health 212: 146-56.

KiGGS-Basispublikation (2007): Ergebnisse des Kinder- und Jugendgesundheitssurveys (KiGGS). In: Bundesgesundheitsbl – Gesundheitsforsch – Gesundheitsschutz, 50 (5/6).

Oakes JM, Rossi PH (2003): The measurement of SES in health research: current practice and steps toward a new approach. In: Soc Sci Med., 56: 769-84.

Robin M, Matheau-Police A, Couty C (2007): Development of a scale of perceived environmental annoyances in urban settings. In: J Environ Psychology, 27: 55-68.

Taylor SE, Repetti RL, Seeman T (1998): Health psychology: What is an unhealthy environment and how does it get under the skin? In: Annu Rev Psychol, 48: 411-47.

Winkler J, Stolzenberg H (1999): Der Sozialschichtindex im Bundesgesundheitssurvey. In: Gesundh Wes, 61 (2 Suppl): 178S-83S.

Winkler J, Stolzenberg H (2009): Adjustierung des Sozialen-Schicht-Index für die Anwendung im Kinder- und Jugendgesundheitssurvey (KiGGS) 2003/2006. In: Wismarer Diskussionspapiere Heft 07/2009: 1-28.

Contact

Dipl.-Biol. Detlef Laußmann
Robert Koch Institute
Division 22
General-Pape-Str. 62-66
D-12101 Berlin
Email: laussmannd[at]rki.de

The first author, Dr. Dieter Helm, regrettably died unexpectedly in April this year. This paper had been written in a good co-operation with him.

The basic right „healthy living“ – environmental politics as health and social politics

Diana Hein

Abstract: *Environmental health protection is of great importance in North Rhine Westphalia, which is characterised by a high density of population, traffic and industrial sites. In agglomeration areas it is evident that the exposure to air pollution and traffic related noise is different for social groups. Within the framework of a master plan environment and health the relation between exposure to pollution and social status will be analysed systematically.*

Introduction

European metropolitan areas still face special challenges, which primarily result from European Union commission specifications in the areas of ambient noise and air quality. Their focus is to protect people from health hazards. Environmentally related health protection is important in North Rhine-Westphalia (NRW) because of its high traffic and population density, and its advanced level of industrialisation. The objective is to minimise health risks related to environmental factors.

Environment and Health Action Programme North Rhine-Westphalia

Using a practical and project-oriented approach, in concordance with strategies of the World Health Organization and the EU-commission, North Rhine-Westphalia has a regional Environment and Health Action Programme (APUG North Rhine-Westphalia), which in recent years has focussed on the relationships between traffic, environment and health (Ministerium für Umwelt und Naturschutz, Landwirtschaft und Verbraucherschutz des Landes Nordrhein-Westfalen 2008).

Socio-spatial distribution of environmental pollution in North Rhine-Westphalia

In this context the aspect of socio-spatial distribution of exposure to environmental pollution was taken up early. In 2006 the GHS University Essen conducted the “Social distribution of exposure to environmental pollution and health consequences in industrially polluted areas in North Rhine-Westphalia” study, which further analysed data from the “Hot Spot study” using social distribution criteria (Kolahgar et al. 2006; Rauchfuss et al. 2008). The study found relationships between exposure and social status. The investigations were focussed on the health of children and their mothers living close to industrial facilities in Duisburg and Dortmund.

Prompted by the APUG NRW, the issue has been the topic of various theses by students of the Dortmund and Bielefeld universities. These dealt with aspects such as mobility management, the comparison of models from other European regions, and promoting health with neighbourhood redevelopment measures.

Currently it is generally assumed that there is a direct correlation between living on busy streets and the associated exposure to air pollutants and noise, and a lower social status. Brackeler street – one of the most polluted roads in North Rhine-Westphalia – is a main road in the northern part of Dortmund. A lot of socially vulnerable people live there – the proportion of welfare (Hartz IV) recipients is approximately 45 %. Gladbecker street in Essen is another example for how socially disadvantaged subpopulations are severely exposed to environmental influences. On the other hand, Corneliusstrasse in Duesseldorf shows that targeted measures for improving noise abatement (e.g. subsidising the installation of soundproof windows) and air quality management measures (heavy truck bans, environmental zones) contribute to preserving the quality of housing and social diversity in residential areas. Beyond that they are also generally suitable for stabilising conditions for the retail trade.

Environment and Health Master Plan

In its 2010 coalition agreement, the North Rhine-Westphalia government specifically highlighted the role of the state in protecting people from harmful environmental effects. This is to be achieved using a comprehensive integrated concept of "Environment and health". For this purpose a state-wide "Environment and Health Master Plan NRW" is being developed. Previous activities and structures of the APUG NRW are to be used as a platform for the development and implementation of the master plan. In addition to previous emphasis on traffic related health risks caused by air pollutants and noise, other topics such as drinking water, healthy nutrition and health effects related to climate change will be integrated. Close integration with "Environmental medicine" will be necessary. The issue of environmental justice will also be taken up in the context of the master plan. A systematic approach for examining the relationship between exposure to environmental pollution and social disadvantage will form the basis for further action.

Literature

Ministerium für Umwelt und Naturschutz, Landwirtschaft und Verbraucherschutz des Landes Nordrhein-Westfalen (ed.) (2008): Aktionsprogramm Umwelt und Gesundheit Nordrhein-Westfalen, Ergebnisse 2002-2007, Düsseldorf.

Kolahgar B, Hoffmann B, Jöckel KH (2006): Die soziale Verteilung von Umweltbelastungen und gesundheitlichen Folgen an industriellen Belastungsschwerpunkten in Nordrhein-Westfalen. http://www.apug.nrw.de/pdf/Abschlussbericht_Umweltgerechtigkeit.pdf (Accessed: 20.04.2011).

Rauchfuss K, Hoffmann B, Kolahgar B, Eberwein G, Kraft M, Franzen-Reuter I (2008): Umweltgerechtigkeit: Die soziale Verteilung von Umweltbelastungen und gesundheitlichen Folgen an industriellen Belastungsschwerpunkten in Nordrhein-Westfalen. In: UMID, 2/2008: 35-38.

Contact

Senior Ministerial Counsellor Dr. Diana Hein
Ministry for Climate Protection, Environment, Agriculture, Nature Conservation and Consumer Protection of the Federal State of North Rhine-Westphalia
Schwannstr. 3
D-40476 Düsseldorf
Email: diana.hein[at]mkulnv.nrw.de

Impact of individual social characteristics and factors of the neighbourhood socioeconomic context on inequalities in children's environmental quality

Inke Thiele and Gabriele Bolte

Abstract: *Social disparities in housing conditions, environmental exposures and children's environmental health is a thematic focus of the health monitoring units (GME) in the federal state of Bavaria, Germany. We used data of the study region Munich from three surveys of the GME performed in 2004-2007 (N=3,700) and data from Munich's statistical office to analyse for the first time individual and neighbourhood socioeconomic factors simultaneously in regard to children's environmental quality by multilevel analysis. The bivariate analysis yielded significant relations between several individual as well as contextual socioeconomic characteristics and environmental quality. In the multilevel analysis, only income showed a significant association among the individual indicators. Even controlled for the individual socioeconomic characteristics a high percentage of low income households in the neighbourhood was significantly related to a disadvantaged environmental quality.*

Environmental justice as a thematic priority of the Health Monitoring Units in Bavaria

Health Monitoring Units (HMU) have been operating in three counties and three cities in Bavaria since 2004 – a cooperation between the local health authorities and the Bavarian Health and Food Safety Authority (Bolte et al. 2007). The HMUs' objective is to obtain relevant current data on children's health in Bavaria as a priority and to identify and quantify health risks, evaluate health promotion measures and ultimately to contribute to the establishment of intervention strategies.

As reported in an earlier UMID paper, social inequality in connection with environmental burdens, resources and environment-related health are thematic priorities of the HMUs (Bolte, Fromme 2008).

Impact of individual social characteristics and factors of the neighbourhood socioeconomic context

Background and objective

Against the backdrop of international discussions on environmental justice and health, and the importance of social inequality in environmental burdens ("environmental inequalities"), the relationship between social situation and environmental exposure has been increasingly investigated in Europe over the last few years (WHO Regional Office for Europe 2010; Bolte et al. 2010). The studies usually show greater burdens in deprived social situations. A systematic, comparative study of the importance of different social indicators and the inclusion of contextual factors at the neighbourhood level has so far been lacking. So for the first time, the following two issues based on socioeconomic and environmental data of the HMU surveys of 2004/2005, 2005/2006 and 2006/2007 in the study region of Munich have been investigated:

- Is there a relationship between socioeconomic characteristics of the neighbourhood and environmental quality of the children's or families' environment respectively, while controlling for their individual socioeconomic characteristics?
- Which socioeconomic indicators are best at describing exposure variation?

Study population and methodology

The population analysed covered 3,700 Munich children of between 5 – 6 years old. The 19 school districts in which these children live represented the contextual level. Sociodemographic characteristics of the population with primary residence in these school districts were selected as contextual factors. The data were provided by the City of Munich

Statistics Office. The analyses of the socioeconomic contextual factors used the expression of a disadvantaged social situation, divided into tertiles of high, medium and low percentage of households with each characteristic.

The subjective burden on the families of the three negative environmental influences of noise, air pollution and lack of accessible green space in their neighbourhood was selected as an environmental exposure (cf. Bolte, Fromme 2008). An adverse environmental quality was defined as a just bearable, strong or a very strong burden by at least two of the three environmental influences (Thiele 2010).

The relationship between individual socioeconomic characteristics and the environmental quality of the neighbourhood was determined in bivariate analyses. A multilevel model (Diez-Roux 2000) was used as an appropriate method to simultaneously analyse characteristics of different levels (individual level: family, contextual level: neighbourhood) and to consider different dependencies. A two-level model in the form of a random intercept model was selected. Social variables which failed to show a significant relationship with environmental quality in the bivariate analysis, were not included in this model. In order to avoid collinearity, only one of socioeconomic characteristics which correlated strongly with one another in bivariate tests, was included in the multivariate analysis.

Results of bivariate analysis

The bivariate analysis showed a significant relationship between the environmental quality of the children's neighbourhood and the six individual socioeconomic characteristics of the families displayed in **Table 1a**. The direction of this relationship was always inverse, i.e. the worse the social situation of families, the higher the percentage of families with an adverse environmental quality.

Likewise, six socioeconomic contextual characteristics showed a significant association with the environmental quality of the children's neighbourhood (**Table 1b**). The characteristics of unemployment ratio, percentage of low-income households, percentage of low education households and percentage of households with children of foreign nationality showed that the higher the percentage of households with any one of these characteristics of social disadvantage in the school district, the higher the percentage of families with an adverse environmental quality. However, this relationship did not apply for the two characteristics of percentage of single-parent households and percentage of households with three or more children. Here the percentage of families with adverse environmental quality was higher at a lower expression of the characteristics.

Results of the multilevel analysis

A mutual adjustment for the effects of the different individual characteristics of social situation and neighbourhood contextual factors was performed within the multilevel analysis. The final model contained the five indicators of gainful employment of parents, household equivalent net income, parents' education, single parent households and child's nationality at the individual level. At the aggregated school district and neighbourhood level, respectively, the model contained the two characteristics of percentage of low-income households and percentage of single-parent households.

At the individual level, only the characteristic of household equivalent net income proved to be significantly associated with the families' residential environment conditions. The direction of this relationship is inverse: families with a medium income face a 40 % higher risk that their residential environment quality is unfavourable (odds ratio (OR): 1.39 [95 % confidence interval (CI): 1.05-1.85]) and families with relative poverty face about a 70 % higher risk (OR: 1.71 [95 % CI: 1.23-2.39]) compared to high-income families.

The characteristic of income or poverty also exhibited a significant relationship with environmental quality at the contextual level with a simultaneous adjustment for individual social variables. Families in school district with a high percentage of low-income households have a 2.5-fold risk of adverse residential environment quality compared to families in school districts with a low percentage of low-income households (OR: 2.50 [95 % CI: 1.24-5.05]).

Discussion and outlook

In our study, the term adverse environmental quality was defined based on the parents' data on how they perceive their subjective burden from air pollution, noise level and lack of accessible green space in the neighbourhood. For noise at least, it could be shown that the subjective burden of road traffic noise (noise annoyance) correlates strongly with their objective exposure (noise level) based on the data of the 3rd HMU Survey in 2006/2007 and the exposure data from the City of Munich noise map (Kohlhuber et al. 2009).

Table 1: Relationship between socioeconomic characteristics and adverse environmental quality.

a) Individual characteristics		b) Context characteristics	
Individual socioeconomic characteristics of the families	**Adverse environmental quality [%]**	**Socioeconomic characteristics of the population's primary residence in the school districts**	**Adverse environmental quality [%]**
Employment of parents		**Unemployment ratio**	
unemployed [(a)]	28.5	high percentage (6.01 - 8.00 %)	19.0
employed	17.3	low percentage (2.80 - 4.00 %)	12.4
Equivalent net household income [(b)]		**Low-income HH**	
low ("poor")	26.0	high percentage (21.88 - 37.94 %)	27.9
medium	20.6	medium percentage (19.53 - 21.87 %)	15.9
high	13.8	low percentage (5.08 - 19.52 %)	12.9
Education of parents [(c)]		**HH with low education**	
low	21.4	high percentage (42.60 - 50.92 %)	26.0
medium	19.8	medium percentage (39.90 - 42.59 %)	14.3
high	16.2	low percentage (29.54 - 39.89 %)	15.2
Single parent		**HH with single parents**	
yes	21.3	high percentage (2.48 - 3.20 %)	14.8
no	17.6	low percentage (1.38 - 2.00 %)	21.9
Nationality of the child		**HH with foreign child/ren**	
foreigner	22.8	high percentage (25.17 - 32.79 %)	22.2
German	17.0	low percentage (7.33 - 19.44 %)	10.1
High user density of the dwelling [(d)]		**HH with three or more children**	
yes	23.4	high percentage (1.48 - 2.62 %)	10.2
no	15.0	low percentage (0.47 - 1.15 %)	24.4

Adverse environmental quality: just bearable, strong or very strong impairment by at least two of the three negative environmental influences noise, air pollution and lack of accessible green space in the neighbourhood.
HH = household.

Only selected categories of the characteristics with significant bivariate relationships are shown.
a: One unemployed parent, the other is not working or unemployed.
b: Equivalent net household income of the families: low: < 60 % of median equivalent net household income in Bavaria; medium: 60 % to median, high: > median.
c: Parents' education: low: max. secondary school (Hauptschule) education; medium: O-level; high: admitted to technical college, or A-level.
d: More than one person per room or less than 20 m² living space per person.

Even if the subjective perception of the environmental quality did not correspond exactly to the objective environmental exposure in the neighbourhood, this perceived burden is however, significant with regard to health (O'Campo, O'Brian 2006). Nevertheless, the health relevance of the social differences with regard to the burdens from noise, air pollution and lack of accessible green areas must still be proven.

Our multilevel analysis based on individual family data and aggregated resident population data of the City of Munich showed that the characteristic relative income poverty, both at the individual family level and at the resident population level, is associated most strongly with an adverse environmental quality in the neighbourhood.

Evidence on the importance of contextual factors at the neighbourhood level can contribute to the development of innovative intervention models at the community level (Pickett 2001; Leyland, Gronewegen 2003).

Acknowledgement

We cordially thank Mr. Ronald Bauch of the City of Munich Statistics Office for the provision of data aggregated at a school district level and Ms. Lana Hendrowarsito, Department of Occupational and Environmental Epidemiology of the Bavarian Health and Food Safety Authority (LGL) for data processing.

HMU study group of the first three surveys in 2004 – 2007:
Bavarian Health and Food Safety Authority, Oberschleißheim and Munich (Gabriele Bolte, Hermann Fromme, Annette Heißenhuber, Lana Hendrowarsito, Martina Kohlhuber, Christine Mitschek, Gabriele Morlock, Michael Mosetter, Uta Nennstiel-Ratzel, Dorothee Twardella, Manfred Wildner); Public Health Authority, Bamberg State Administration Office (Wiltrud Doerk, Rosemarie Sittig, Winfried Strauch, Heidi Thamm); Public Health Authority, Günzburg State Administration Office (Tatjana Frieß-Hesse, Dagmar Rudolph, Roland Schmid, Gudrun Winter); Public Health Authority, City of Ingolstadt (Christine Gampenrieder, Margot Motzet, Elizabeth Schneider, Traudl Tontsch, Gerlinde Woelk); Health and Environment Office, City of Munich (Sylvia Kranebitter, Heidi Mayrhofer, Gertraud Rohrhirsch, Brigitte Weise); Public Health Authority, Schwandorf State Administration Office (Kornelia Baranek, Gitte Koch-Singer, Maximilian Kühnel); Institute for Social Paediatrics and Adolescent Medicine, Ludwig Maximilian University Munich (Ladan Baghi, Rüdiger von Kries); Bavarian State Ministry for the Environment and Health (Bernhard Liebl).

Literature

Bolte G, Heißenhuber A, von Kries R et al. (2007): Gesundheits-Monitoring-Einheiten (GME) in Bayern: Konzept, Ziele und thematische Schwerpunkte des 1. Surveys zu Umwelt und Gesundheit von Kindern. In: Bundesgesundheitsblatt – Gesundheitsforschung – Gesundheitsschutz, 50: 476-483.

Bolte G, Fromme H für die GME-Studiengruppe (2008): Umweltgerechtigkeit als Themenschwerpunkt der Gesundheits-Monitoring-Einheiten (GME) in Bayern. In: UMID, 2/2008: 39-42.

Bolte G, Tamburlini G, Kohlhuber M (2010): Environmental inequalities among children in Europe – evaluation of scientific evidence and policy implications. In: Eur J Public Health, 20: 14-20.

Diez-Roux AV (2000): Multilevel analysis in public health research. In: Annu Rev Public Health, 21: 171-192.

Kohlhuber M, Mayrhofer H, Kemmather D et al. (2009): Subjective annoyance and road traffic noise exposure in Munich: results of questionnaire data and noise mapping. In: Epidemiology, 20, suppl. 6: S200.

Leyland AH, Groenewegen PP (2003): Multilevel modelling and public health policy. In: Scand J Public Health, 31: 267-274.

O'Campo P, O'Brien Caughy M (2006): Measures of residential community contexts. In: Oakes JM, Kaufman JS (eds.): Methods in social epidemiology. San Francisco. Jossey-Bass: 193-208.

Pickett KE, Pearl M (2001): Multilevel analyses of neighbourhood socioeconomic context and health outcomes: a critical review. In: J Epidemiol Community Health, 55: 111-122.

Thiele I (2010): Soziale Ungleichheit bei Umweltqualität bei Kindern in München – eine Mehrebenenanalyse. Masterarbeit im Rahmen des postgradualen Studiengangs Master of Public Health, Ludwig-Maximilians-Universität München.

WHO Regional Office for Europe (2010): Environment and health risks: a review of the influence and effects of social inequalities. Copenhagen. http://www.euro.who.int/__data/assets/pdf_file/0003/78069/E93670.pdf (Accessed: 11.01.2011).

Contact

PD Dr. Gabriele Bolte, MPH
Bavarian Health and Food Safety Authority
Department of Occupational and
Environmental Epidemiology
Pfarrstr. 3
D-80538 München
Email: gabriele.bolte[at]lgl.bayern.de

Exposure of preschool children to environmental pollutants – results of the Saxony-Anhalt pre-school study

Constanze Gottschalk[1], Julia Fleischer[1], Lutz Gräfe[1], Armin Sobottka[1], Hanna Oppermann[1], Frank Benkwitz[2]

Abstract: *Preschool children spend most of their time inside their homes, in their neighbourhoods or in the kindergarten. Depending on conditions in their neighbourhoods, they are exposed to environmental influences such as noise and exhaust fumes to varying degrees. These influences constitute potential health hazards, especially for children. The conception of a school beginners study made it possible to assess and evaluate important aspects of the health, the environment and the lifestyles of preschool children in Saxony-Anhalt (Germany). Road traffic analyses in the vicinity of family-homes showed a correlation between the family home's exposure to traffic emissions and the socioeconomic status of the family. Moreover, the children's exposure to road traffic was correlated with the socioeconomic status of the family. Children living in homes with high traffic exposure showed a higher prevalence of respiratory diseases.*

Introduction

The Saxony-Anhalt Pre-school Study looks back on 20 years of continuous work in the area "children – environment – health". The pre-school study made it possible to reliably monitor and assess many important aspects of the health, the environment and the lifestyles of children who are about to go to school in Saxony-Anhalt – it also provided data for the support of suitable prevention concepts and serves as a basis for assessing current health policy issues.

Every day, children spend a considerable amount of time in their parent's home, their immediate neighbourhood and/or in day care centres. Not just their home but the neighbourhood as well affects their health. Depending on location and type of neighbourhood, children are exposed to different levels of environmental pollution such as noise and car exhaust. These influences are potential health hazards and put particularly children at risk. Since they are still in a highly dynamic stage of development and growth, they have an increased vulnerability to environmental pollution (RKI 2008).

Numerous epidemiological studies have confirmed the impact of socioeconomic status on health. The socially disadvantaged are more often exposed to higher levels of environmental pollution, but at the same time typically lack sufficient resources to cope with them. Children from socioeconomically disadvantaged families more often exhibit developmental deficits and early health problems and are more frequently affected by illnesses caused by environmental factors (Mielck 2008; Lange et al. 2007; Bolte, Mielck 2004).

Approach

The core element of the cross-sectional study was the standardised questionnaire survey which has been conducted annually since 1991. In addition to a comprehensive section with questions about illnesses and symptoms regarding the lifetime prevalence of diseases, symptoms indicative of allergic illnesses, the prevalence of diseases and symptoms in the last 12 months before the school enrolment health examination, a section on sociodemographic characteristics

[1] Saxony-Anhalt State Office for Consumer Protection, Division of Urban Sanitation
[2] Saxony-Anhalt Ministry of Health and Social Welfare

Table 1: Classification of the exposure of the home and/or day-care centre to traffic emissions.	
Degree of exposure	**Categorisation**
1: very low	Outlying urban periphery location and/or suburban character, very low traffic density (local resident traffic only)
2: low	Residential area in the city, urban periphery location, low traffic density
3: moderate	Residential area in the city, close to city centre, medium traffic density, commercial traffic
4: high	Located on a busy trunk road, high traffic density, medium share of trucks, transit traffic, but farther away from the street and/or better aeration than category 5
5: very high	Located on an inner city traffic hotspot with an enclosed character, very high traffic density , significant share of trucks, high share of transit traffic

asked the parents about their tobacco consumption, personal health regimen and their housing and living conditions. From 1991 to 2005, 5 to 6 year old children, and from 2005, 4 to 5 year old children were invited to participate in the study as part of the school enrolment health examination. Between 1991 and 2009, data from a total of 33,701 children were collected, with an overall response rate of 83 %. In 1991, the selection of study sites was based on a selection of diverse regions with varying airborne sulphur dioxide and dust pollution. This selection was retained throughout the years of the investigation, including after subsequent air quality improvements. Study locations selected were the cities of Halle/Saale and Merseburg with former highly polluted urban regions, the city of Magdeburg as a previously moderately polluted urban region, and the Altmark town of Klötze (up to 2001), Salzwedel, Osterburg and Gardelegen as control areas in rural regions. From 2003 to 2007 Halberstadt in Harzvorland was added to the study.

In order to more accurately investigate the effects of outside air, particularly car exhaust pollution, on the health of the children and to examine the impact of socioeconomic status on exposure to these pollutants, the standardised questionnaire asked parents about the location of the home and day-care centre in terms of their proximity to a busy street. In their answers, the parents could choose between “less than 10 metres”, “10 to 50 metres” and “more than 50 metres”. They were also asked to answer the following question: “Is your child exposed to car exhaust fumes for more than one hour a day – whether on foot or on a bicycle?”

The school enrolment class of 2010 marks the first time that a small-scale traffic analysis was conducted in the Magdeburg area – in co-operation with the State Office for Environmental Protection Saxony-Anhalt, using the Air Monitoring and Information System Saxony-Anhalt (LÜSA). For this purpose the exposure to traffic pollutants (nitrogen dioxide (NO_2) and particulate matter) of the homes of 394 study participants from this school enrolment class was officially assessed. To this end, five categories (“very low”, “low”, “moderate”, “high” and “very high”) were set for the exposure levels. In a second step, the residence was assigned to a category based on the exact address. The categories were defined according to emission exposure and traffic as represented in **Table 1**.

The classification was made as follows:

- Homes in definite traffic hotspots were placed in the highest category (5), i.e. very high exposure.
- Addresses in residential areas in the city were placed in the moderate category (3), provided they were not located directly on busy main roads.
- Addresses in residential areas on the outskirts were assigned to the lowest category (1).
- For greater differentiation, categories (2) and (4) were created.
- In some cases however, in order to achieve meaningful classifications, the introduction of intermediate categories, for example 2-3, became necessary, since the exposure level could not be clearly assigned to a single category.
- For homes where the address information did not show whether the home was located on the highly exposed front (“street”) of a busy main road or on the less exposed rear (“courtyard”), both categories were listed, separated by a forward slash (for example: 4/2 and/or 4/3).

A subsequent, clearer classification, e.g. based on interior measurements, was not possible, since insufficient interior data was available for these homes.

In order to be able to make statistically meaningful observations of homes which were assigned to two

categories, averages were created for performing calculations – both for homes with different exposure levels on the front and back of the house and for homes in the intermediate categories (**Table 2**).

After a residential address had been allocated to an air pollution category, the State Office for Consumer Protection Saxony-Anhalt merged the categories with the anonymised questionnaires in order to be able to statistically determine the correlation between air pollution, state of health and socioeconomic status. Likewise, the day care centres attended by the study participants were classified and allocated to the anonymised questionnaires.

All statistical calculations were performed using the SPSS software application [SPSS Inc. (2009) SPSS® Base 18.0. Chicago 2009].

To determine the socioeconomic status, the "Brandenburg Social Index" was used "(Böhm et al. 2007). For assessing the social index, the study recorded education level (low/ medium/ high) and employment status (yes/no) of the parents. Based on the classification into the socioeconomic status groups the correlation between socioeconomic status, occurrence of illness, risk factors and/or exposure was examined. Parents' employment data were recorded starting from 1996; therefore a comparative analysis is only possible from that date forward.

Table 2: Calculation of the exposure level in intermediate categories.

Classification (Examples)	Exposure level calculated
1-2 and 1/2	1.5
2-3 and 2/3	2.5
3-4 and 3/4	3.5

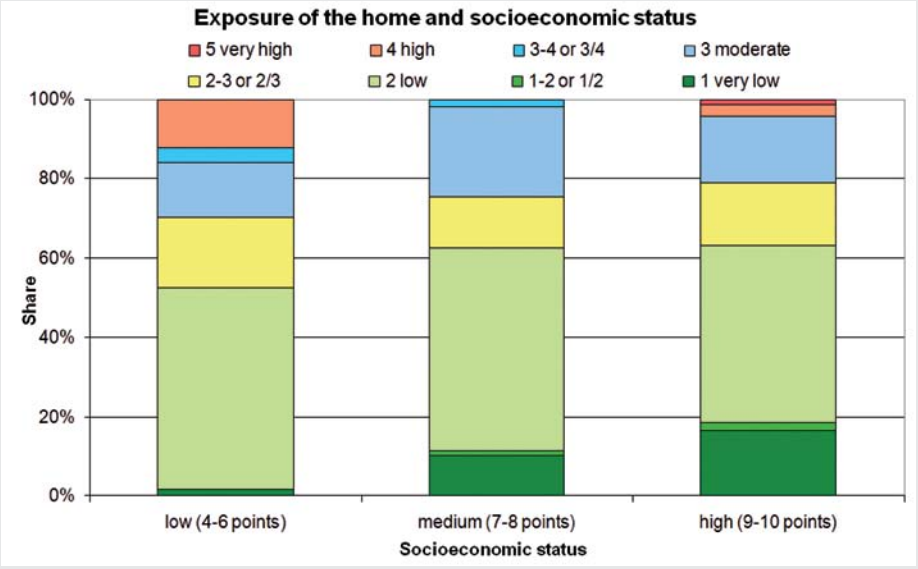
Results

Small-scale traffic analysis (Magdeburg)

With 324 out of 394 homes examined (82.2 %) in Magdeburg, the predominant share of homes was in the "low" or "moderate" (2 or 3) exposure categories for traffic emissions. 50 homes (12.7 %) were classified as belonging to the 1 or 1-2 exposure categories, 20 homes (5.1 %) were in categories 3-4, 4 or 5. None the day care centres included were in the "very high" or "high" traffic exposure categories. The majority of children, a total of 89.6 %, attended day care centres in the "low" or "moderate" categories (2 or 3). 8.2 % of the children attended centres in category 1 or 1-2. 2.2 % of the children attended centres in the "moderately high" category (3-4).

Significant correlation was determined between exposure of the home to traffic emissions and the socioeconomic status of families. Accordingly, children from families of high socioeconomic status lived significantly more frequently in homes with lower levels of exposure to traffic emissions than children from

Figure 1: Exposure of the home to traffic emissions as a function of socioeconomic status, Magdeburg children school enrolment class of 2010, Saxony-Anhalt pre-school study.



families of low socioeconomic status, in which cases the parents' level of education was less of a determining factor than employment status (**Figure 1**).

A very clear relationship was found between the categorisation of the home in terms of traffic emissions exposure and the following question from the questionnaire: "How far away (straight line) from a busy street is the home in which the child now lives? "This validates the approach taken when categorising into different exposure levels (**Figure 2**).

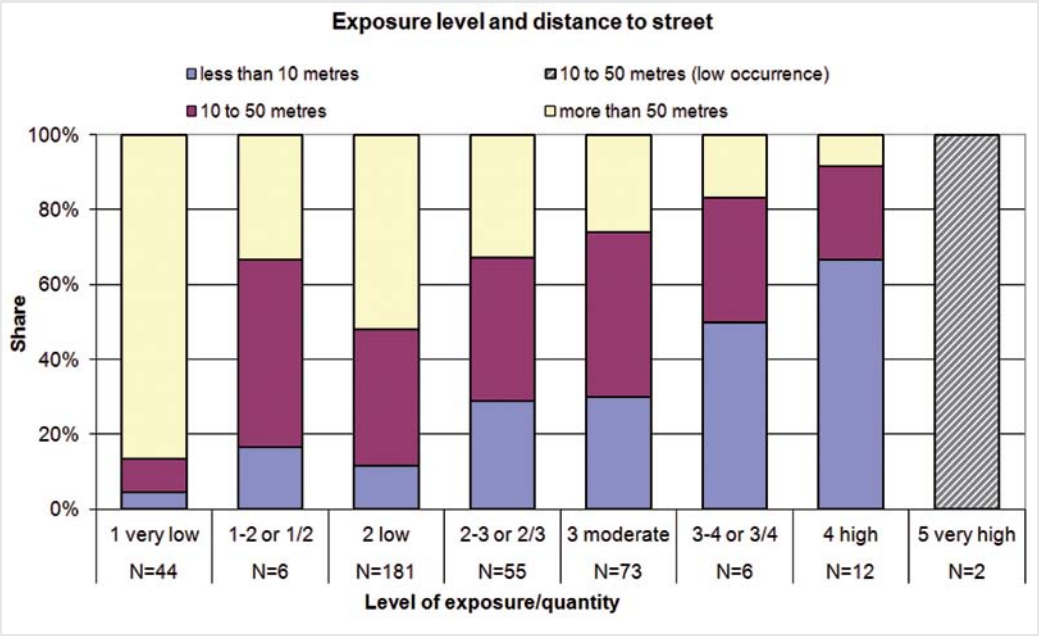
No correlation could be established between outside air pollution of the residential surroundings and children's illnesses and/or disease symptoms. In contrast, a significant correlation was proven between the outside air pollution exposure of the day care centre and "dry cough at night in the last 12 months while not suffering from a cold or bronchitis" (per stage odds ratio (OR): 2.677; 95 % confidence interval (CI): 1.276-5.617). The size of the study sample was probably too small (only one random sample of Magdeburg children's school enrolment class of 2010) to detect other correlations in this small-scale traffic analysis. In the overall study sample there were quite significant correlations between level of traffic exposure (obtained from distance of the home and day care facility to busy streets and the exposure to car exhaust fumes while outside) and illnesses and/or disease symptoms.

Distance of the home and day care facility to a busy street

The location of the home in terms of proximity to a busy street is clearly affected by the socioeconomic status. Altogether 38 % of children from families with low socioeconomic status lived in homes which were located less than 10 metres from a busy street, as opposed to children from families with high socioeconomic status, out of which only 19.2 % lived that close to such streets. Only 28.8 % of the children from families with low socioeconomic status lived in homes located more than 50 metres away from a busy street. On the other hand, 54.6 % of the children from families with high socioeconomic status lived more than 50 metres away from such a street.

Looking at the evolution in different status groups, a slight degradation of the housing situation can be observed among families with low socioeconomic status, with respect to their proximity to a busy street (per year OR: 0.954; 95 % CI: 0.937 - 0.970). Among families of medium socioeconomic status the change is not significant. Among families with high

Figure 2: Exposure level of the home to traffic emissions compared to the distance of the home to a busy street, Magdeburg children school enrolment class of 2010, Saxony-Anhalt pre-school study.



Note: 15 questionnaires without parental data about „Distance to street".

socioeconomic status their housing situation is significantly improved (per year OR: 1.022; 95 % CI: 1.012-1.033) (**Figure 3**).

The parents' origin was found to be an additional factor influencing the housing situation. In 2010, children from families with an immigrant background lived significantly more frequently closer to busy streets (OR 1.3; 95 % CI: 1.18-1.54) than children from families without an immigrant background. This factor was also observed in the KiGGS study (RKI 2008).

Exposure to traffic emissions due to time spent outdoors daily

The question "Is your child exposed to car exhaust fumes outdoors for more than one hour a day – whether on foot or on a bicycle?" was answered "yes" for approximately 60 % of all children from the school enrolment classes from 1996 to 2010 by their parents in the questionnaire.

With a share of 76 %, children from families of low socioeconomic status were significantly more often exposed to car exhaust fumes than children from families with high socioeconomic status at a share of 47 % (low compared to medium socioeconomic status OR: 1.879; 95 % CI: 1.716 -2.057; high compared to medium socioeconomic status OR: 0.497; 95 % CI: 0.465-0.531).

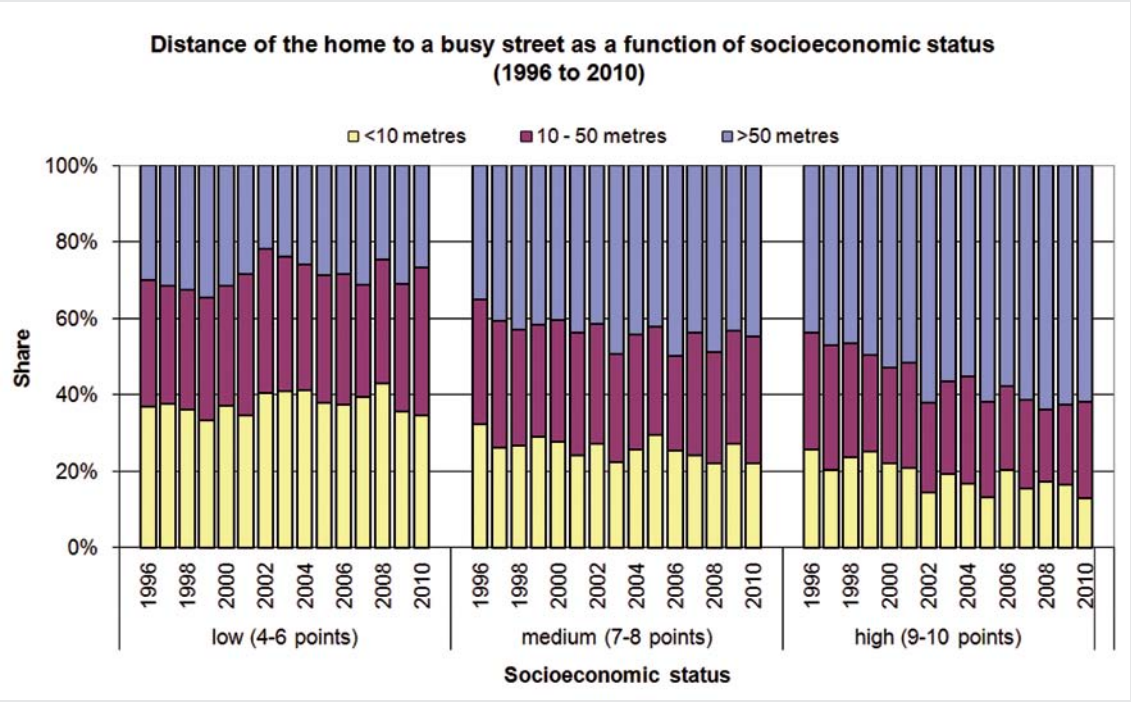
Adverse effects on the children's health from outside air pollutants

Respiratory tract inflammation and infections

During the investigation period from 1991 to 2010, the occurrence of bronchitis decreased continuously in all study sites. To a large extent, this was due to drastically reduced sulphur dioxide and industrial dust pollution. Since 2000 bronchitis prevalence has been more or less on the same level at approximately 33 %. Cities exhibit the highest prevalence rates. Highly educated parents increasingly reported cases of bronchitis among their children. Children from less well educated parents had to be treated for bronchitis in hospital more often. In regards to exposure to car exhaust fumes it was found that children whose kindergarten was farther away from a busy street suffered from bronchitis less often (OR: 0.909; 95 % CI: 0.859-0.961).

For school enrolment classes from 1991 to 2010, pneumonia was reported for 11.1 % of the children

Figure 3: Housing situation development as a function of socioeconomic status, school enrolment classes of 1996-2010, Saxony-Anhalt pre-school study.



although a significant decrease in the prevalence of this illness could be seen over the entire time period. A significant correlation was seen between the proximity of a kindergarten to a busy street and the frequency of pneumonia occurrences. Children whose kindergarten was located farther away from a busy street suffered a significantly lower rate of pneumonia infection (OR: 0.886; 95 % CI: 0.821-0.957).

Sinusitis was identified in 3.6 % of all children about to be enrolled in school during the investigation period from 1991 to 2010 – with an irregular trend, initially with a downward tendency but then followed by increased occurrences of the illnesses. Again, a greater distance to a busy street positively affected the prevalence of the disease. Children whose kindergarten was located farther away from a busy street, suffered from sinusitis significantly less often (OR: 0.861; 95 % CI: 0.762-0.974).

Parents indicated an increased susceptibility to colds for approximately 16 % of all children about to be enrolled in school. This value remained relatively constant over the 20 years of the investigation period. A greater than one hour exposure of children to car exhaust fumes was clearly associated with an increased inclination towards colds.

For children from families of low socioeconomic status an increased susceptibility to colds was found. On a daily basis, these children were also exposed to car exhaust fumes outdoors for significantly longer periods of time, and lived significantly more often near a busy street (see above). Children who lived in a home located farther away from a busy street were significantly less often described by their parents as susceptible to colds(OR: 0.836; 95 % CI: 0.751-0.930).

Allergies

A steady increase of bronchial asthma was observed in all study sites by the year 2010. In terms of exposure to car exhaust fumes, it was found that children who lived in a home located farther away from a busy street were significantly less often affected with bronchial asthma (OR: 0.874; 95 % CI: 0.777-0.983). A direct correlation between socioeconomic status and illness frequency could not be demonstrated.

Summary

Using small-scale traffic analysis, a significant correlation between the level of exposure of the home to traffic emissions and the socioeconomic status of families was determined for the partially random sample of 394 Magdeburg children of the school enrolment class of 2010. Children from families of high socioeconomic status lived in homes with lower levels of exposure to traffic emissions significantly more often than children from families of low socioeconomic status. For the overall study sample, a significant correlation between the level of traffic exposure and respiratory tract diseases and/or disease symptoms of children was determined. Environmental factors as well as lifestyle and early childhood influencing factors on health development of children about to be enrolled in school will be shown in detail and discussed in a final report entitled “Environmental effects on the health of children – Saxony-Anhalt Pre-school Study 2009” by the Saxony-Anhalt Ministry of Health and Social Welfare.

Literature

Böhm A, Ellsäßer G, Lüdecke K (2007): Der Brandenburger Sozialindex. Ein Werkzeug für die Gesundheits- und Sozialberichterstattung auf Landes- und kommunaler Ebene bei der Analyse von Einschülerdaten. In: Gesundheitswesen 2007; 69: 555-559.

Bolte G, Mielck A (eds.) (2004): Umweltgerechtigkeit. Die soziale Verteilung von Umweltbelastungen. Weinheim/München: Juventa.

Lange M, Kamtsiuris P, Lange C, Schaffrath Rosario A, Stolzenberg H, Lampert T (2007): Messung soziodemographischer Merkmale im Kinder- und Jugendgesundheitssurvey (KiGGS) und ihre Bedeutung am Beispiel der Einschätzung des allgemeinen Gesundheitszustands. In: Bundesgesundheitsblatt – Gesundheitsforschung – Gesundheitsschutz, 50: 578-589.

Mielck A (2008): Soziale Ungleichheit und Gesundheit in Deutschland. Die internationale Perspektive. In: Bundesgesundheitsblatt – Gesundheitsforschung – Gesundheitsschutz, 51: 345 -352.

Ministerium für Gesundheit und Soziales des Landes Sachsen-Anhalt (2010): Auswirkungen der Umwelt auf die Gesundheit von Kindern. Schulanfängerstudie Sachsen-Anhalt 2009.

RKI (Hrsg.) (2008): Lebensphasenspezifische Gesundheit von Kindern und Jugendlichen in Deutschland. Ergebnisse des Nationalen Kinder- und Jugendgesundheitssurveys (KiGGS). Berlin. Robert Koch-Institut. Berlin.

Contact

Dr. med. Constanze Gottschalk
State Office for Consumer Protection
Division 2
Wallonerberg 2-3
D-39104 Magdeburg
Email: constanze.gottschalk[at]lav.ms.sachsen-anhalt.de

Mould and damp in houses – focusing on households with lower social status

Bettina Kaiser and Heike Otremba

Abstract: *Mould and damp in indoor environments is a major focus of the work in the field of environmental hygiene at the Bremen local public health office. Data from a questionnaire-based study conducted in 2006 revealed that mainly people with low income and higher education level requested information and guidance. This induced us to establish a number of changes in our work to reach more people with lower social status. Data from the continuation of the questionnaire study up to 2010 show that a higher percentage of people with low income and lower education level have requested information. Thus, the changes seem to be successful and the approach developed will be continued.*

Background

The Bremen Local Public Health Office has offered advice to citizens on environmental health issues over many years. The paper "Small-scale health reporting: mould and damp in houses and social status" in the UMID Special Issue "Environmental justice – environment, health and social status", Issue 2/2008, contained this advice, as well as the evaluation of the collected data and the results of an additional poll in 2006. Data were collected through on-site visits using a questionnaire on damage from mould and damp in the home, health and social status, all of which was later analysed. It became apparent that predominantly low income households were looking for advice and assistance from the Local Public Health Office. About 56 % of households surveyed lived in relative poverty, based on the monthly household equivalent net income (Statistisches Bundesamt 2004). At the same time it also became clear that the percentage of households with a high education level was comparatively high. However, a special socio-spatial distribution of the affected households could not be derived from the data (Becker et al. 2007).

From these results, apart from the necessity for providing free advice, it was concluded that low-income and educationally disadvantaged households increasingly need to be targeted. For this additional work, various approaches have been followed with the objective of talking to intermediaries who have access to the homes of those affected. The intermediaries were from local initiatives and self-help groups. Additionally, targeted information meetings were offered to institutions and social welfare authorities and in particular, to outreach services.

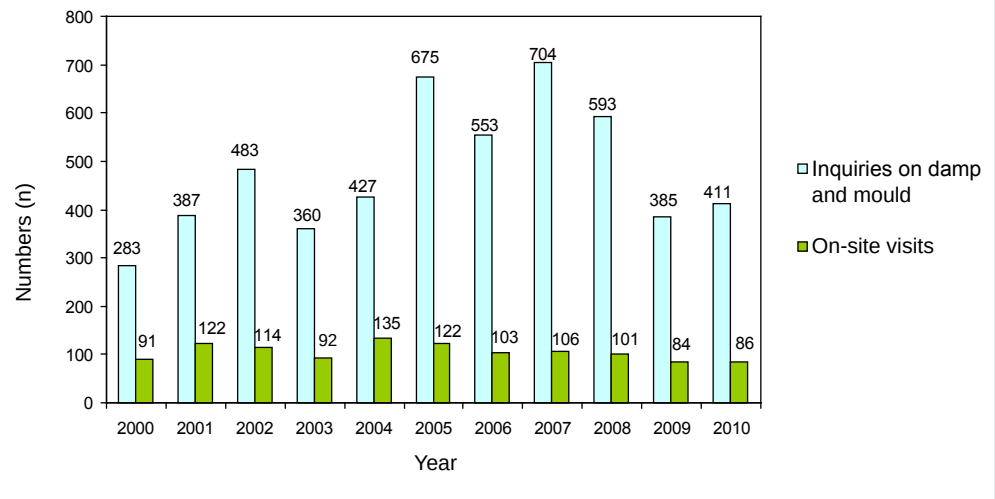
This paper records the continuation of counselling and development of the projects. The additional survey was also continued using on-site visits. The aim was to examine whether the advisory service had reached significantly more low-income and educationally disadvantaged households. Since health and injury data were not relevant, and for reasons of practicability, the survey was abbreviated to education and income data only.

Development of the inquiries

The total number of inquiries concerning environmental health has declined slightly since 2008 and is placed at approximately 1,400 per year on average over the last 10 years. About 40 % of the inquiries have addressed indoor air. More than two-thirds of these still refer to inquiries about damp and mould. In selected cases a site inspection has been offered. **Figure 1** shows the trend in inquiries and the numbers of on-site visits concerning damp and mould in the years 2000 to 2010.

The number of inquiries about mould and damp increased up to 2007 and have decreased since 2008. This seems to have been reflected in the on-site visits as well. As a result of the changed approach by the intermediaries to those affected, an increase in the inquiries on mould and damp had initially been expected.

Figure 1: Inquiries and on-site visits on damp and mould – numbers from 2000 to 2010.



Different reasons can be given as an explanation for the decline. Raising awareness on the issue of damp and mould was a significant objective of the information sessions for intermediaries, in particular for the outreach services. Another task was to enable the intermediaries to pass on simple assistance directly to those affected. Thus it can be assumed that potential requests to public health authorities were probably solved in advance. In this context it should be noted that, in parallel with the decline in requests, a tendency towards more difficult cases within the advisory activities was seen. The reasons for this are very different: e.g. complex problems, culturally determined behaviour patterns or language barriers.

It was pointed out at the information sessions that recommendations for changes in practice and behaviour made through intermediaries who have had contact with local initiatives or groups of those affected have been accepted, rather than through a direct approach by an authority. This could also have contributed to the fact that despite an increased approach to intermediaries, no increase in the numbers of requests has been recorded.

Another aspect, which may reflect the decrease in the number of inquiries, is the updating and expansion of the Local Public Health Office's website on the subject of mould and damp in August 2009. For example a „frequently asked questions" (FAQ) was inserted, in addition, all brochures and flyers are still being made available from the site. An analysis of the traffic on the Local Public Health Office' websites for the years 2008 to 2010 shows that increasing numbers of people obtain the specialist information via the website. The advice leaflet "Removing mould correctly – how it's done!" has headed the list of the documents downloaded from the Local Public Health Office's website over the past three years. The traffic increased from 5,000 in 2008 through 26,000 in 2009 to 49,000 accesses in 2010, thus the number of downloads has increased nearly tenfold in the past three years. The information sheet "Mould in homes", with 4,000 accesses in 2010 is the third most downloaded document. The search term "Removing mould" is the second most common term after "Bremen Local Public Health Office", which is used to access the Health Authority's pages. This shows that, apart from the high relevance of the topic of mould and damp in houses, at least some of the initial enquiries to the Citizens Advice Bureau are probably satisfied via the electronic form of information distribution. Another indication is that number of email inquiries have also increased.

Data on social status

The following data analysis for the years 2006 to 2010 is based on a total of 353 households who took part in the survey from an over-all 480 on-site visits. This corresponds to a response of about 74 %. It is still dominated by households with one to three persons; their percentage being between 65 % and 84 %. Since the survey asked for the number of living rooms and bedrooms, the rooms per head index (RHI) (ratio of the number of living rooms and bedrooms to the number of persons living in the household) can be given. The value 1 indicates that exactly 1 living room and/or bedroom per inhabitant is available.

Figure 2 shows the RHI values between 2006 and 2010. It can be seen that the percentage of households with a RHI of less than 1 and/or exactly 1 is higher than the percentage with a RHI greater than 1. Brasche et al. (2003) suggested that a high RHI can be considered as a protective factor concerning damage by dampness. The social status of those affected was derived from the questions on education, occupation and income. The details of the main earner and the monthly net incomes of all household members were considered. Against the backdrop of the household's monthly disposable income, it has been confirmed that it is mainly low-income households who ask the Local Public Health Office for advice. In 68 % of the households the monthly income in 2006 did not exceed 1,500 euros. This percentage rose to 76 % in 2010. The increase is particularly recognisable in households with incomes no greater than 1,000 euros: 29 % (in 2006) to 46 % (in 2010).

Figures 3 and **4** show the evaluation of education & training qualification data respectively of the households surveyed. While nearly half of all households surveyed had a high level of education (48 % advanced technical college entrance qualification/university entrance diploma (A level)) in 2006, this percentage decreased considerably by 2010 (16 %). On the other hand, the number of households with "secondary school (Hauptschule)" or "without any school leaving certificate" increased in each case: from 21 % to 48 % and from 4 % to 15 %, respectively. In terms of a completed education, there were a high percentage of households with a polytechnic or university degree (23 %) in 2006. This figure dropped considerably in the following years and was only 1.5 % in 2010. The number of people with vocational training however increased from 29 % to 42 % and those without any training from 26 % to 36 %. However, occupation or income failed to reflect the relatively high education level found in the 2006 random sample. The majority of the main earner were associated with the group "unemployed and those not in work" (46 %). This figure increased to 70 % by 2010.

Summary

It can be noted that the Local Public Health Office's advisory service still reached low-income households during the review period from the first survey in 2006 to 2010. Contrary to the 2006 random sample however, both the percentage of the main earner with low or no school qualifications and those with a low vocational training grew considerably. The objective of the Local Public Health Office's advisory service to bring the Local Public Health Office's advice within reach of the educationally disadvantaged households has been achieved.

This means that the need to offer free advice, as identified after the first survey, is confirmed by the present analysis over a period of five years. The information sessions and collaboration with intermediaries will also be continued. To further optimise the advisory services, interviews concerning evaluation are being held with those institutions where the information events were carried out.

We wish to thank all colleagues of the advisory team for their hard work.

Figure 2: Rooms per head index from 2006 to 2010 for the households polled (in %).

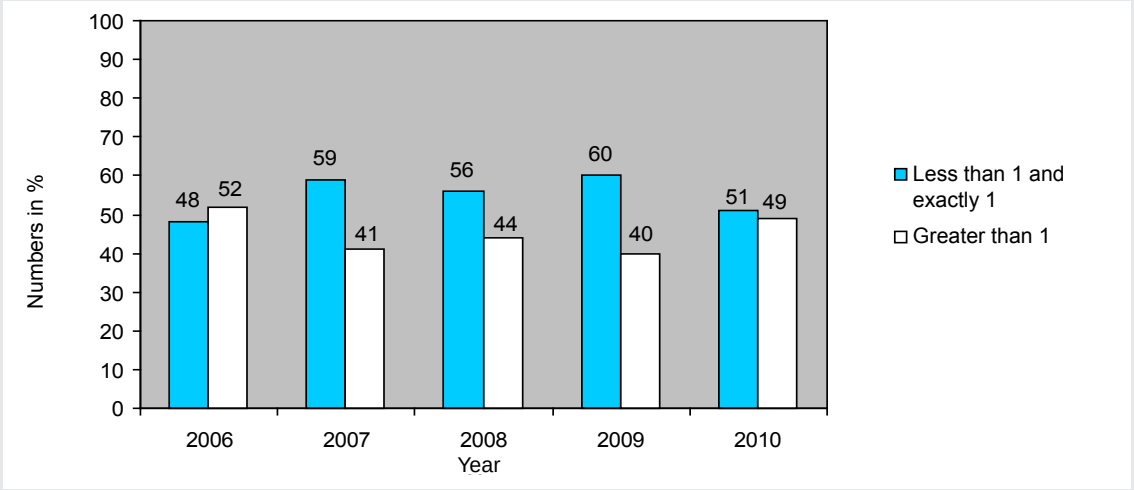


Figure 3: Completed education of the households polled (in %).

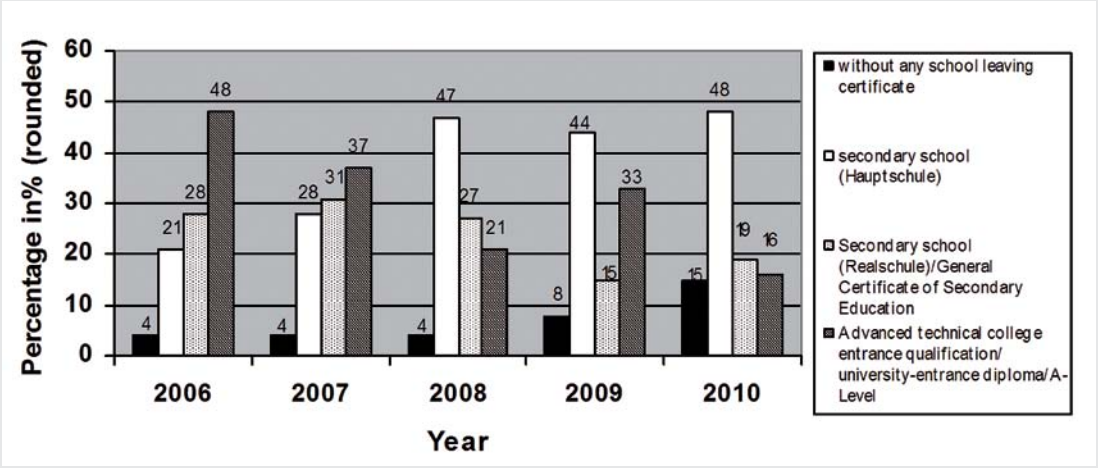
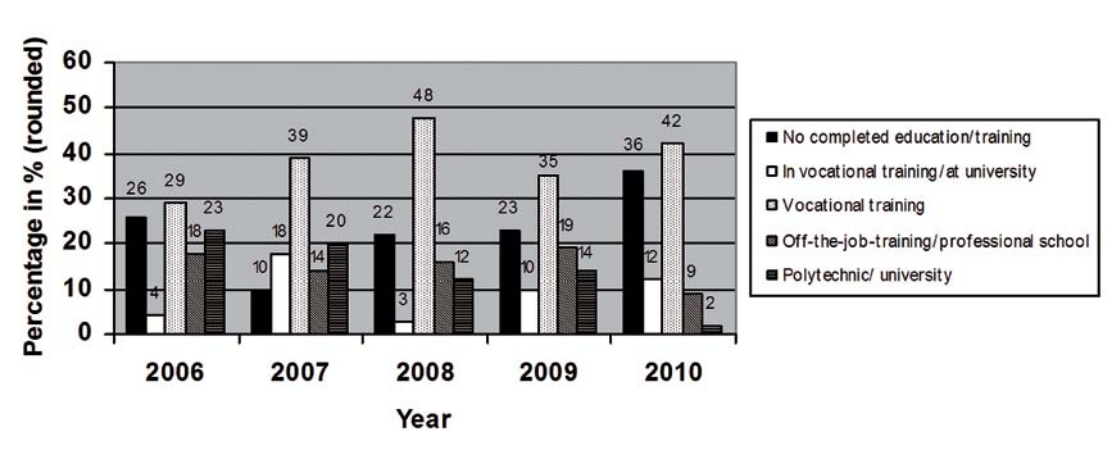


Figure 4: Training qualification of the households polled (in %).



Literature

Becker W, Kaiser B, Luther S, Otremba H (2007): Um Schimmels Willen: Feuchteschäden in Wohnräumen und Soziale Lage. Bericht der Kommunalen Gesundheitsberichterstattung und des Referats Umwelthygiene am Gesundheitsamt Bremen. http://www.gesundheitsamt.bremen.de/sixcms/media.php/13/3_nb_GBE_Um_Schimmels_Willen.pdf (Accessed: 11.01.2011).

Brasche S, Heinz E, Hartmann T, Richter W, Bischof W (2003): Vorkommen, Ursachen und gesundheitliche Aspekte von Feuchteschäden in Wohnungen. Ergebnisse einer repräsentativen Wohnungsstudie in Deutschland. In: Bundesgesundheitsblatt – Gesundheitsforschung – Gesundheitsschutz, 46 (8): 683-693.

Statistisches Bundesamt (2004): Datenreport Teil 2.

Contact

Dr. Bettina Kaiser
Dr. Heike Otremba
Gesundheitsamt Bremen
Abt. Gesundheit und Umwelt
Horner Str. 60-70
D-28203 Bremen
Email: umwelthygiene[at]gesundheitsamt.bremen.de

Democratic smog? An empirical study on the correlation between social class and environmental pollution[1]

Andreas Diekmann and Reto Meyer

Abstract: *For years the public and scientific debate on environmental justice was mostly confined to the U.S. Only recently, the question about the existence and strength of the "social gradient" of environmental pollution has entered the European debate. Earlier research simply recorded subjective perceptions of pollution and correlated them with indicators of social status. Objective measures of environmental quality have seldom been used, and even then only in studies of small geographic areas. In contrast, the present study uses various objective measures of air pollution (nitrogen dioxide, particulate matter, ozone) and road traffic noise (day, night) and assigns them to the respondents of the Swiss Environmental Survey 2007 (N=3,369) using a geographic information system (GIS). The combination of objective GIS coded data with subjective measures allows for a new approach in environmental sociology that takes spatial context into account, which is often neglected in sociological studies.*

Introduction

"Environmental Justice" we read on protest group's banners and in public initiative slogans in the USA, which condemn environmental pollution and health hazards, to which underprivileged social classes and ethnic minorities are particularly exposed. Local industrial emissions, noise, waste, landfills with toxic materials often occur where the political resistance is low, while poverty and unemployment is rampant and the percentage of ethnic minorities is high, say the protestors. The protests and initiatives have also been reflected in scientific research. Empirical studies into "environmental justice" provide data with case studies and statistical evidence showing the cumulative burdens on the lower social classes in the highly segregated urban settlements of North America (Maschewsky 2001; Evans, Kantrowitz 2002; O' Neill et al. 2003; Ash, Fetter 2004; Maschewsky 2004). However, there are opposing results found in some indicators. Atlas (2002) failed to find any evidence that predominantly poor population groups and minority groups were living near hazardous waste landfills in the USA. The fact that an individual's environmental quality is dependent on their household income is undisputed on a global scale. Serious air pollution, shortage of and access to drinking water, poor water quality and inadequate sanitation are concerns which trouble impoverished countries in particular.

Whether and to what extent the "social gradient" reduces or exacerbates environmental pollution, and how strong the distinction is a major research question today. These are controversial questions of great importance for environmental and public health policy. In contrast, only isolated studies have been carried out in Germany, Austria and Switzerland, which typically connect social status and "objective" environmental quality measurement data with one another, but only in the local context (overview in Mielck, Heinrich 2002; Bolte, Mielck 2004; Bolte,

[1] The Swiss Environment Survey 2007 was funded by the Schweizerischer Nationalfonds (Swiss National Fund, project: 100012-107835). The project was supported by the Federal Office for the Environment (BAFU), the cantons Basel City (Office for the Environment and Energy) and Zurich (Office for Waste, Water, Energy and Air), the central Swiss cantons (environmental offices) and the Environment and Health Protection of the City of Zurich. Furthermore the project was supported by the Swiss Federal Statistical Office (BFS). The BFS has had no influence on the methodology used and the results obtained. We thank the Departments of Air Quality Management and Noise Abatement of BAFU for data on objective environmental pressures and Mr. Thomas Künzle of Meteotest for valuable advice. A longer version has been published by the authors under the same title (Diekmann, Meyer 2010).

Kohlhuber 2008; Hornberg, Pauli 2009; cf. also Elvers 2007). Frequently, it is only subjective perceptions, such as those recorded in "Environmental Surveys", that have been correlated with social status indicators (Grunenberg, Kuckartz 2003). Completely subjective survey data on the perception of environmental quality may be useful to answer certain research questions; however, with these data researchers may fail to give an accurate picture of the social gradients of environmental pollution. Thus we find positive relationships with the "green" orientation or the education level, but not necessarily because environmental pollution is higher, rather because environmental problems are perceived more sensitively (Preisendörfer 1999: 178ff).

Why is there an increased concentration of environmental pollution near homes of lower social strata? Two mechanisms can be identified: First, decision makers might be inclined to plan traffic projects, industrial settlements and landfills in poorer residential areas because there is less likelihood of political resistance. In addition, they might be trying to spare their own, on average, wealthier, neighbourhoods. Secondly, it can be assumed that the environmental quality of a residential property influences rents and prices. The extent of environmental pressure is often reflected in prices through the market mechanism. Whether in Zurich or Munich – rents and the price of land are usually lower near airports than on the Starnberger Lake or on the "Gold Coast" of Lake Zurich. The inverse relationship between social class and environmental pressures charts these two mechanisms.

Our intention is to report on the results of a nationwide investigation in Switzerland and present them for discussion. Our study methods are also of interest. We have linked the survey data from the Swiss Environmental Survey to air and noise pollution data in a geo information system (GIS) aiming to answer questions on the distribution of environmental pressures. The Swiss Environmental Survey has provided a nationwide pool of data for a broad spectrum of environmental topics and sociodemographic characteristics. Records of different indicators of air pollution and noise level are available in electronic form from the Swiss Confederate Offices. In order to assign national coordinates to the addresses of the survey respondents, two data sets are available, i.e. individual data of the Environmental Survey and spatial data on environmental pollution which can be linked in GIS and analysed at the micro level.

Data and methodology

The Swiss Environmental Survey is based on a random sample. It was conducted through telephone interviews with 3,369 people (response rate 52 %), followed by a written follow-up survey. The survey was performed in the three national languages German, French and Italian (Diekmann, Meyer 2008).

Household income and degree of education have been used as social class indicators. In addition, the characteristic of nationality has been included wherein four categories have been considered: 1. Swiss nationality, 2. Western Europe/North America, 3. South Europe (Greece, Italy, Portugal, Spain), 4. other countries (the Balkans, Eastern Europe, Asia, South America, Africa). An equivalent income has been derived from the household income using a suitable weighting factor appropriate to the household size and is used in our statistical analyses. The respondent's level of education has also been taken into account. Other sociodemographic characteristics were age, sex, community size, language region, household size and the attribute whether children live in the household. The choice of residence for tenants is influenced by the amount of rent they have to pay, while residential property owners will have paid special attention to the location when purchasing their properties and tend to avoid negative environmental pressures. Both variables, i.e. amount of rent and home ownership, were raised in the Environmental Survey. Furthermore, the subjective perception of environmental quality was queried. The subjective assessment of noise and air pollution was determined using a five-step scale in the telephone interview and a ten-step scale in the written survey.

Air pollution indicators are nitrogen dioxide (NO_2), particulate matter of different size (PM_{10} and $PM_{2.5}$) and the number of hours ozone levels are above the limiting value of 120µg/m^3 (hourly average). The model values are available as high-definition raster maps (200m × 200m for nitrogen dioxide and particulate matter, 250m × 250m for ozone). The values for nitrogen dioxide, particulate matter and ozone are based on measured values and model calculations from 2000. These values are however, relatively robust over longer periods of time.

Traffic noise during the day and night in decibels is likewise determined by model calculation for 10-m long, quadratic areas. SonBase, the GIS Swiss noise database, is based on data on traffic volume, speed

and other basic data, so allowing the source of the emissions to be calculated. Subsequently, using the digital elevation model in the noise calculation software CadnA, the propagation abatement is determined and the total noise emission calculated (BAFU 2009a). The decibel scale is logarithmic: an increase of three units, e.g. from 50 to 53, means the physical sound pressure has doubled. Each indicator value comprises a triplet of numbers: the measured value and two site specific coordinate values. The same data structure can be produced from the Environmental Survey data. This can be done by converting the addresses of the households into coordinate values, i.e. the households will be geo-coded. The two sets of records can be linked via the coordinate values and the indicators, air pollution and noise level can be attributed to the individuals respondents (N = 2,961 people with 'address-definition' geo coding; see methodology in greater detail in Diekmann, Meyer 2010).

Air pollution (except for ozone in urban areas, see below) and noise pollution are particularly pronounced in larger cities and in Tessin with its hefty traffic pollution. **Figure 1** gives an impression of the spatial distribution of the environmental pollution indicators with data from our random sample.

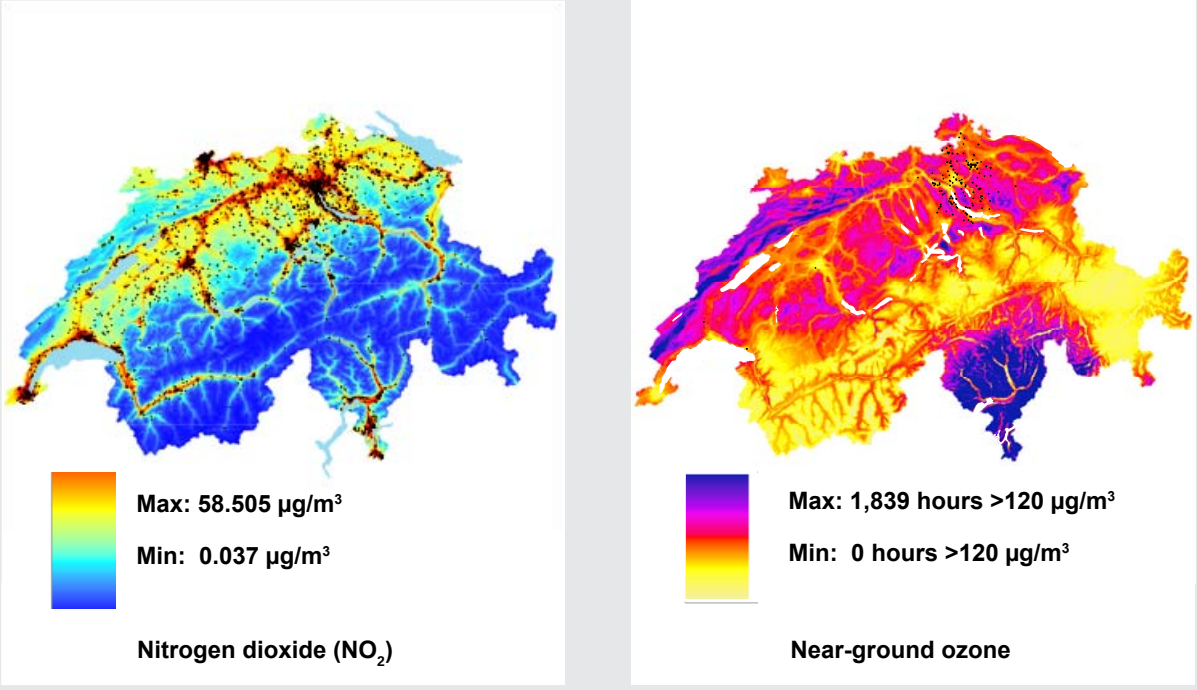
Results

Indicators of social classes and environmental pollution

We do not consider third variables in the first step. We are initially interested only if education, income and nationality are linked to local environmental pressures. **Table 1** contains the results of bivariate correlations with the indicators of environmental pressures. The results are surprising. The income is not significantly associated with environmental pressures; the level of education however, displays a significantly positive relationship to air pollution, except for ozone.

Only the additional burden of foreigners is consistent with the hypotheses from the research into environmental justice. Foreigners from Southern Europe and from other non-western states (the Balkans, Eastern Europe, Asia, South America, Africa) live in places with higher air pollution and their homes are in streets with higher traffic noise. The average

Figure 1: Spatial distribution of the environmental pollution in Switzerland: nitrogen dioxide (annual average values), near-ground ozone (number of hours exceeding the limiting value).



Sources: Air pollution: Pollutant maps, Federal Office for the Environment (SAEFL 2003; 2004; BAFU 2009b)
Black points: Homes of interviewed people: Swiss Environmental Survey 2007 (Diekmann, Meyer 2008)

additional noise pollution is substantial for people from Southern Europe (approximately 2.1 decibels at night) and immigrants from "other states" (2.8 decibels at night). However it must be said that the latter category is heterogeneous and constitutes only about 2 % of those interviewed.

If the size of the town/city is included in the regression equation – we used four categories from countryside to major city – , the estimates for the foreigner categories decline slightly. Part of the higher burdens on foreigners stem from the fact that a greater percentage lives in cities than do those surveyed owning a Swiss passport. However it can be seen that the city vs. countryside difference is more important concerning air pollution than nationality and income (**Table 2**).

Although the effects of income on air pollution indicators are negative and significant, high-income households do not ignore environmental aspects when choosing their homes. Nevertheless, the magnitude of the effects is very small. The social gradient of income is very weakly pronounced in comparison to the city vs. countryside difference.

Take pollution by particulate matter (PM_{10}) as an example. As is expected, it is highest in large cities (8.5 units) as opposed to the countryside. This difference is 120 times greater than the income effect -0.07 based on a monthly income of 1000 SFr. (**Table 2**).

In contrast to nitrogen dioxide and particulate matter, ozone levels are paradoxically lower in urban areas than in the countryside (**Figure 1**). This is in spite of the fact that traffic is causing air pollution. The reason is that the same exhaust gases that have contributed to the daytime ozone production go on to decompose part of the ozone in urban areas after dark. Ozone produced in the cities spreads to the (suburban) countryside without opposing forces taking effect, therefore higher ozone values can be measured in the countryside. This is the reason that we find the opposite sign for ozone compared to all other air quality indicators.

Discussion and outlook

Our investigation reveals a mixed picture. Disadvantages in terms of our research on environmental justice are evident for foreigners, but only in certain nationalities. While people from Western Europe do not endure any higher burdens than people with a Swiss passport, people from Southern Europe and households with inhabitants from the Balkans States, Eastern Europe and from non-European countries are faced with substantial environmental pressures. Contrary to expectations, social status indicators such as income and education, on a bivariate level, are not significantly related to the environmental indicators considered here. However, the relationships are more complex. Indeed the multivariate analysis shows a significant effect from income, the extent of this effect is however, relatively weak. Furthermore, income does not explain the increased burden of the groups of foreigners as cited. The environmental pressure decreases strongly when residential property has been purchased. The strongest effect however, is the urban-rural difference. When someone

Table 1: Correlation of sociodemographic characteristics with environmental contamination.

	Air pollution			Street noise		
	NO_2	PM_{10}	$PM_{2.5}$	Ozone	Day	Night
Swiss	ref.	ref.	ref.	ref.	ref.	ref.
Foreigner	0.10**	0.08**	0.08**	-0.00	0.07**	0.08**
Education years (ten-year intervals)	0.10**	0.08**	0.08**	-0.06**	0.01	-0.02
Equivalent income (per month, in thousand SFr.)	-0.04+	-0.03+	-0.03+	-0.02	-0.02	-0.03
Average number of cases	2,828	2,827	2,827	2,824	2,801	2,801

Notes: p-values of significance tests of the bivariate correlation coefficients (no control variables), + p<0.10, * p<0.05, ** p<0.01.
Mandatory school, household training year, shortened vocational school: 9 years; occupational training, full-time vocational school: 12 years; vocational maturity, secondary school (Gymnasium) maturity, teachers' seminar: 13 years; higher specialist examination, engineering school: 14 years; college of further education, engineering secondary school: 16 years; university degree: 19 years. This is the education status of the household. In partner households it is the level of the partner with a higher education. Allocation of years of education according to the Swiss Federal Statistical Office.

Table 2: Regression estimates for air pollution and street noise as a function of nationality, social status indicators and town/city size.						
	Air pollution				Street noise	
	NO_2 ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	Ozone (h)	Day (dB)	Night (dB)
Swiss	ref.	ref.	ref.	ref.	ref.	ref.
Western Europe, North America	-0.37 (-0.73)	-0.18 (-0.60)	-0.10 (-0.47)	2.77 (0.28)	0.54 (0.90)	0.62 (1.02)
Southern Europe	2.28** (4.10)	1.44** (4.35)	0.91** (4.01)	18.82+ (1.73)	1.48* (2.22)	1.84** (2.75)
Others: Balkan, Eastern Europe, Asia, South America	3.20** (4.16)	1.72** (3.74)	1.05** (3.33)	-21.23 (-1.41)	1.89* (2.01)	2.03* (2.14)
Education years (ten-year intervals)	0.27 (0.68)	0.04 (0.17)	0.02 (0.13)	0.74 (0.10)	-0.54 (-1.13)	-0.76 (-1.58)
Equivalent income (per month, in thousand SFr.)	-0.14** (-4.88)	-0.07** (-4.28)	-0.05** (-4.15)	-0.05 (-0.08)	-0.04 (-1.13)	-0.04 (-1.19)
Countryside	ref.	ref.	ref.	ref.	ref.	ref.
Agglomeration	6.55** (21.47)	3.36** (18.52)	2.29** (18.41)	-22.83** (-3.82)	2.30** (6.33)	2.61** (7.16)
Small or medium town	8.33** (22.49)	2.90** (13.13)	1.91** (12.61)	-54.37** (-7.50)	5.03** (11.37)	4.00** (8.99)
Major city	16.91** (50.44)	8.50** (42.58)	5.45** (39.78)	-139.77** (-21.30)	5.37** (13.40)	4.21** (10.45)
Constant	16.42** (29.59)	17.24** (52.13)	13.27** (58.52)	303.35** (27.92)	48.52** (73.02)	37.50** (56.12)
Adjusted R^2	0.526	0.446	0.409	0.195	0.086	0.052
Number of cases	2,569	2,568	2,568	2,565	2,546	2,546
Notes: t-values in brackets, + p<0.10, * p<0.05, ** p<0.01.						

moves to the countryside, the environmental pressure is reduced significantly, except for ozone. To give a feel for the magnitude: nitrogen dioxide contamination for home owners is about 2 units ($\mu g/m^3$) lower on average compared with tenants (other sociodemographic characteristics being controlled). The difference between a major city and the countryside is by contrast 16 units ($\mu g/m^3$), i.e. a factor 8 in comparison to the effect of home ownership. The paradoxical effect of ozone smog has a compensatory influence whose limiting value is more frequently exceeded in the countryside than in busy cities.

Taking income and education as criteria, the Swiss smog exhibits a 'democratic' distribution. However, when taking into account home ownership and nationality tenants and foreigners are more strongly affected by environmental burdens than people owing their home or people with a Swiss passport. Is the flat social gradient with regard to income a special case for the Swiss? Switzerland is federal, small scale, without distinctive major cities and recognisable slums and the extent of segregation of residential areas might also be less expressed than in densely populated areas of other states.

As with any study, a word of caution is needed as to the limits of the validity of the results due to the special features of data acquisition and measurement. In our study we have selected six noise and air pollution indicators which signal noise and air quality outside the home. The indicators measure the "public" environmental pollution, but fail to give any clue as to "private" pollution inside the home. No statements have been made about pollutants, mould and above all cigarette smoke in the homes. However, much stronger relationships with the social class are expected in this respect (Braun-Fahrländer 2004; Becker et al. 2008). Finally, one can shield oneself against environmental pollution, in particular noise, by suitable structural measures such as sound-proof windows. Those who have a larger house or flat, can move to quieter rooms, e.g. those facing the garden. At the same noise level (measured at the outer wall), households with better income resources have more creative ways to escape external noise nuisance. However, our data failed to show any relationship

between the installation of sound-proof windows and income. A further point of discussion is the additional burdens on foreign households. The random sample includes only those foreign households with which the survey could be conducted in any of the national languages. This means that well-integrated foreigners are more likely to have been included in the random sample. The distortion of the foreigner sample therefore probably means that the environmental pressures on foreign households have been rather underestimated. Random samples from municipal registers combined with geo referenced data would be needed to estimate the extent of a possible bias.

Literature

Ash M, Fetter TR (2004): Who Lives on the Wrong Side of the Environmental Tracks? Evidence from the EPA's Risk-Screening Environmental Indicators Model. In: Social Science Quarterly, 85 (2): 441-462.

Atlas M (2002): Few and Far Between? An Environmental Equity Analysis of the Geographic Distribution of Hazardous Waste Generation. In: Social Science Quarterly, 83 (1): 365-378.

BAFU (Bundesamt für Umwelt) (ed.) (2009a): SonBase – Die GIS-Lärmdatenbank der Schweiz. http://www.bafu.admin.ch/publikationen/publikation/01037/index.html?lang=de (Accessed: 22.02.2011).

BAFU (Bundesamt für Umwelt) (ed.) (2009b): Luftbelastung: Schadstoffkarten. http://www.bafu.admin.ch/luft/luftbelastung/schadstoffkarten/index.html?lang=de (Accessed: 22.02.2011).

Beck U (1986): Risikogesellschaft. Auf dem Weg in eine andere Moderne. Frankfurt am Main: Suhrkamp Verlag.

Becker W, Kaiser B, Luther S, Otremba H (2008): Feuchtschäden in Wohnräumen: gesundheitliche, umweltbezogene und soziale Aspekte – Kleinräumige Erhebung aus dem Gesundheitsamt Bremen. In: Das Gesundheitswesen, 70: 636-639.

Bolte G, Kohlhuber M (2008): Sozioökonomische Faktoren und Umweltbelastungen in Deutschland – aktueller Erkenntnisstand und exemplarische Analysen ausgewählter Umweltschadstoffe Teilprojekt A: Systematische Zusammenstellung der Datenlage in Deutschland. Publikationen des Umweltbundesamtes. Umweltbundesamt.

Bolte G, Mielck A (eds.) (2004): Umweltgerechtigkeit. Die soziale Verteilung von Umweltbelastungen. Gesundheitsforschung. Weinheim/München: Juventa Verlag.

Braun-Fahrländer C (2004): Die soziale Verteilung von Umweltbelastungen bei Kindern in der Schweiz. In: Bolte G, Mielck A (eds.): Umweltgerechtigkeit. Die soziale Verteilung von Umweltbelastungen, Weinheim/München: Juventa: 155-173.

Diekmann A, Meyer R (2008): Schweizer Umweltsurvey 2007. Dokumentation und Codebuch. Zürich, Professur für Soziologie, ETH Zürich.

Diekmann A, Meyer R (2010): Demokratischer Smog? Eine empirische Untersuchung zum Zusammenhang zwischen Sozialschicht und Umweltbelastungen. In: Kölner Zeitschrift für Soziologie und Sozialpsychologie, 62: 437-457.

Elvers HD (2007): Umweltgerechtigkeit als Forschungsparadigma der Soziologie. In: Soziologie. Forum der Gesellschaft für Soziologie, 1: 21-44.

Evans GW, Kantrowitz E (2002): Socioeconomic Status and Health: The Potential Role of Environmental Risk Exposure. In: Annual Review of Public Health, 23: 303-331.

Grunenberg H, Kuckartz U (2003): Umweltbewusstsein im Wandel. Ergebnisse der UBA-Studie. Umweltbewusstsein in Deutschland 2002. Opladen: Leske+Budrich.

Hornberg C, Pauli A (2009): Umweltgerechtigkeit – die soziale Verteilung von gesundheitsrelevanten Umweltbelastungen. Dokumentation der Fachtagung vom 27. - 28. Oktober 2008 in Berlin. Bielefeld: Universität Bielefeld.

Maschewsky W (2001): Umweltgerechtigkeit, Public Health und soziale Stadt. Frankfurt: VAS, Verlag für Akademische Schriften.

Maschewsky W (2004): Umweltgerechtigkeit – die Diskussion in den USA. In: Bolte G, Mielck A (eds.): Umweltgerechtigkeit. Die soziale Verteilung von Umweltbelastungen. Weinheim und München: Juventa Verlag: 29-40.

Mielck A, Heinrich J (2002): Soziale Ungleichheit und die Verteilung umweltbezogener Exposition (Environmental Justice). In: Das Gesundheitswesen, 64: 405-416.

O'Neill M, Jerrett M, Kawachi I, Levy JI, Cohen AJ, Gouveia N, Wilkinson P, Fletcher T, Cifuentes L, Schwartz J (2003): Health, Wealth, and Air Pollution: Advancing Theory and Methods. In: Environmental Health Perspectives, 111 (16): 1861-1870.

Preisendörfer P (1999): Umwelteinstellungen und Umweltverhalten in Deutschland. Empirische Befunde und Analysen auf der Grundlage der Bevölkerungsumfragen: Umweltbewusstsein in Deutschland 1991-1998. Opladen: Leske+Budrich.

SAEFL (Swiss Agency for the Environment Forests and Landscape) (ed.) (2003): Modelling of PM_{10} and $PM_{2.5}$ ambient concentrations in Switzerland 2000 and 2010. Environmental Documentation No. 169, Air, Swiss Agency for the Environment Forests and Landscape.

SAEFL (Swiss Agency for the Environment Forests and Landscape) (ed.) (2004): Modelling of NO_2 and benzene ambient concentrations in Switzerland 2000 to 2020. Environmental Documentation No. 188, Air, Swiss Agency for the Environment Forests and Landscape.

Contact

Andreas Diekmann
Reto Meyer
ETH Zürich
Professorship for Sociology
Clausiusstraße 50
CH-8092 Zürich
Email: diekmann[at]soz.gess.ethz.ch
meyer[at]soz.gess.ethz.ch

Environmental justice and urban transport – empirical status quo in Germany and further analyses

Philine Gaffron

Abstract: *This paper discusses the status quo of research on environmental justice and urban transport in Germany, which is largely based on the analyses of secondary data sources and of an exploratory nature (though exceptions can be found). A study by the author is introduced, which looked at German time budget data and found significant differences in the amount of time different socioeconomic sub-groups habitually spend at home. This is noteworthy as most transport emissions are at least to some extent volatile and will have most effect on those people actually found in physical proximity during their creation. Finally, the paper presents the findings of an intersection of road noise data from the City of Hamburg with population parameters. It was found that non-German residents and the unemployed tend to live in noisier areas while teenagers and people over 65 are more often found in areas less burdened by road noise.*

State of the research in Germany

In the study and discussion regarding environmental justice in the context of urban transport, the main focus generally lies on distributive justice. This deals with how positive and negative environmental influences are distributed fairly across different population groups (cp. Maschewsky 2004 for a more detailed discussion of different principles of environmental justice). There are no generally accepted normative benchmarks for how existing or intended distributive justice should be measured. It appears desirable, however, that the risk of exposure to environmental burdens should not be borne disproportionally by any particular population group. It is also important to note that some groups, such as children, the elderly or financially disadvantaged households are, for different reasons, often more sensitive to environmental health issues (Bunge 2008). It is therefore important to have as much first-hand evidence as possible at the descriptive level in order to be able to provide reliable information for planning decisions and participation processes, both to decision makers and stakeholders.

An overview of the empirical status quo in Germany regarding environmental justice, which was produced for the Federal Environment Agency (UBA), found 17 studies, published between 1999 and 2007, which distinguished between the distribution and/or effect of transport emissions based on different socio-economic parameters. In nine of these studies children were the focus of the investigation, another five concentrated on adults and the remaining three dealt with all age groups. However, none of these studies compared a subjective assessment of exposure to traffic emissions with an objective measure of the same exposure (Bolte, Kohlhuber 2008). Another study from Kassel in 2008 (Köckler et al. 2008) did take this step, but Bunge and Katzschner (2009) concluded in a detailed study of the data situation in Germany: "The majority of studies are secondary analyses of small-scale environmental epidemiological studies as well as regularly performed nation-wide population surveys. [...] Predominantly, the subjective perception of environmental burdens was determined by interviewing the respondents, but objective data were rarely collected as measured values. Most authors emphasise the explorative nature of their studies and point out that the results obtained require a more in-depth analysis. "(ibid.: 43).

In addition to a limited availability of empirical results and the rare comparison of subjective with objective exposure data, there are several aspects which have not, or only very rarely, been considered in studies on environmental justice and urban transport. Research into this topic has generally been concerned with exposure of people in their homes. With regard to noise and volatile air pollutants, the potential scale of such exposure is directly connected to the question of who is actually at home when and how

these activity patterns coincide with the daily traffic cycles, because „[s]tudies in several industrialised countries show that more than half of all non-sleep activities of employed people aged between 18 and 64 occur inside housing units. Children, the elderly, and housewives spend even more time indoors." (Lawrence 2002: 38).

Furthermore, only few studies have combined an analysis of the parameters income, nationality and/or migration background, employment and education. The parameters sex and age have been studied in even fewer cases. It is therefore nearly impossible to discuss the relative importance of these factors reliably with respect to the distribution of traffic related burdens. It should further be noted that households with a high socioeconomic status can also be found at residential locations with a high degree of exposure to traffic noise and/or air pollutants (Bolte et al. 2004; Gaffron 2010; Köckler et al. 2008; Pennycook et al. 2001), because: „The higher social classes will maximise their utility choosing from a whole range of property characteristic bundles, and this may mean that they choose access to cultural amenities in preference to clean air." (McLeod et al. 2000: 83). So in order to correctly identify reasons for environmental injustice at the residential location as well as possible solutions, it is important to ascertain to what extent the choice of residential location is affected by a subjective perception of the existing exposure to transport emissions and what differences there are among socioeconomic groups in this respect.

Hamburg Study

The results of an analysis of the time spent at home by different population groups can be found in detail in Gaffron (2010). They are summarised in the following. The German Time Use Survey (TUS) 2001/2002 (Statistisches Bundesamt 2005) contains data which allows the calculation of average daily time-use patterns for different socioeconomic groups. The data set is based on the following survey methodology: between April 2001 and March 2002, 13,798 study participants of 10 years or older from 5,160 households recorded their use of time over a total of 35,691 days in standardised diaries. The use of time – which activity took place where – was recorded at 10-minute intervals over three days. One of these days was supposed to be on a weekend. In addition, a range of socioeconomic data was collected for each person and each household. For an environmental justice oriented analysis, the relevant parameters were sex, household income, age, educational status and employment situation (**Table 1**).

Findings

Differences in time spent at home for different population groups

The analysis of these data showed that people in certain age groups and household income classes respectively spend significantly more – or less – time at home than the members of all other sub-groups of the same parameter. Regarding employment, only the part-time workers and those in casual or infrequent employment were very similar in the amount of time spent at home. When grouped according to the highest level of education, a less clear picture resulted, but here, too, significant differences were found between certain sub-groups. Furthermore it was found that on average, women and girls spend nearly two hours more at home every day (18 hours 4 minutes) than do men and boys (16 hours 8 minutes). This sex difference was also found in almost all sub-groups of the parameters studied.

In another step, the patterns of time spent at home were superimposed onto the average daily traffic patterns on Hamburg's main roads. It should be noted that the data from the TUS cannot be differentiated at a regional level or according to settlement types. Although the TUS quality report does mention a regional breakdown of the investigation according to "Germany", "former Federal territory", "new Federal States and Berlin-East" and "Federal States" (Statistisches Bundesamt 2005; Section 1.5), the data available for research only allowed a spatial division into East and West Germany. Therefore, the average data for the entire Federal territory was assumed to be representative of the time use of Hamburg's population. The data on average daily traffic flows (ADT) on Hamburg's streets from 2008 comes from nine permanent counters operated by the Ministry for Urban Development and Environment (**Figure 1**). The ADT curve for weekdays (ADT_W) was compared to the patterns of time spent at home by different population groups. To this end, the count data which differentiate traffic volume into goods traffic over 3.5 tonnes and passenger cars were converted into passenger car equivalents using the following formula: N*(1+0.082*pHGV) where N = number of vehicles per time interval and pHGV = percentage of heavy goods vehicles above 3.5 tonnes (in accordance with Bundesministerium der Justiz 2006). **Figures 2** and **3** show the time-use patterns of different age groups

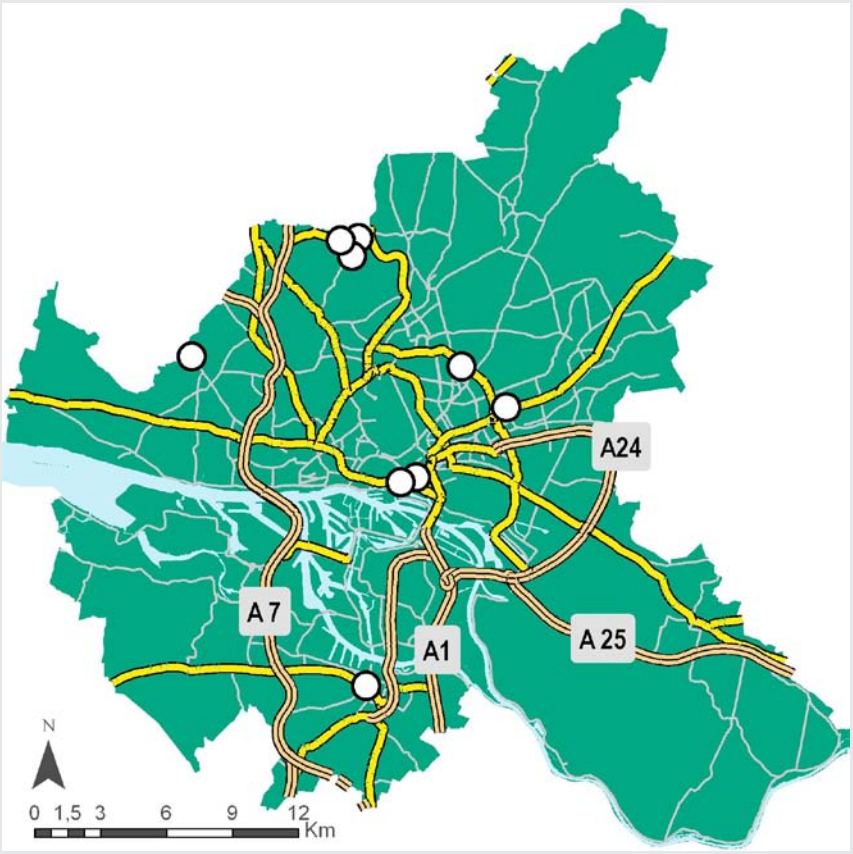
Table 1: Subdivision of the socio-economic parameters from the German time-use survey 2001/2002 for the analysis of time spent at home by the respective sub-groups.	
Household income ((in € per month net)	0-999; 1000-2499; 2500-3749; 3750-4999; 5000+
Age (years)	10-14; 15-24; 25-49; 50-64; 65 plus
Level of education	still at school; A-level equivalent (admission to university); vocational qualification; O-level equivalent; formal qualification below O-level equivalent; left school without formal qualification
Employment situation	not employed, no paid work; in military/alternative social service; in vocational training/ industrial re-training; casual or infrequent employment; low-level employment; part-time employment; full-time employed

and of households of different income groups against the background of ADT_W.

Figure 2 shows that among all age groups, children of between 10 and 14 years spend least time at home during the morning traffic peak until approximately 12:45. This changes in the afternoon, though, when many children come home from school. Between 13:40 and 16:30 they are at home almost as much as are people aged 65 and above, who overall spend most time at home during times of high traffic flow.

It can be seen in **Figure 3** that while patterns of time spent at home are more alike for members of different income classes than among different age groups, the frequency with which members of these groups can be found at home is clearly graded according to income: the higher the household income, the less time is spent at home during the day, at least until early evening. In combination with the frequent finding that financially disadvantaged households often live on noisier streets (Gaffron 2010; Köckler et al. 2008), this shows an even greater differential burden compared to financially better-off households than a consideration

Figure 1: Permanent traffic counters (without motorways) in Hamburg (2008).



of either residential location or time use alone would have suggested. Average values were used in the analyses presented here, both for the population's time-use patterns and for the volume of traffic in Hamburg's road system. The potential exposure identified is therefore indicative and only realised when the corresponding individuals actually live near busy roads and both their time-use pattern and the ADT_W curve are roughly consistent with the average values. The results do show, though, that time use plays a crucial role in determining the degree to which potential exposure to traffic emissions at home can become an actual burden for individuals. In the following, spatial data on road traffic noise and the Hamburg resident population will be intersected with each another.

Traffic noise in Hamburg and spatial distribution of the population

As part of the Strategic Noise Action Plan for Hamburg, commissioned by the Ministry of Urban Development and Environment (BSU), maps were produced for traffic noise among other sources. In accordance with the relevant directives (Bundesministerium der Justiz 2006) and based on 2007 traffic data, these maps show noise levels at 4m above street level in a 10m x 10m grid for all of Hamburg's streets with an ADT of at least 8,000 vehicles per day. Noise levels are shown in dB(A) both as L_{den} (day-evening-night index) and as L_{night} (22:00 to 6:00 hours). The Statistics Office North divides Hamburg into 928 statistical areas (status 2008, without the isle of Neuwerk). Structural data sets are available for these areas which contain information on the percentage of various age groups in the total population, the percentage of non-German residents, the average income per taxpayer and the percentage of recipients of unemployment benefit and social benefit (Hartz IV).

Using a geographic information system (GIS), noise data and structural data were superimposed. It was not possible however, to map the socio-economic information described above at a street level resolution and thus to directly correlate it with street noise data. Instead, the percentage of the area of each statistical district was calculated which according to the BSU maps is affected by $L_{den} \geq 65$ dB(A) or $L_{night} \geq 55$ dB(A). These decibel values correspond to the limit values as specified in the Hamburg Strategic Noise Action Plan requiring short-term action to avoid health risks to those concerned (ARGUS Stadt- und Verkehrsplanung et al. 2008:11).

Figure 2: 24hr patterns of time spent at home by different age groups on weekdays and ADT_W on Hamburg's main streets in passenger car equivalents. The pie chart indicates the percentage shares of the respective groups of the total population.

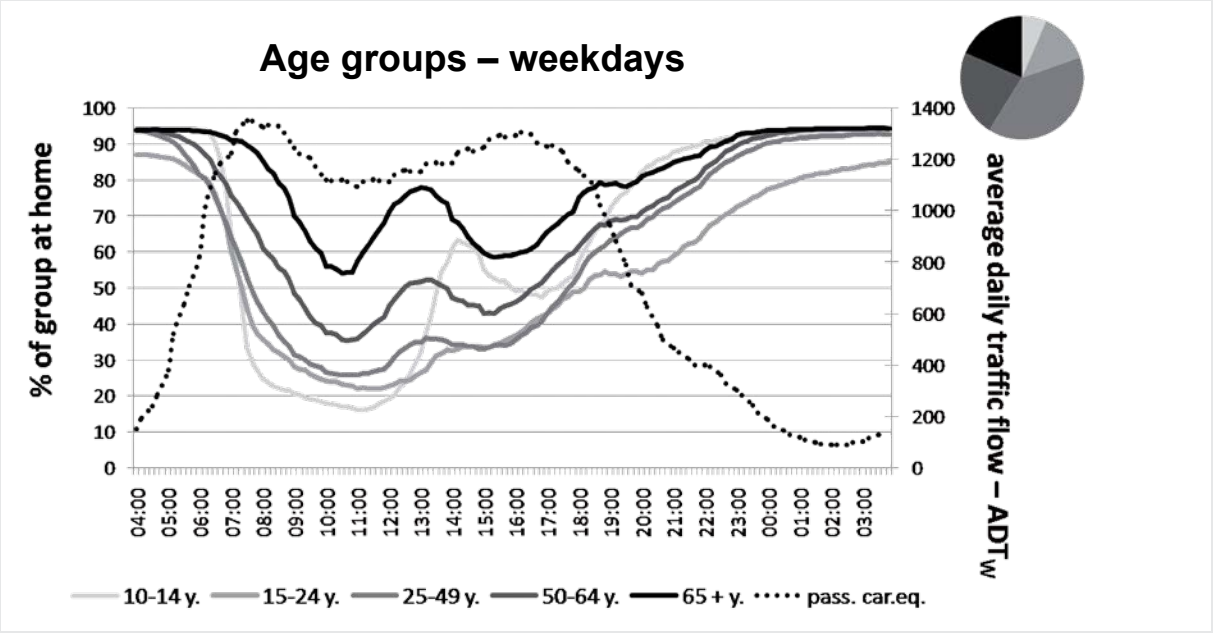
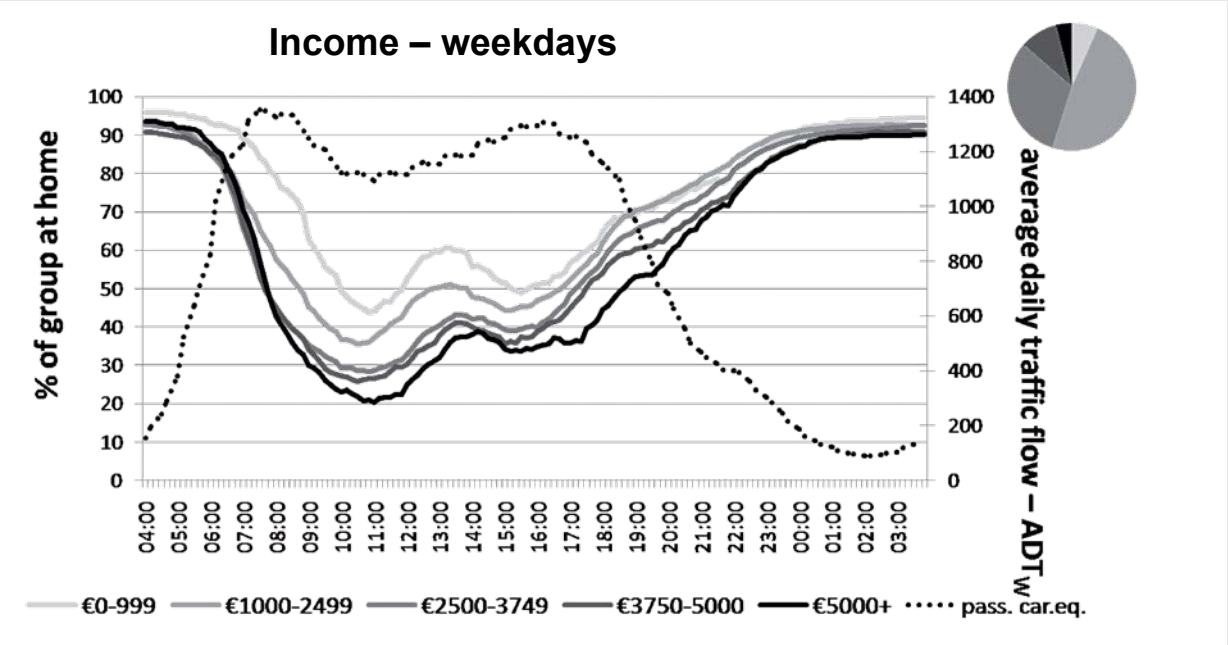


Figure 3: 24hr patterns of time spent at home by different income groups on weekdays and ADT_w on Hamburg's main streets in passenger car equivalents. The pie chart indicates the percentage shares of the respective groups of the total population.



The area percentages per statistical spatial unit affected by the respective noise levels were then correlated with demographic data. The areas of the statistical units vary greatly, though (3.4-1562 hectares; standard deviation/σ = 151.8 hectares) and also correlate negatively with the percentages of the areas affected by noise (Pearson's $r = -0.148$; $p < 0.01$), i.e. the larger the statistical unit, the smaller the area affected by noise. The analysis performed should thus be considered as explorative. It can, however, provide indicators for a potentially unequal exposure of different population groups to road traffic noise and at the same time help identify areas which should be examined in greater detail.

Statistically significant positive correlations have been found between the percentage of non-German residents as well as the percentage of unemployed (unemployment benefit as per SGB III or Hartz IV) between 15 and 65 years in the population of the statistical units and the percentage of the area which was affected by the above mentioned noise levels. The higher the noise level, the higher the percentage of non-German and unemployed residents within the area. An inverse correlation of noise level with the average income per taxpayer has been found, but with less significance than for the aforementioned variables. It should be noted here that while the overall socio-economic data set was created for 2008, the income data came from 1995. Prices on the (rental) housing market in Hamburg have risen faster (by 32.7 % from 1999 to 2007 on average) than the disposable income of households, though (+ 26 % in the same period; Statistisches Amt für Hamburg und Schleswig-Holstein 2010). It is therefore likely that income data of 1995 no longer reflect the choices available to households on the housing market in 2007, for which the noise data have been calculated. The analysis has also shown that the portion of the population in the age group 10 to 15 years and of 65 years and over shows a tendency to be higher in areas with less street noise, i.e. families with children and older people on average tend to live in quieter or at least less noisy locations (**Table 2**). This is a positive result but it should not be forgotten that those adolescents and older people, who do live in noisy locations, would tend to be more exposed to road noise than other age groups at the same residential location.

Overall, there is thus a tendency for certain groups in Hamburg to be at a disadvantage concerning the burden of road noise at their residential location. This result however, does not allow any conclusions on

causal relationships, since it is based on a temporal snapshot. One can of course speculate, whether socially weaker groups select residential locations with higher noise levels because the rents are lower, or whether for example the population in socio-economically better-off areas can better resist being affected by higher noise levels. The data, however, provides no information about this.

Future work

As in the studies cited by Bunge and Katzschner (2009), it can be stated here, too, that the analyses presented are of an explorative nature. They will serve as a basis for on-going and further planned investigations in the project "Environmental justice and urban transport" at the Institute for Transport Planning and Logistics at the Hamburg University of Technology.For future phases of the study, it is intended to use better spatially differentiated socio-economic data. Depending on availability, this will come from official statistics or from the synthetic Hamburg population which is currently being generated at the Institute for a transport demand model as part of the project "Efficient airport 2030". Since the actual population data does not provide sufficient detail to calculate demand, homogeneous behaviour groups and origin/destination relationships for this purpose, a statistical population is being mathematically derived for all building blocks in Hamburg from the socio-economic statistics available. In addition to the noise data, the data on nitrogen dioxide and particulate matter burdens, which are currently being calculated for Hamburg, shall also be evaluated. After selecting the study areas for detailed analysis, it is planned to conduct household surveys which will provide, inter alia, information on the relevance of emissions from road traffic for different population groups in making residential location choices.

Concluding remarks

Analyses performed by other researchers and those presented here and planned for the future on the theme of environmental justice and urban transport, can only be regarded as a first step towards a basis for decision making in urban and transport planning. In order to make policy recommendations for resolving possible inequalities in traffic emission burdens for different population groups, it is necessary to formulate standards and objectives at both the political and the planning level. Questions about standards for assessing the attainment of distributive justice must be answered and it must be clarified whether there are groups needing particular protection from traffic emissions (and from other sources) and if so, which ones. Only then can a diagnosis of environmental injustice be translated into recommendations for practical measures. In addition, it should be noted that an increase in social environmental justice should always go hand in hand with a benefit from an ecological perspective. Passive noise protection measures or diverting heavy goods traffic may indeed produce positive local effects but they cannot in themselves fulfil the requirement for integrated and sustainable planning.

Table 2: Results of correlation analysis of socio-economic parameters for the Hamburg population. Statistical domains with the percentage of the domain area affected by the indicated noise level (domains only ≥ 100 inhabitants, N=860).

Socio-economic parameter	Noise parameter Percentage of domain area contaminated with...	Spearman's rho	Significance level of correlation
Percentage unemployed (15-65 years) (2008)	L_{den} ≥ 65 dB(A)	0.194	p < 0.01
	L_{night} ≥ 55 dB(A)	0.193	p < 0.01
		Pearson's r	
Percentage foreigners (2008)	L_{den} ≥ 65 dB(A)	0.297	p < 0.01
	L_{night} ≥ 55 dB(A)	0.284	p < 0.01
Average income per taxpayer (1995)	L_{den} ≥ 65 dB(A)	-0.071	p < 0.05
	L_{night} ≥ 55 dB(A)	-0.069	p < 0.05
Percentage 10-15 years (2008)	L_{den} ≥ 65 dB(A)	-0.291	p < 0.01
	L_{night} ≥ 55 dB(A)	-0.260	p < 0.01
Percentage 65 years and older (2008)	L_{den} ≥ 65 dB(A)	-0.254	p < 0.01
	L_{night} ≥ 55 dB(A)	-0.249	p < 0.01

Municipalities interested in participating in a study on these issues are invited to contact the author. Further information on the projects is available at www.vsl.tu-harburg.de/de/Forschung/Projekte.

Literature

ARGUS Stadt- und Verkehrsplanung et al. (2008): Strategischer Lärmaktionsplan Hamburg: Im Auftrag der Freien und Hansestadt Hamburg, Behörde für Stadtentwicklung und Umwelt. Hamburg.

Bolte G et al. (2004): Soziale Ungleichheit bei der Belastung mit verkehrsabhängigen Luftschadstoffen: Ergebnisse der Kinderkohortenstudie LISA. In: Bolte G, Mielck A (eds.): Umweltgerechtigkeit: Die soziale Verteilung von Umweltbelastungen. Weinheim und München: Juventa: 175-220.

Bolte G, Kohlhuber M (2008): Untersuchungen zur Ökologischen Gerechtigkeit: Explorative Vorbereitungsstudie: Teilprojekt A: Systematische Zusammenstellung der Datenlage in Deutschland. Dessau-Roßlau.

Bundesministerium der Justiz (ed.) (2006): Bekanntmachung der Vorläufigen Berechnungsverfahren für den Umgebungslärm nach § 5 Abs. 1 der Verordnung über die Lärmkartierung (34. BImSchV). (Bundesanzeiger). Bonn.

Bunge C (2008): Umweltgerechtigkeit – Umwelt, Gesundheit und soziale Lage: Empirische Befunde und zukünftige Herausforderungen. In: UMID, 2/2008: 5-9.

Bunge C, Katzschner A (2009): Umwelt, Gesundheit und soziale Lage: Studien zur sozialen Ungleichheit gesundheitsrelevanter Umweltbelastungen in Deutschland. Dessau.

Gaffron P (2010): Urban Transport, Environmental Justice and Human Daily Activity Patterns: Paper ID: 01479, in WCTRS - World Conference of Transport Research Society (ed.): Selected Proceedings of the 12th World Conference on Transport Research Society: July 11-15, 2010 – Lisbon, Portugal. http://www.civil.ist.utl.pt/wctr12_lisboa/WCTR_Selected/documents/01479.pdf (Accessed: 21.03.2011).

Köckler H et al. (2008): Umweltbezogene Gerechtigkeit und Immissionsbelastungen am Beispiel der Stadt Kassel. Kassel.

Lawrence RJ (2002): Inequalities in urban areas: innovative approaches to complex issues. In: Scandinavian Journal of Public Health, 30 (59): 34-40.

Maschewsky W (2004): Umweltgerechtigkeit: Gesundheitsrelevanz und empirische Erfassung. Berlin: Wissenschaftszentrum Berlin für Sozialforschung (Veröffentlichungsreihe der Arbeitsgruppe Public Health, WZB, Berlin).

McLeod H et al. (2000): The relationship between socio-economic indicators and air pollution in England and Wales: implications for environmental justice. In: Regional Environmental Change, 2 (1): 78-85.

Pennycook F et al. (2001): Environmental Justice – Mapping transport and social exclusion in Bradford. London.

Statistisches Amt für Hamburg und Schleswig-Holstein (2010): Volkswirtschaftliche Eckdaten der Metropolregion Hamburg 1999 bis 2007. http://statistik-nord.de/uploads/tx_standocuments/P_I_4_1_j07_H.pdf (Accessed: 21.03.2011).

Statistisches Bundesamt (Hrsg.) (2005): Qualitätsbericht: Zeitbudgeterhebung 2001/2002. Wiesbaden. www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/DE/Presse/abisz/Zeitbudgeterhebung.psml (Accessed: 18.03.2011).

Contact

Dr. Philine Gaffron
Hamburg University of Technology
Institute for Transport Planning and Logistics
D-21071 Hamburg
Email: p.gaffron[at]tu-harburg.de
Internet: www.vsl.tu-harburg.de

Health inequalities in the city: assessing the concurrence of social and environmental risks in the Ruhr Area

Natalie Riedel[1], Barbara Hoffmann[2], Kateryna Fuks[2], Karl-Heinz Jöckel[3], Nico Dragano[3]

Abstract: *Urban neighbourhoods are an important setting for the development of health inequalities. Against this background, two main hypotheses of environmental justice are discussed: (1) Exposure to environmental risk factors depends on the socioeconomic status of the residents and their neighbourhood, and (2) the socioeconomic status shapes the residents' susceptibility to environmental risks. In this project, these two hypotheses are tested by linking long-term data of environmental risk factors and socioeconomic features of neighbourhoods to individual health data of a large epidemiological study in the Ruhr Area. In cross-sectional analyses, traffic-related exposures tend to accumulate in neighbourhoods with low socioeconomic status and especially burden residents with a comparatively low individual socioeconomic status. In forthcoming research projects, the team will investigate cumulative effects and socially induced susceptibility, accounting for the residential history of the participants.*

Environmental justice from an epidemiological research perspective

Across nations, individuals with low income and little education face significantly increased risks of illness and death (WHO CSDH 2008). The fundamental cause for this strong link between social and health inequality are the specific living conditions associated with the socioeconomic status (SES) of subpopulations (Link and Phelan 1995). These living conditions range from residential location to behaviour-related aspects such as nutrition and include numerous health-related dimensions, so that, depending on the socioeconomic status, it can be assumed that there are typical situations and risk factors interacting with each other.

Within medically oriented fundamental research, social epidemiology is focussed on research on social background of diseases. In addition to a traditional research perspective focussed on the individual, there has been an increasing interest in urban environmental factors influencing health inequality (Diex Roux and Mair 2010). So far, assumptions about the relationship between social inequality, environment and health in an urban context can be summarised in two core environmental justice hypotheses (O'Neill 2003; Bolte and Mielck 2004; Bolte and Kohlhuber 2006, van Lenthe 2008):

1) Exposure to harmful environmental factors in cities varies by socioeconomic status of residents and districts.

2) Depending on their socioeconomic status and associated other health risks, people can be more susceptible to, or more resilient against negative health effects from environmental risk factors.

Current studies indicate that exposure to environmental stressors like toxic waste or problematic housing quality actually follows a social gradient (WHO Europe 2009; Martuzzi et al. 2010; Braubach and

[1] TU Dortmund University
[2] Heinrich Heine University of Düsseldorf
[3] University Hospital of Essen, University of Duisburg-Essen

Fairburn 2010). In contrast, evidence for a close association of chronic background environmental pollution such as particulate matter in American and European cities with individual SES is not as conclusive. Among other things, this may be due to atmospheric (meteorological) transport of air pollutants within cities, their historical socio-geographical development or urban development policies (Köckler et al. 2008, Crouse et al. 2009, Deguen and Zmirou Navier 2010). Regarding the second hypothesis of an SES-mediated increased susceptibility, it has been so far difficult to draw final conclusions. Some epidemiological studies have shown that individuals of low SES were susceptible to chemico-physical environmental risks (Laurent et al. 2007; Deguen and Zmirou Navier 2010). In other studies, however, health outcomes did not differ across social strata (Gouveia and Fletcher 2000; Dragano et al. 2009a; Zanobetti and Schwartz 2000).

Despite this inconsistency of the present evidence, it is plausible to suggest that socially differentially distributed environmental pollution and their consequences significantly contribute to the emergence of health inequalities. Considering the importance of the health inequity problem, it is necessary to further investigate these relationships and to close existing gaps in our knowledge (O'Neill et al. 2003; Schulz and Northridge 2004).

In this paper, a new project is presented which deals with the relationship between social inequality, environmental exposure at the residence and individual disease risks. It focusses on common chemico-physical factors in the urban space, especially background particulate matter and traffic-related exposures including noise. The project uses health data from the Heinz Nixdorf Recall Study (HNRS), a population-based longitudinal epidemiological study in the Ruhr Area. On the basis of this study, specific environmental justice research questions are addressed from an epidemiological perspective. The following section briefly outlines the study and presents first results (Jöckel et al. 2010).

Environmental justice analyses in the Heinz Nixdorf Recall Study

Participants of the Heinz Nixdorf Recall Study (HNRS) were randomly chosen from three large adjacent cities in the Ruhr Area in Germany: Mülheim, Essen, and Bochum. The region is highly industrialised and still subject to extensive economic, social and ecological turmoil which makes the study sample suitable for environmental justice studies (Percy 2003, Dragano et al. 2009b). A total of 2,419 women and 2,395 men aged between 45 and 75 took part in the HNRS baseline examination. The HNRS contains a number of medical, psychosocial, socioeconomic and lifestyle-related data, on the basis of which the social and health risks of the study participants can be described in great detail (Schmermund 2002; Erbel 2010; Dragano et al. 2009a/2009b; Hoffmann et al. 2007). **Table 1** presents an overview of the sociodemographic composition of the study participants in the three cities.

In order to show chemico-physical contextual risks of the study participants in their city district, extensive contextual data were collected. The chemico-physical contextual data included various air pollutants

Table 1: Description of the study population.

	TOTAL	MÜLHEIM	ESSEN	BOCHUM
Number of participants	4,814	1,757	1,656	1,400
Age (mean, standard deviation)	59.6 (±7.8)	59.8 (±7.9)	59.96 (±7.8)	59.1 (±7.7)
with				
≥ 18 years	507 (10.6)	215 (12.3)	150 (9.1)	142 (10.2)
14-17 years	1,068 (22.3)	417 (23.8)	355 (21.5)	296 (21.2)
11-13 years	2,676 (55.8)	926 (52.8)	948 (57.5)	802 (57.4)
≤ 10 years of education	547 (11.4)	195 (11.1)	196 (11.9)	156 (11.2)
with				
High	1,529 (33.9)	605 (36.9)	521 (33.6)	402 (30.7)
Medium	1,502 (33.3)	551 (33.6)	493 (31.8)	458 (34.9)
low income (gender-specific tertiles)*	1,473 (32.7)	482 (29.4)	538 (34.7)	453 (34.5)
who are				
Employed	1,928 (40.2)	718 (41.0)	647 (39.2)	563 (40.4)
Unemployed	305 (6.4)	104 (5.9)	305 (6.4)	98 (7.0)

Shown are absolute numbers and proportions in percent.
*** 310 individuals did not state their income.**

Table 2: What were the environmental conditions of the study-participants at the time of the baseline survey? Distribution of the social and chemico-physical contextual risks stratified by individual characteristics of the participants (HNRS study population at baseline n=4,814; Cities: Mülheim, Essen, Bochum).

	Particulate matter mean ($PM_{2.5}$ µg/m³)*	Study participants living <100 m from a major road (%)**	Number of vehicles in a 50-m radius, daily mean **	Study participants exposed to 24 h noise > 65 dB, mean (%)***	Study participants exposed to night-time noise > 60 dB, mean (%)***	Unemployment rate in the district (%)	Mean income in the district (€)
Total	16.65	7.4	3,702	11.6	4.30	12.5	25,212
Men	16.63	7.2	3,867	12.2	4.22	12.5	25,281
Women	16.66	7.5	3,539	11.0	4.38	12.6	25,143
Education (years)							
≥ 18 years	16.66	4.9	2,256	8.9	1.78	11.2	28,108
14-17 years	16.68	6.1	3,515	11.5	4.21	12.1	26,248
11-13 years	16.61	8.4	4,162	12.2	4.71	12.7	24,632
<= 10 years	16.76	7.3	3,168	11.3	4.75	13.6	23,495
Income							
High	16.65	7.1	3,248	10.0	3.14	11.8	26,769
Medium	16.65	6.8	3,478	12.0	4.73	12.7	24,831
Low	16.62	8.8	4,429	12.7	5.02	13.2	23,812
Employment status							
Employed	16.64	7.7	3,923	11.9	4.41	12.3	25,670
Unemployed	16.61	7.5	4,760	13.8	3.93	12.9	24,841

The social contextual variables refer to the district (median: 11,263 residents), environmental exposure data are assigned to the participants address using a GIS.

*** Modelling on a 1-km² grid according to the CTM EURAD model (Ebel et al. 2007).**

**** Definition according to the highest quintile of daily traffic density of all cars (original data: NRW).**

***** Modelling according to European Union Directive 2002/49/EC for traffic-related noise mapping by city registries.**

such as particulate matter ($PM_{2.5}$ µg/m³), modelled on a 1-km² grid, mean road traffic noise exposure for 24 hours and at night-time in 5 dB categories traffic proximity, as well as vehicle density. Geocoded residential addresses were used to allocate environmental exposure (Bauer et al. 2010). Air pollutant modelling was conducted by the Rhenish Institute for Environmental Research at the University of Cologne (Rheinisches Institut für Umweltforschung an der Universität zu Köln). Traffic data were retrieved from the Agency for Nature, Environment and Consumer Protection North Rhine-Westphalia (Landesamt für Natur, Umwelt und Verbraucherschutz, LANUV NRW), and noise data were obtained from municipal environmental agencies.

Next to chemico-physical contextual data, social contextual data were integrated into the study data base. The social contextual data refer to the 'statistical district' in which the study participants lived. The 'statistical district' has been shown to be a meaningful spatial unit in epidemiological studies (e.g. Stafford et al. 2008). Among others, unemployment rate, mean income and residential turnover data were used as indicators for the social burden at the district level district. These data were obtained from municipal agencies for statistics.

On the basis of these chemico-physical and social contextual data, exposure models for two different time references have been developed so far:

1) for the period of the baseline examination, in order to perform explorative cross-sectional correlation analyses, and

2) for the period up to ten years prior to the baseline examination in order to reconstruct the exposure history of the study participants and to be able to quantify the cumulative impact of chemico-physical and social context risks.

Below, first analyses using selected contextual data are presented which demonstrate the concurrence of social and chemico-physical contextual risks at baseline.

Results and discussion

In our initial approach, chemico-physical and social contextual data are presented stratified by socioeconomic characteristics of the study participants (**Table 2**). This shows that there are only small differences in exposure levels of men and women at the time of the baseline examination. However, there are differences depending on education and income at

Table 3: Indications for multiple exposure – risk correlations collected using the address at baseline [HNRS study population, n=4,814; cities: Mülheim, Essen, Bochum].						
	Proximity to major road (50-m paces)	**Number of vehicles in a 50-m radius density**	**24h noise (mean in dB)**	**Night-time noise (mean in dB)**	**Unemployment rate (%)**	**Mean income (€)**
Partic. matter ($PM_{2.5}$ µg/m³)	-0.022	0.022	0.046**	0.052***	-0.056***	0.395***
Distance to street		-0.352***	-0.333***	-0.347***	-0.005	-0.010
Number of vehicles			0.498***	0.522***	0.083***	-0.050***
24h noise (mean in dB)				0.936***	0.124***	-0.083***
Night-time noise (mean in dB)					0.108***	-0.059***
Unemployment rate						-0.712***
Shown are Pearson's correlation coefficients and levels of significance (p<0.01; ***p<0.001)**						

the individual level. With the exception of the background burden of particulate matter, this applies both to chemico-physical and to social contextual risks. Therefore, our results suggest that participants with high individual social risks tend to be also exposed to higher social and chemico-physical contextual risks.

In the next step, we investigated to what extent contextual risks of different origins occurred in particularly high concentrations in certain areas (**Table 3**). A correlation analysis shows that nearly all social contextual risks tend to concur with the chemico-physical contextual risks of traffic density (number of vehicles in a 50 m radius) and traffic noise. In contrast, particulate matter background exposure levels were particularly high in districts which were less affected by adverse social contextual factors. Presumably, this result ensues from the strong northwest southeast gradient of particulate matter concentration in the study area due to local and regional transport of particles by prevailing westerly winds. At the same time, some districts with a high social risk are located in the western part of the area and are therefore strongly affected by background air pollution. Apart from this result, it can be summarised that there is a trend towards multiple exposure especially in subjects with low SES.

Overall, the analyses based on the Ruhr Area population show that individuals with social risks associated with a low education or a low income are more frequently affected by chemico-physical risks. Additionally, chemico-physical and social contextual risks often concur in districts.

These correlations seem to be related to health parameters. In earlier analyses using HNRS data, it was shown that both chemico-physical and social contextual risks were independently associated with subclinical coronary heart disease (Hoffmann et al. 2007; Dragano et al. 2009a; Bauer et al. 2010). Further analyses in the context of the new project outlined here confirm these findings and also show correlations with coronary risk factors like hypertension as well as with psychological illnesses (results not included here). Thus, the study population seems to feature socio-spatially differentiated health effects. However, in a first cross-sectional study, a higher susceptibility could not be confirmed. Maybe, the effects of chemico-physical risks estimated among socially disadvantaged study participants were masked by the multiple contextual and individual risks and were therefore systemically underestimated.

Outlook

This epidemiological analysis on environmental justice succeeded in observing chemico-physical exposure variations following socio-contextual and individual risks, and in showing a high prevalence of multiple exposures that potentially impact health. Several additional analytical steps are planned in order to complete the picture. The focus will be on the temporal perspective which will extend to the retrospective exposure modelling 10 years before the baseline examination. This methodological approach will make it possible to examine exposure duration and intensity relative to both socioeconomic status and disease. Preliminary results show that there is a tendency towards accumulation of environmental pollution and social burdens over time. Accordingly, study participants who lived predominantly in poorer districts or districts characterised by unemployment, were also permanently exposed to road traffic noise and particulate matter. However, fully substantiated results are still pending at this point. Furthermore, it is planned to continue the exposure history up to

the second examination of the HNRS cohort in order to correlate exposure changes inside districts, changes in the socioeconomic status of study participants, and health status. Thus, the question of socially differentiated susceptibility can be examined again in more depth. To that end, this project opens up a broad field of research for profound analysis of environmental justice.

Acknowledgement

We cordially thank the numerous agencies of the three study cities which supported the research. We would also like to expressly thank the Investigative Group of the Heinz Nixdorf Recall study (speaker: Professor Dr. Raimund Erbel, West German Heart Centre) and the Heinz Nixdorf Foundation for their close cooperation and continued funding of the HNRS. Our thanks also go to the dedicated personnel of the study. The current results were supported by the Volkswagen Foundation (in the context of the "individual and social perspectives of aging" research initiative). The HNRS study is also supported by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation).

Literature

Bauer M, Fuchsluger M, Moebus S et al. (2010): Urban particulate matter air pollution is associated with subclinical atherosclerosis – results from the Heinz Nixdorf Recall Study, JACC 2010 in press.

Braubach M, Fairburn J (2010): Social inequities in environmental risks associated with housing and residential location a review of evidence. In: European Journal of Public Health 20 (1): 36-42.

Bolte G, Mielck A (2004): Umweltgerechtigkeit. Die soziale Verteilung von Umweltbelastungen. Weinheim: Juventa.

Bolte G, Kohlhuber M (2006): Soziale Ungleichheit und Gesundheit: Erklärungsansätze aus umweltepidemiologischer Perspektive. In: Richter, Matthias; Hurrelmann, Klaus (eds.) 2006: Gesundheitliche Ungleichheit. Grundlagen, Probleme, Perspektiven. 1. Auflage, Wiesbaden: VS Verlag für Sozialwissenschaften,: 91-108.

Crouse DL, Ross NA, Goldberg MS (2009): Double burden of deprivation and high concentrations of ambient air pollution at the neighbourhood scale in Montreal, Canada. In: Social Science & Medicine, 69: 971-981.

Deguen S, Zmirou-Navier D (2010): Social inequalities resulting from health risks related to ambient air quality – A European Review. In: European Journal of Public Health, 20 (1): 27-35.

Diex Roux AV, Mair C (2010): Neighborhood and Health. In: Annals of the New York Academy of Sciences 1186 (Issue: The Biology of Disadvantage): 125-145.

Dragano N, Hoffmann B, Moebus S et al. on behalf of the Heinz Nixdorf Recall Study Investigative Group (2009a): Traffic exposure and subclinical cardiovascular disease: is the association modified by socioeconomic characteristics of individuals and neighbourhoods? Results from a multilevel study in an urban region. In: Occupational and Environmental Medicine 2009, 66: 628-635.

Dragano N, Hoffmann B, Stang A et al. on behalf of the Heinz Nixdorf Recall Study Investigative Group (2009b) Subclinical coronary atherosclerosis and neighbourhood deprivation in an urban region. In: European Journal of Epidemiology, 24: 25-35.

Ebel A, Memmesheimer M, Jakobs HJ, Feldmann H (2007): Advanced air pollution models and their application to risk and impact assessment. In: Ebel A, Davitashvili T (eds.): Air, Water and Soil Quality Modelling for Risk and Impact Assessment. Netherlands: Springer. 83-92.

Erbel R, Möhlenkamp S, Moebus S et al. (2010): Coronary risk stratification, discrimination, and reclassification improvement based on quantification of subclinical coronary atherosclerosis: the Heinz Nixdorf Recall study. In: J Am Coll Cardiol. 2010, 56: 1397-406.

Gouveia N, Fletcher T (2000): Time series analysis of air pollution and mortality: effects by cause, age and socioeconomic status. In: Journal of Epidemiololgy and Community Health 2000, 54: 750-5.

Hoffmann B, Moebus S, Möhlenkamp S on behalf of the Heinz Nixdorf Recall Study Investigative Group (2007): Residential exposure to traffic is associated with coronary atherosclerosis. In: Circulation 2007, 116: 489-496.

Jöckel KH, Dragano N, Riedel N, Fuks K, Hoffmann B (2010): Einflüsse der sozialen und physikalisch-chemischen Umwelt auf die Gesundheit älterer Menschen. Eine interdisziplinäre Studie zum Zusammenhang zwischen kontextuellen Risikofaktoren und individueller Gesundheit bei einer bevölkerungsbezogenen Stichprobe aus drei Städten des Ruhrgebiets. Analysen zur Umweltgerechtigkeit in der Heinz Nixdorf Recall Studie. Ein Projekt im Rahmen der Förderinitiative ‚Zukunftsfragen der Gesellschaft: Individuelle und gesellschaftliche Perspektiven des Alterns' der gemeinnützigen VolkswagenStiftung. Abschlussbericht.

Köckler H, Katzschner L, Kupski S et al. (2008): Umweltbezogene Gerechtigkeit und Immissionsbelastungen am Beispiel der Stadt Kassel. Center for Environmental Systems Research, CESR-Paper 1, Kassel: Kassel University Press.

Laurent O, Bard D, Filleul L et al. (2007): Effect of socioeconomic status on the relationship between atmospheric pollution and mortality. In: Journal of Epidemiology and Community Health, 61: 665-675.

Link BG, Phelan J (1995): Social conditions as fundamental causes of disease. In: Journal of Health and Social Behavior; 35 (Extra Issue: Forty Years of Medical Sociology: The State of the Art and Directions for the Future): 80-94.

Martuzzi M, Mitis F, Forastiere F (2010): Inequalities, inequities, environmental justice in waste management and health. In: European Journal of Public Health, 20(1): 21-26.

O'Neill MS, Jerrett M, Kawachi I et al. (2003): Health, Wealth, and Air Pollution: Advancing Theory and Methods. In: Environmental Health Perspectives 111; 16: 1861-1870.

Percy S (2003): The Ruhr: from Dereliction to Recovery. In: Couch C, Fraser C, Percy S (eds.): Urban Regeneration in Europe. Real Estate Issues. Oxford: Wiley-Blackwell: 149-165.

Schmermund A, Möhlenkamp S, Stang A et al. (2002): Assessment of clinically silent atherosclerotic disease and established and novel risk factors for predicting myocardial infarction and cardiac death in healthy middle-aged subjects: Rationale and design of the Heinz Nixdorf RECALL Study. In: American Heart Journal 2002, 144: 212-8.

Schulz A, Northridge ME (2004): Social determinants of health: implications for environmental health promotion. In: Journal of Health Education & Behaviour, 31: 455-471.

Stafford M, Duke-Williams O, Shelton N (2008): Small area inequalities in health: Are we underestimating them? In: Social Science and Medicine, 67: 891-899.

van Lenthe F, Mackenbach JP (2006): Aggregate deprivation and health. In: Siegrist J, Marmot M (ed.) Social inequalities in health. Oxford: Oxford University Press: 167-192.

WHO CSDH (2008) (ed.): Closing the gap in a generation. Health equity through action on the social determinants of health. Final report of the Commission of Social Determinants of Health. Geneva: World Health Organisation.

WHO Europe (2009): Environment and health risks: the influence and effects of social inequalities. Report of an expert group meeting Bonn, Germany, 9-10 September 2009. Copenhagen: World Health Organisation.

Zanobetti A, Schwartz J (2000): Race, gender, and social status as modifiers of the effects of PM10 on mortality. In: Journal of Occupational and Environmental Medicine, 42: 469-74.

Contact

Natalie Riedel
Institute of Spatial Planning (IRPUD)
Faculty of Spatial Planning
TU Dortmund University
August-Schmidt-Straße 10
D-44221 Dortmund
Email: natalie.riedel[at]udo.edu

Indicators for environmental justice – on the operationalisation and interrelation of household income and noise annoyance

Heike Köckler and Thomas Weible

Abstract: *The extent of distributional environmental injustice, which means that certain social groups live in a worse environmental quality compared to others, is in Germany still under debate. Contemporary studies often use secondary data for analyzing correlations between the environmental situation and social groups. For this process, indicators are used to operationalise the complex framework of 'environmental justice'. These indicators differ from study to study depending on the respective field of research. In this article, two of such indicators are chosen for further discussion. Noise exposure as well as household income are often used indicators in present scientific debates. Therefore, both of them seem to be good examples to point up the relevance of choice of indicators.*

Introduction

A key issue in the German debate on environmental justice is still the empirical confirmation of the extent of social inequalities in the distribution of environmental quality. It is generally assumed that certain identifiable social groups live in poorer environmental quality than others (Bunge, Katzschner 2009). So far, data have been frequently evaluated in Germany which have been collected to highlight other issues (Kolahgar 2006; Mielck 2004). There are however, occasional studies that explicitly address this issue (Kliemeczek et al. 2009). In all studies, socio-demographic data are combined with environmental data in relationships. Based on such data, statistical relationships have been calculated between the environmental situation and social groups.

The complex relationships of environmental justice are represented by indicators which are either calculated from existing data or from those collected for this purpose. From study to study these indicators differ amongst each other. This is caused by different approaches in these studies regarding topics, methods and theoretical concepts. Depending on the spatial level (district, city, region, national) of the analyses, different data have been produced (Köckler 2011). Thus the topic 'environment' can not only be represented by the objectively measurable and locally available noise indicator L_{den}, for example, but also by the subjectively perceived noise annoyance. But completely different topics such as green space supply or air pollution can also be used as indicators. The spectrum of indicators is just as broad in the social field. A construct such as social status (Burzan 2007), which integrates several single indicators, can also be used. In addition, individual factors such as migration background or household income can be considered which can be represented by different indicators.

This paper discusses indicator examples which represent the factors "noise exposure" and "household income", since both of them occur frequently in the current debate (Bunge, Katzschner 2009) and serve as good examples for the relevance of indicator selection.

The indicator "household income"

As in other countries, a dual trend has developed in Germany in recent years. Firstly, real income has fallen since the beginning 21st century after it had remained largely constant over the 1990s. On the other hand, the number of middle income recipients dropped over this time interval while the proportions of both high- and low-earners have risen in society (Grabka, Frick 2008). A growing divergence between peak earnings and low wages with a simultaneous reduction in average income has been seen (ibid., Wuppertal-Institut für Klima et al. 2009).

In order to enable an assessment of such social effects, in addition to determining and calculating the average household income or the per-capita household income, the determination of the respective equivalent income became the generally accepted default method for poverty assessment. The household income comprises all earnings from all contributing household members (Brümmerhoff 2007). The determined statistical data on income are based on paper questionnaires from a random sample of the population, for instance EU-SILC (European Union Statistics on Income and Living Conditions) or on the "Mikrozensus" (micro census) of the Statistisches Bundesamt (2008). In order to compare the income situation of households of unequal size and structure with one another, the household income is transformed by means of equivalence scales into need-weighted per-capita income. This conversion using a key weighting considers the fact that households with several individuals benefit from the on-going effects of savings in running costs due to multiple occupation (Bundesministerium für Arbeit und Soziales 2008).

The OECD scale, named after the Organisation for Economic Co-operation and Development, has been frequently used in its modified form for this purpose since 2005. In this scheme, the first adult of the household receives the weighting factor 1. The factor 0.5 is attributed to every other adult as well as children from 14 years of age and the factor 0.3 to children under 14 (Bundesministerium für Arbeit und Soziales 2008). An indicator of household income based on this equivalence scale has the consequence that households with children under 14 years have a statistically higher household income than if it was calculated per capita. The quality of the equivalent income indicator depends to a large extent on how well the weighting factor reflects the saving effects due to the household configuration (Schulze 2009; Strengmann-Kuhn 2003; Reinowski, Steiner 2006).

To facilitate an intra-European comparison, the equivalent incomes are uniformly determined annually in the context of the EU-SILC project by means of the modified OECD scale (European Union 2010). The indicator "poverty risk rate", which can be determined from the equivalent income, in turn describes the total social share of those people in households whose net equivalent income is less than 60 % of the general population average (Bundesministerium für Arbeit und Soziales 2008). Poverty should be understood as always being relative to the social realities of a city, region or a state and not in absolute terms. Also, it is not always only a matter of income; rather, it is a "relative, multidimensional and dynamic social issue" (in translator's words) (Bude 2008) which cannot be met using a single indicator.

It should be noted that although indicators such as household budget or equivalent income represent a common practice in social prosperity assessment, such indicators can only to a limited extent express complex relationships such as social inequalities. In this area, however, the indicator "income" makes it possible to identify "low-income households" and to suggest a possible special environmental pressure situation of those concerned.

Noise indicators

Noise is a key topic of environmental justice (Kloepfer et al. 2006; Mielck 2004; Swart, Hoffmann 2004). In related studies, either the perceived annoyance or the objective noise level is used as an indicator. The objective noise level is modelled and/or measured and usually refers to individual sources of noise. The subjectively perceived noise annoyance is frequently determined as a total load by questioning the population and is sometimes specified with regard to different sources. Regarding health effects, the objective noise level is chiefly considered in dose-response models (Kloepfer et al. 2006).

In national studies, which deal with quality of life, environment and/or health, the subjective noise annoyance is determined. Here, questions frequently ask about the perceived noise pollution within the home (sometimes with closed windows). In these studies it is as common to report disturbance in sleep as it is different sources of noise. Usually traffic noise and neighbourhood noise are perceived as the most frequent and most intensive sources (BMU, UBA 2010). Objective noise pollution indicators are usually available for cities and conurbations, since they must be determined in the context of noise action planning. Accordingly, they are used in local studies. Due to the uniform EU legal specifications on environmental noise, a Europe-wide standardisation of data collection and indicators is going on.

Objectively identical noise levels are perceived differently depending on individual factors (Kuhnt et al. 2008). Kruize (2007) found in a study of the Netherlands that income has less influence on a different perception of road traffic noise than education: people with a higher education feel more troubled

by exposure to low level traffic noise than do less well educated people.

In a telephone survey, carried out in Kassel as a pre-test at the Centre for Environmental Systems Research of Kassel University in the winter of 2009/2010, people were quota sampled in polluted areas and low-pollution areas as well as with and without a migration background (N=84). The degree of exposure to traffic-related threshold values for air pollutants (PM_{10} and NO_2) was determined which are documented in the air quality management plan. Since the respondents lived on major roads in polluted areas, it is assumed for the following analysis that, due to the relationship between noise and air pollution, people have also been exposed to an increased noise annoyance. Following the above-mentioned studies, it was also asked whether people felt troubled by noise in their homes with their windows closed.

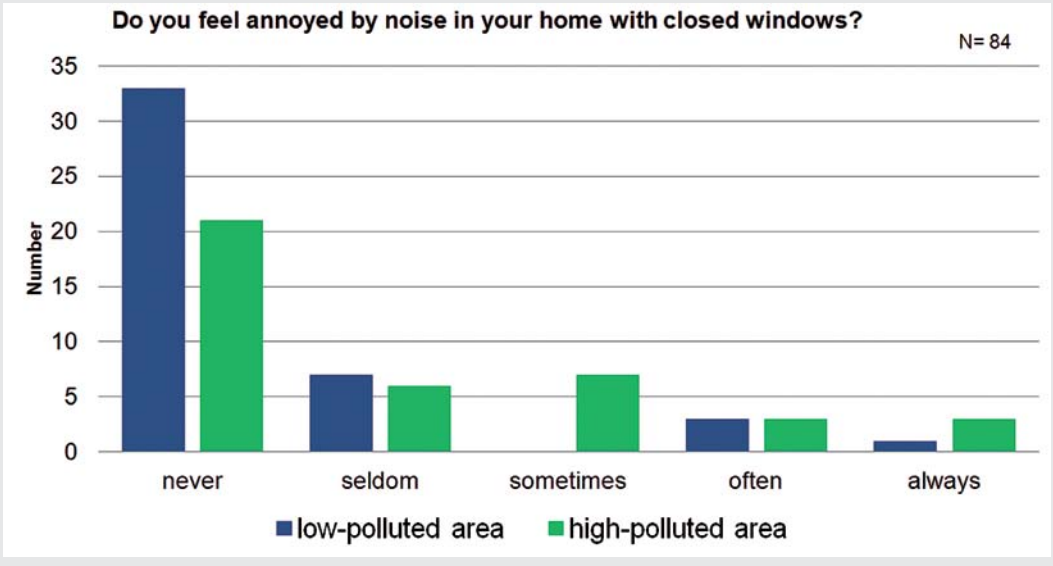
The analysis of variance (ANOVA) shows a statistically significant difference between the objective pollution in the residential surroundings and the subjectively perceived annoyance in the home ($F=5.182$, $p=.025$). The objective situation therefore has an influence on the subjectively perceived situation. Figure 1 shows that despite this main influence by the objective pollution, 21 of the respondents in the affected area never feel troubled, which corresponds to a share of 52.5% of those who live in polluted areas. From the 64 people who claimed never to have felt troubled, 38.9% live in polluted areas. This makes it clear that in this study, for a large part of those who indicated they were not troubled, the objective situation was quite different. Whether or not these results can be generalised remains to be seen. The main investigation was carried out in the Ruhr District and supports these findings for the pre-test. A further publication on this is planned for 2012.

Combining noise annoyance and household incomes in a relationship

In different studies, statistical relationships have been established between noise and income indicators in order to obtain information about social inequality in the distribution of environmental quality. Thus Mielck (2004) investigated differences in noise level and air pollution versus household income. For this, he used data from the socioeconomic panel in which noise, related to the residential area, is raised as a subjective indicator. Income is represented by the indicator "net equivalent income". When determining the equivalent income, Mielck relies on the standard rate gradations used in cost of living benefits calculations from the 1990s. They are above the OECD weights indicated above which means that larger households and households with children have more net income than if the OECD weighting had been used. He concludes "that the lower income groups are much more affected by noise and air pollution than the upper income groups" (Mielck 2004:151).

As part of health monitoring in Bavaria which chiefly collected data on the health situation of children, environmental justice had its own theme. Based on

Figure 1: Perceived annoyance and objective noise exposure in Kassel.



the data, Bolte and Fromme (2008) combined the equivalent income from OECD (see above) into a relationship with the subjective assessment of the respondents regarding air pollution, noise and lack of green space. They came to the following conclusion: "In agreement with the data on housing conditions, families in relative income poverty, both in urban and rural regions, frequently are more severely or very severely affected by air pollution, noise and lack of accessible green space in their residential area." (ibid. 41). Considering the analysis of Mielck and that of Bolte and Fromme against the background of the above findings on noise, it can be assumed that those who said they were not troubled by noise, were objectively exposed to high levels of noise. Thus in an analysis of more objective data, the share of households who are actually troubled would be higher. The statement regarding the relationship between income and environmental pressure would be even more significant. If we consider interpreting the data further, inferences using the indicator "household income" in a new analysis and with a different weighting would be interesting.

The discussions make it clear that noise and income indicators help identify findings on social inequality in the distribution of environmental quality and groups such as "households in relative poverty". It is crucial for the interpretation of the data to recall the definition of the individual indicators. The selection of objective noise indicators or other household weightings would not question past findings, rather, they would support them, as the short discussion of the study of Mielck and that of Bolte and Fromme has already shown.

In order to empirically prove the extent of social inequality in the spatial distribution of environmental quality in Germany it would be useful for the "noise" and "income" factors discussed here to be used to calculate statistical correlations between objective and subjective noise data and objective income. Since objective noise pollution data usually differ quite a lot on the small scale, and only objective income data are available, if at all, on the large scale, they cannot be blended together. Therefore one has to frequently resort to survey data which are based on subjective information both concerning noise and income.

This problem can only be tackled if either the official statistics provide small-scale income data as well or the survey results are objectified so that a clear pollution situation can be assigned to the collected data. This can happen in two ways: either as in the discussed pre-test in Kassel where initially exposed or low-exposure areas were identified and respondents were then randomly selected in these areas, or when the residential addresses of the respondents are also recorded in the data poll and then assigned to an objective noise situation, as outlined by Bolte and Fromme (2008) with regard to the Bavarian health monitoring.

Finally, it should be noted that it is important to collect primary data for environmental justice. The aim should be to combine objective and subjective data on environmental quality as far as possible. It is important to relate these analyses not only to the factors "income" and "noise" as discussed in the examples but also to other thematic areas.

Literature

Bolte G, Fromme H (2008): Umweltgerechtigkeit als Themenschwerpunkt der Gesundheits-Monitoring-Einheiten (GME) in Bayern. In: UMID-Themenheft: Umweltgerechtigkeit – Umwelt, Gesundheit und soziale Lage., H. 2: 39-42.

Brümmerhoff D (2007): Volkswirtschaftliche Gesamtrechnungen. 8. Aufl. München: Oldenbourg.

Bude H (2008): Die Ausgeschlossenen. Das Ende vom Traum einer gerechten Gesellschaft. 4. Aufl. München: Hanser.

Bundesministerium für Arbeit und Soziales (ed.) (2008): Lebenslagen in Deutschland. Der 3. Armuts- und Reichtumsbericht der Bundesregierung.

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU), Umweltbundesamt (UBA) (eds.) (2010): Umweltbewusstsein in Deutschland 2010. Berlin, Dessau-Roßlau.

Bunge C, Katzschner A (2009): Umwelt, Gesundheit und soziale Lage. Studien zur sozialen Ungleichheit gesundheitsrelevanter Umweltbelastungen in Deutschland. Reihe Umwelt und Gesundheit, 2/2009, Dessau-Roßlau: Umweltbundesamt.

Burzan N (2007): Soziale Ungleichheit. Eine Einführung in die zentralen Theorien. 3., überarbeitete Auflage. Wiesbaden: VS Verlag für Sozialwissenschaften.

European Union (2010): Income and living conditions in Europe. Luxembourg: Publications Office of the European Union.

Grabka MM, Frick JR (2008): Schrumpfende Mittelschicht – Anzeichen einer dauerhaften Polarisierung der verfügbaren Einkommen? In: DIW-Wochenbericht, Jg. 75, H. 10: 101-108.

Klimeczek H, Lakes T, Brückner M et al. (2009): Umweltgerechtigkeit in Berlin – Entwicklung und Umsetzung einer praxistauglichen Konzeption zur Untersuchung der räumlichen Verteilung von Umweltbelastungen. In: Hornberg C, Pauli A (eds.): Umweltgerechtigkeit – die soziale Verteilung von gesundheitsrelevanten Umweltbelastungen. Dokumentation der Fachtagung vom 27. bis 28. Oktober 2008 in Berlin. Bielefeld: Universität Bielefeld: 120-127.

Kloepfer M, Griefahn B, Kaniowski AM et al. (2006): Leben mit Lärm? Risikobeurteilung und Regulation des Umgebungslärms im Verkehrsbereich. Berlin, Heidelberg: Springer-Verlag Berlin Heidelberg (Wissenschaftsethik und Technikfolgenbeurteilung, 28).

Köckler H (in print): Der Micro-Macro-Link am Beispiel von Indikatoren umweltbezogener Gerechtigkeit. In: Pinter D, Schubert U (eds.): Wirtschaft – Gesellschaft – Umwelt. Festschrift für Eberhard K. Seifert. Weimar: Metropolis.

Kolahgar B (2006): Die soziale Verteilung von Umweltbelastungen und gesundheitlichen Folgen an industriellen Belastungsschwerpunkten in Nordrhein-Westfalen. Abschlussbericht.

Kruize H (2007): On environmental equity. Exploring the distribution of environmental quality among socio-economic categories in the Netherlands. Utrecht.

Kuhnt S, Schürmann C, Schütte M et al. (2008): Modelling Annoyance from Combined Traffic Noises: An Experimental Study. In: Acta Acustica united with Acustica, H. 94: 393-400.

Mielck A (2004): Unterschiede bei Lärmbelastungen und Luftverschmutzungen nach dem Haushaltseinkommen. In: Bolte G, Mielck A (eds.): Umweltgerechtigkeit. Die soziale Verteilung von Umweltbelastungen. Weinheim und München: Juventa: 139-153.

Reinowski E, Steiner C (2006): Armut von jungen Erwachsenen in der Bundesrepublik. In: Vierteljahreshefte zur Wirtschaftsforschung, Jg. 75, H. 1: 89-107.

Schulze A (2009): Sozioökonomische Konsequenzen der Fertilität. Folgen der Geburt von Kindern für den Wohlstand von Paarhaushalten. Univ., Diss., Mainz, 2008. 1. Aufl. Wiesbaden: VS Verlag für Sozialwissenschaften.

Statistisches Amt der Europäischen Union: EN-EU-SILC-MICRODATA. http://epp.eurostat.ec.europa.eu/portal/page/portal/microdata/documents/EN-EU-SILC-MICRODATA.pdf (Accessed: 26.01.2011).

Statistisches Bundesamt (ed.) (2008): Gemeinschaftsstatistik über Einkommen und Lebensbedingungen. Leben in Europa 2006. Statistisches Bundesamt: Äquivalenzeinkommen. http://www.destatis.de/ (Accessed: 30.01.2011).

Strengmann-Kuhn W (2003): Armut trotz Erwerbstätigkeit. Analysen und sozialpolitische Konsequenzen. Univ., Diss., Frankfurt (Main), 2002. Frankfurt/Main: Campus-Verl. (Frankfurter Beiträge zu Wirtschafts- und Sozialwissenschaften, 8).

Swart E, Hoffmann B (2004): Modifiziert der Sozialstatus die gesundheitlichen Auswirkungen von Lärmexpositionen? In: Bolte G, Mielck A (eds.): Umweltgerechtigkeit. Die soziale Verteilung von Umweltbelastungen. Weinheim und München: Juventa: 199-220.

Wuppertal-Institut für Klima UE, Bund für Umwelt und Naturschutz Deutschland, Brot für die Welt (eds.) (2009): Zukunftsfähiges Deutschland in einer globalisierten Welt. Ein Anstoß zur gesellschaftlichen Debatte. 3. Aufl. Frankfurt am Main: Fischer-Taschenbuch-Verlag.

Contact

Dr. Heike Köckler
Thomas Weible
CESR Kassel University
D-34109 Kassel
Email: Koeckler[at]usf.uni-kassel.de
Weible[at]usf.uni-kassel.de

Urban green spaces and health: a contribution to the debate about social and spatial inequality

Thomas Claßen, Angela Heiler, Björn Brei, Claudia Hornberg

Abstract: *Urban green spaces as a part of our everyday landscape are of high public health relevance. They contribute to reducing environmental stressors such as noise, ambient air pollution and climatic extremes. Furthermore, they serve as valuable health resources since they promote physical activity, recreation and relaxation, social contacts and mental health of the urban population. Urban green areas are, however, unequally distributed and show great diversity in terms of attractiveness, accessibility, safety and functionality to different population groups. Recent studies have analysed the potential health effects or associations between urban green spaces, health and social determinants contributing to the environmental justice debate. The results show clear associations between lack of green spaces, minor health and socio-economic status as well as migration status.*

Introduction

Green spaces can contribute to reducing urban environmental health risks such as noise, air pollution and climatic extremes (Bruse 2003; Makhelouf 2009). Public green spaces are also places enhancing physical activity, social contacts and recreation for various social, ethnic and age groups (Maller et al. 2006; de Vries et al. 2011). Publicly accessible urban green spaces are particularly valuable resources for health and well-being of the urban population (Groenewegen et al. 2006; Maas et al. 2009) and also have a high potential for counteracting socio-spatial polarisation and social deprivation processes in urban areas (Weeber et al. 2011). Natural and semi-natural urban green spaces therefore are of high relevance to public health (Pikora et al. 2003). This paper describes the effects of green spaces on health status of the urban population particularly considering social and spatial inequalities.

Environmental health and social situation of populations

Environmental health is determined by physical, chemical, biological and psychosocial environmental factors which can have a potentially harmful, but also beneficial, impact on health. Enhanced understanding of the environment in terms of the WHO includes both negative ("environmental bads") and positive ("environmental goods") aspects of the environment equally, and is compatible with the notion of health as a constantly renewed balance between resources on the one hand and environmental stressors on the other (Whitehead, Dahlgren 1991; Hornberg, Pauli 2011).

A number of studies have shown that the quality of the environment and abidance in residential surroundings (neighbourhoods) is closely linked to the social situation of the resident population. Socially disadvantaged subpopulations (in terms of income, educational and employment status) are thus more often exposed to harmful environmental stressors (e.g. traffic noise and air pollution) (Mielck, Bolte 2004; Bolte et al. 2010; Hornberg et al. 2010), while access to semi-natural green spaces and recreational areas is below average (Frumkin 2005; Bell, Rubin 2007).

Health, urban green spaces and social inequalities

From a pathogenic perspective in the sense of hazard prevention and pollution reduction, human health is adversely affected by air pollutants i.e. from noise, temperature extremes, allergens or pathogens (Claßen 2008). To counteract this, nature provides healthy products and services (so-called ecosystem services), such as drinking water, clean air, space for physical activity, relaxation and recreation, high quality food or medicinal plants (ibid.; Job-Hoben et al. 2010). Beyond that, the recreational effects of spending time in natural or semi-natural areas affects the psychological and social well-being of people (Hartig et al. 2003). Semi-natural areas also promote physical

Photo: Claßen.

activity (Coombes et al. 2010; de Vries et al. 2011) and can contribute to an increasing sense of security and social cohesion in residential neighbourhoods (Kuo, Sullivan 2001). Urban green spaces are, however, unevenly distributed throughout cities and vary in size, quality, accessibility and usability. Particularly with respect to perception and possible options for use, socially and spatially differentiated patterns emerge, which have so far been only marginally included in the "environmental justice" debate (Hornberg et al. 2010; see paper on p. 9).

In a Dutch study which looked at 24 clinical symptoms in relation to the residential distance of the investigated population from green spaces, Maas et al. (2009) found that people living in urban neighbourhoods with a lack of green space suffer more frequently from these symptoms than do people who live close to green spaces. This link was particularly evident for psychological diseases and handicaps related to depressive disorders and anxieties. The study also showed that in particular children and adults with a low socioeconomic status lived farther away from green spaces (ibid.). In low income areas of England, Mitchell and Popham (2008) found a strong association between low availability of green space and the general state of health. Thus, the morbidity and mortality rates, as a function of higher incomes, were lower among people who had better access to semi-natural environments (ibid.). Another study from Japan showed that good access to urban green space is significantly associated with the quality of life and life expectancy of people (Takano et al. 2002). Common to all quoted studies - as cross sectional studies – is that they only describe associations. They do however provide early indications for the fact that health risks can be reduced by urban green spaces because of their functional contributions to noise reduction, air quality and urban climatic balance.

Perception, assessment and use of natural areas

Urban green spaces and open spaces in urban surroundings exhibit large differences in terms of quality (Hornberg et al. 2007), accessibility, and are used and valued in different ways by the urban population (Brei, Hornberg 2009), since in the (qualitative) rating of urban green spaces, social and emotional aspects as well as aesthetic and cultural elements are of high importance. As part of the Bielefeld 2000 plus Initiative, various studies on the nature and use of urban green spaces were conducted. Thus parks especially are considered balanced socio-spatial temporal systems and social meeting spaces, which nevertheless provide privacy for the individuals and their different interests. Diverse social groups mix in parks (e.g. with respect to age, gender, and ethnic origin) – this potential for social integration has so far been underestimated (ibid.).

The use and perception of designed (natural) spaces, for which a new type of use has been created (e.g. brownfield woodlands) can be very different depending upon the target group using them. Significant differences in perception and usage patterns of urban green spaces (e.g. parks) were found depending on gender, ethnicity and nationality (immigration status), and age group (Brei et al. 2009; Loukaitou Sideris, Sideris 2010). Despite this, most people associate nature and green spaces, however, with a positive effect on health and well-being (Frank et al. 2004; Brei et al. 2008). Therefore increased park use takes place if for instance recreation and sports activities are possible, if natural elements exist and if a park is clean and well maintained (Loukaitou Sideris, Sideris 2010).

Several studies have shown that green spaces have to meet defined quality criteria if they are to exploit their full potential for promoting health (Pikora et al. 2003; WHO Europe 2007). These primarily include the functionality of the green space, its security, aesthetics and attractiveness as well as access. Access should be easy and possible at any time (Pikora et al. 2003). A Swedish study found that the leading causes for a lack of use of urban green spaces by

the urban population are time constraints and the fact that they are too far away from the users home (Stigsdotter, Grahn 2004). Effects on health and well-being were estimated in two studies (Brei et al. 2008, 2009) on behalf of the Ministry for Climate Protection, Environment, Agriculture, Nature Conservation and Consumer Protection of the German State of North Rhine-Westphalia (MKULNV) in the Rhine Elbe brownfield woodland (Gelsenkirchen), using data from the local population. Those surveyed associated the woodland with health benefits such as clean air, recreation and positive effects on health maintenance. As potential barriers to usage, residents cited lack of cleanliness, lack of infrastructure (e.g. density of seats) and not feeling safe. Time of residence in that neighbourhood, identification with the area and nationality/immigration background of those surveyed also had a significant influence on usage. Therefore, sometimes big differences between different subpopulations (e.g. depending on immigration background) were found in terms of their perception and use or lack of use of urban green spaces (ibid.).

Conclusions and recommendations

The aforementioned studies and aspects suggest that availability of and access to green and open spaces as health-promoting (salutogenic) resources must receive increased attention. It also turned out that socioeconomic obstacles that hinder participation in the sharing of health-promoting environmental resources can lead to health inequalities (Mitchell, Popham 2008; Weeber et al. 2011).

Photo: Hornberg.

In further research on the topic of urban green spaces as health resources, the human-nature-relationship and patterns of distribution (in terms of accessibility, availability, options for use of urban green spaces), should be captured and assessed differently e.g. by age, gender, and target group (Brei et al. 2008; Bowler et al. 2010; de Vries et al. 2011). Interdisciplinary co-operation and strategies, and health-promoting green space networks need to be implemented under consideration of the WHO setting model, in order to open up the health-promoting potential for different subpopulations. Urban and city development and planning could be a significant tool for promoting environmental justice as far as the residents of the respective areas are involved in the early planning process in order to take account of positive or negative effects (Mielck 2009; Böhme 2010). After all, contiguous green space structures can contribute to improved accessibility. Beyond that, the quality criteria defined for the Anglo-American region, such as functionality, safety, aesthetics and access (Pikora et al. 2003) might be expanded to include additional criteria considering specific central European aspects. They can contribute to optimising the functionality of urban green spaces as a health resource (Hornberg et al. 2007). Target group specific offers (e.g. for people with a migrant background, children and youth, older people, women, handicapped people) could lead to an increase in use and activity in urban green spaces. Because of the high public health relevance of urban landscape and green spaces, it is important to expand these areas and to design them suitably.

Literature

Bell JE, Rubin V (2007): Why Place Matters: Building a Movement for Healthy Communities. Oakland, CA: PolicyLink; Los Angeles, CA.: California Endowment.

Böhme C (2010): Benachteiligte Quartiere – Gesundheitsförderung durch Freiraumentwicklung in Städten. In: Landschaftsarchitektur, 2010 (4): 8-9.

Bolte G, Pauli A, Hornberg C (2010): Environmental justice – social disparities in environmental exposures and health. Overview of the state of knowledge and current discussion from a public health point of view. In: Nriagu J. (ed.): Encyclopedia of Environmental Health. Elsevier (scheduled for publication in 2011).

Bowler DE, Buyung-Ali LM, Knight TM, Pullin AS (2010): A systematic review of evidence for the added benefits to health of exposure to natural environments. In: BioMed Central Public Health 10(456).

Brei B, Claßen T, Robe H, Kosfeld N, Hornberg C (2008): Urbane (Industrie-)Wälder im Ruhrgebiet und ihre Wirkung auf Gesundheit und Wohlbefinden der lokalen Bevölkerung – Konzeptstudie. Bielefeld/Düsseldorf (Final Report, unpublished).

Brei B, Claßen T, Robe H, Weiffen M, Hornberg C (2009): Urbane (Industrie-)Wälder im Ruhrgebiet und ihre Wirkungen auf die Gesundheit und Wohlbefinden der lokalen Bevölkerung. Untersuchung der Nichtnutzung des Industriewaldes Rheinelbe durch die anwohnende Bevölkerung – Aufbaustudie. Bielefeld/Düsseldorf (Final Report, unpublished).

Brei B, Hornberg C (2009): Die Bedeutung von Stadtgrün aus gesundheitswissenschaftlicher Sicht. In: Public Health Forum, 17 (62): 11-12.

Bruse M (2003): Stadtgrün und Stadtklima - Wie sich Grünflächen auf das Stadtklima auswirken. In: LÖBF-Mitteilungen (1): 66-70.

Claßen T (2008): Naturschutz und Vorsorgender Gesundheitsschutz: Synergie oder Konkurrenz? Identifikation gemeinsamer Handlungsfelder im Kontext gegenwärtiger Paradigmenwechsel. Mathematisch-Naturwissenschaftliche Fakultät der Rheinischen Friedrich-Wilhelms-Universität Bonn. Bonn.

Claßen T, Hornberg C (2008): Gesundheitsförderung durch Stadtgrün: Impulse und Voraussetzungen einer gesundheitsgerechten Stadtentwicklung. In: Naturschutz und Biologische Vielfalt, Bd. 65. Bonn-Bad Godesberg: Landwirschaftsverlag: 49-64.

Coombes E, Jones AP, Hillsdon M (2010): The relationship of physical activity and overweight to objectively measured green space accessibility and use. In: Social Science & Medicine 70(6): 816-822.

Frank K, Frohn J, Härtich G, Hornberg C, Mai U, Malsch A, Sossinka R, Thenhausen A (2004): Grün für Körper und Seele. Zur Wertschätzung und Nutzung von Stadtgrün durch die Bielefelder Bevölkerung. Bielefeld 2000plus – Forschungsprojekte zur Region. Diskussionspapier 37. Bielefeld. http://www.uni-bielefeld.de/bi2000plus/dokumente/Gruen_37.pdf (Accessed: 26.05.2011).

Frumkin H (2005): Health, Equity, and the Built Environment. In: Environmental Health Perspectives 113: A290-A291.

Groenewegen PP, Berg AVD, Vries S de, Verheij RA (2006): Vitamin G: effects of green space on health, well-being, and social safety. In: BMC Public Health, 6 (149): 1-9.

Hartig T, Evans GW, Jamner LD, Davis DS, Garling T (2003): Tracking restoration in natural and urban field settings. In: Journal of Environmental Psychology 23 (2): 109-123.

Hornberg C, Brune K, Claßen T, Malsch A, Pauli A, Sierig S (2007): Lärm- und Luftbelastung von innerstädtischen Erholungsräumen am Beispiel der Stadt Bielefeld. Diskussionspapier Nr. 46, Bielefeld: Bielefeld 2000plus.

Hornberg C, Bunge C, Pauli A (2011): Strategien für mehr Umweltgerechtigkeit – Handlungsfelder für Forschung, Politik und Praxis. Universität Bielefeld: Bielefeld.

Hornberg C, Pauli A (2011): Soziale Ungleichheit in der umweltbezogenen Gesundheit als Herausforderung für Stadtplanung. Handbuch Stadtplanung und Gesundheit (in print).

Job-Hoben B, Pütsch M, Erdmann KH (2010): Gesundheitsschutz – eine „neues" Themenfeld des Naturschutzes? In: Natur und Landschaft, 85 (4): 137-141.

Kuo FE, Sullivan WC (2001): Aggression and violence in the inner city: Impacts of environment via mental fatigue. In: Environment and Behavior 33: 543-571.

Loukaitou-Sideris A, Sideris A (2010): What Brings Children to the Park? Analysis and Measurement of the Variables Affecting Children's Use of Parks. In: Journal of the American Planning. Association, 76, 1: 89-107.

Maas J, Verheij RA, De Vries S, Spreeuwenberg P, Schellevis FG, Groenewegen PP (2009): Morbidity is related to a green living environment. In: Journal of Epidemiological Community Health, 63: 967-973.

Makhelouf A (2009): The effect of green spaces on urban climate and pollution. Iran. In: Journal of Environmental Health Science & Engineering, 6 (1): 35-40.

Maller C, Townsend M, Pryor A, Brown P, St. Leger L (2006): Healthy nature healthy people: ‚contact with nature' as an upstream health promotion intervention for populations. In: Health Promotion International, 21 (1): 45-54.

Mielck A (2009): Umwelt-Gerechtigkeit: Plädoyer für die Weiterentwicklung der empirischen Methoden und Ergebnisse aus der Münchner APUG-Region. In: Hornberg C, Pauli A (eds.): Umweltgerechtigkeit – die soziale Verteilung von gesundheitsrelevanten Umweltbelastungen. Dokumentation der Fachtagung vom 27. bis 28. Oktober 2008 in Berlin. Eigenverlag Universität Bielefeld: Bielefeld: 99-112.

Mielck A, Bolte G (2004): Umweltgerechtigkeit. Die soziale Verteilung von Umweltbelastungen. Weinheim: Juventa Verlag.

Mitchell R, Popham F (2008): Effect of exposure to natural environment on health inequalities: an observational population study. In: Lancet. 372: 1655-60.

Pikora T, Giles-Corti B, Bull F, Jamrozik K, Donovana R (2003): Developing a framework for assessment of the environmental determinants of walking and cycling. In: Social Science & Medicine, 56 (2003): 1693-1703.

Stigsdotter UA, Grahn P (2004): A Garden at Your Doorstep May reduce Stress – Private Gardens as Restorative Environments in the City. Department of Landscape Planning Alnarp Swedish University of Agricultural Sciences SLU.

Strohmeier A, Mai U (2007): In guter Gesellschaft: Städtische Öffentlichkeit in Parks. Eine vergleichende Untersuchung von Nordpark und Bürgerpark in Bielefeld. Bielefeld 2000plus – Forschungsprojekte zur Region. Heft 45. Bielefeld.

Takano T, Nakamura K, Watanabe M (2002): Urban residential environments and senior citizens´ longevity in megacity areas: the importance of walkable green spaces. In: Journal of Epidemiology & Community Health 2002, 56: 913-918.

Vries S de, Verheij RA, Groenewegen PP, Spreeuwenberg P (2003): Natural environments – healthy environments? An exploratory analysis of the relation ship between green space and health. In: Environment and Planning A 2003, 35: 1717-1731.

Weeber R, Nothdorf P, Fischer R, Beiträge der Partnerstädte (2011): CoNet‘s Guide to Social Cohesion. Integrated Approaches in Disadvantaged Neighbourhoods. CoNet (eds.). Berlin Senatsverwaltung für Stadtentwicklung.

Whitehead M, Dahlgren G (1991): What can be done about inequalities in health? In: The Lancet, 338 (8774): 1059-1063.

Contact

Dr. Thomas Claßen
Bielefeld University
Faculty of Health Science
WG 7 ‘Environment and Health‘
Universitätsstraße 25
D-33615 Bielefeld
Email: thomas.classen[at]uni-bielefeld.de

Knowledge, attitudes and perceptions of women of Turkish origin regarding environmental health in Berlin

Rahsan Yesil[1], Valerie Kirchberger[2], Ruth Waldherr-Ifada[3], Kathryn C. Dowling[4]

Abstract: *Special attention for minority groups is necessary to achieve environmental justice. In Germany, information is lacking on the environmental health status of minority groups. We addressed this using focus group discussions to assess the knowledge and perceptions of health and environment by first- and second-generation Turkish immigrant women. A notable difference between the generations was apparent. The first generation experiences the environment in tangible ways related to sensory perception, whereas the second generation, similar to German society, appreciates that many contaminants cannot be perceived. The second generation displayed scepticism toward the medical establishment, in contrast to their mothers' generation. Self-reports of social stress among second-generation subgroups may indicate high allostatic loads. The first generation experiences low educational levels and linguistic isolation. Generational differences are pertinent for both their environmental exposure patterns and risk communication approaches.*

Introduction

The concept of environmental justice originated in the USA and refers to the problem that ethnic minorities are frequently exposed to the burden of environmental pollution. This topic is of importance in Germany as well. In 2007, the percentage of people with an immigration background in Germany was approximately 19 % and in Berlin close to 24 %. Of the population of Berlin, 6.3 % were of Turkish nationality in 2007 or were formerly Turkish citizens (Statistisches Bundesamt 2009). Research into environmental justice in Germany has so far been concerned mainly with the health risks of people with low socioeconomic status. According to school enrolment studies in the Berlin District of Friedrichshain-Kreuzberg, 85 % of parents of preschool children of Turkish origin were of low socioeconomic status (Bezirksamt Friedrichshain-Kreuzberg von Berlin 2005). Hornberg and Pauli (2009) describe this as vertical social inequality factors and point out that horizontal factors such as origin, gender and age must also be considered. Morello-Frosch and Shenassa (2006) suggest that there is a possible link between environmental stress factors and their health effects (**Figure 1**).

Data on immigrants' health issues are still lacking and this is complicated by the different ways in which data are acquired for various statistics. In addition, immigration influences both disease risk and health care system access. This is often affected by language and cultural barriers (Razum et al. 2004).

The study presented here was based on the concept of environmental justice and focused on the individual perception and understanding of the environment and environmental burdens by Turkish immigrants living in Berlin. Since women spend on average more time at home (Hornberg, Pauli 2008), women with a Turkish immigration background were interviewed in this study. The working hypothesis was that the cultural adaptation to mainstream society may affect the perception and treatment of the environment and environmental influences in subsequent generations. In

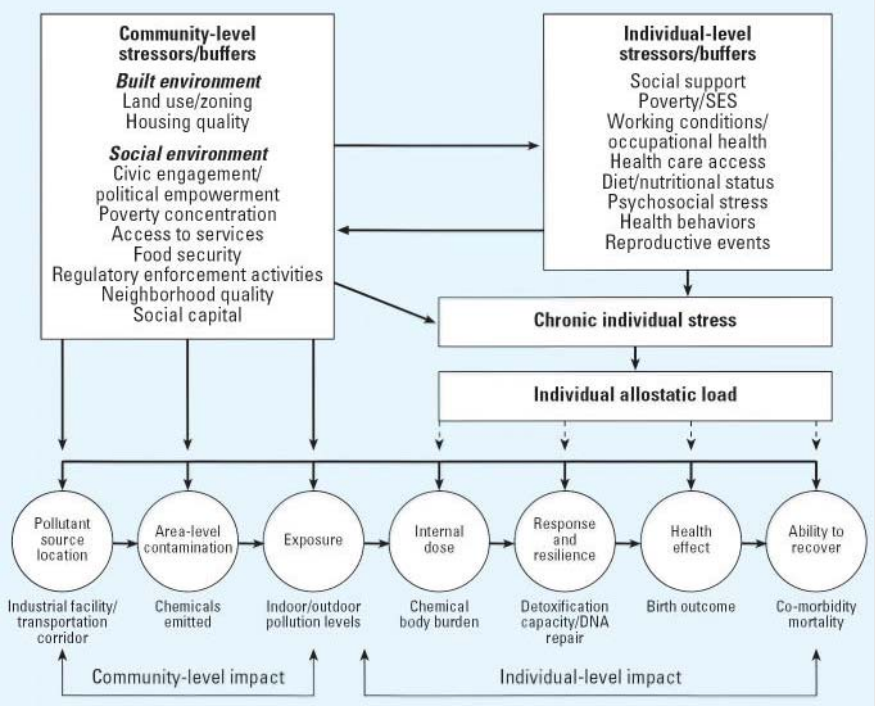
[1] Robert Koch Institute, Berlin

[2] Ludwig Maximilians University, Munich

[3] Berlin School of Public Health, Charité University Medicine, Berlin

[4] Iniciativa EQUIPS, Madrid

Figure 1: Influence of environmental stressors on health (reproduced with permission from Environmental Health Perspectives).



order to investigate this hypothesis, two generations of women were questioned and the results were compared with one another in this study.

Study design

The study used a qualitative research approach. Focus groups are particularly suitable for exploratory studies since they allow various opinions to be expressed (Morgan 1997). Altogether four focus group discussions were performed, two with women of the first and two with those of the second generation. The objective was to investigate their understanding and perception of the environment and environmental influences. The selection criteria for the focus groups were as follows:

- female, of Turkish origin and living in Berlin (Neukölln, Kreutzberg, Wedding),
- first-generation immigrant, Turkish-speaking,
- second-generation German-speaking, predominantly socialised in Germany.

A Turkish and German speaker trained in social pedagogy and a German speaker trained in social economy carried out the recruitment, led the focus group discussion, and conducted the transcribing, coding and a quantitative content analysis according to Morgan (1997) using Atlas.ti software. A physician replicated the coding in order to identify the inter-generational differences and test the inter-rater reliability. All were women.

Methodology

An interview guide was compiled which was pretested and then modified accordingly. Institutions, associations, women's meeting places and personal networks were used as recruitment sites. A personal data questionnaire served as a study tool. Two focus group discussions per generation were carried out; for the first generation in Turkish, for the second generation in German. The discussions from the first generation were transcribed and translated into German. The group discussions took about 90 minutes each. All participants received a voucher worth 20 euros. The research questions focussed on three areas:

- understanding and perception of the environment and the relationship between environment and health,
- living and environmental conditions of the women,
- sources and reliability of health information.

Table 1: Participant data.					
	n	Birth year	Children	Persons per room	Years of education
1st gen., 1st group	8	1953 – 1963	All: 2 – 4	0.5 – 1.7	0 – 8
1st gen., 2nd group	8	1937 – 1959	All: 2 – 5	0.5 – 1.6	0 – 5
2nd gen., 1st group	7	1969 – 1975	57 %: up to 2	0.5 – 1.6	9 – 18*
2nd gen., 2nd group	8	1969 – 1979	25 %: up to 2	0.6 – 2.0	10 – 18*
*The total of 18 years comprises 13 years of primary plus secondary school and 5 years university education.					

Results

Table 1 summarises some characteristics of the participants in the four focus groups. The education level clearly differs between the first and second generation. Participants from the first generation usually had little or no education, were frequently (early) retirees and had German linguistic deficits. Women of the second generation had finished school, many of them had a university degree, good to very good German skills, and some of them were single-parent mothers. All participants of the second generation and nearly all of the first generation lived in flats facing the street.

In order to investigate the reliability of our results, a test for inter-rater reliability with secondary coding was carried out. This relied on the categories specified by the two primary coders and used Hayes and Krippendorf's (2007) K_{ALPHA} methodology. Good K_{ALPHA} values were obtained (above 0.75; 1 represents a perfect match between coders). This means that the developed coding scheme provided comparable results, independently of the coder, her level of knowledge and scientific background. A limitation of the methodology was seen to some extent by the different coding categories which stemmed from categories having been independently developed by the two primary coders. This however did not constrain the results of the questioning in terms of content, but primarily affected the K_{ALPHA} values.

Understanding and perception of environment and health

The two generations have a different understanding of the environment. Second-generation women have a pronounced awareness of the environment. They are concerned about the influence of the environment on health and see a connection between environmental toxins and their health outcomes such as cancer.

> **2nd gen., 2nd group, participant A:** *I just wanted to say that one has already considerable influences, negative ones; that one perhaps does not notice at the moment, but somehow get into the lungs and that one gets some bad diseases, although one for example does not smoke actively; that one can get lung cancer.*

Some environmental burdens were mentioned, to which the women believe they are exposed. The first generation described the importance of air quality and in particular specified poor indoor air quality and car exhaust fumes as problems. In particular, passive smoking by family members is a topic of the first generation.

> **1st gen., 1st group, participant J:** *I used to live in Karl Marx Street and every day saw the doctor and was ill. I am not sure if it was the bad air. I lived in the rear house with coal oven heating. I have lived in Britz for four years now and I feel young again.*

> **2nd gen., 1st group, participant B:** *For me it is the cars on the main street. That is really bad. I notice also, when I dust at home. Really black. Auto exhaust.*

In contrast to the first generation, the second generation spoke about noise. Due to low incomes, second-generation women can usually only afford to live on main streets and they and their children are exposed to street noise and vehicle exhaust fumes. For first-generation women cleanliness and purity are particularly important. Garbage represents a major problem.

> **1st gen., 1st group, participant J:** *Naturally garbage, it is collected far too little. I am not sure if it is because too few people live here, but it is only every other week that they collect the garbage.*

Environment means to perceive through sensory organs, for example through the eyes and nose.

1st gen., 1st group, participant E: *I really feel disturbed by dog feces (...) Have you already noticed that park benches smell of dog feces after it rains?!*

Living and environmental conditions of the women

In Turkish the word *çevre* is used for the environment. In essence it refers to the social environment. Therefore the social environment is crucial for the first generation and is understood as social support. For the second generation, social support in particular is very important when dealing with problems. At the same time it should be mentioned that the social environment also represents a burden for some of them. The second generation reports in detail on enormous difficulties and stress as (single) mothers. Single mothers also complain more frequently about their difficult everyday conditions.

2nd gen., 1st group, participant K: *There is so much paperwork, I don't know, if one wants to see the doctor, you must get a referral for example, you must get it. But if you live in a village, you don't need anything, you have only quiet … Fresh air, everything, no vehicle exhaust, sheep, animals, I say one sees fresh flowers, everything, fresh fruits, vegetables… Here everything is stress, all you hear are problems when talking amongst ourselves.*

In terms of living and environmental conditions the first generation experiences discrimination by the German population. Both generations report conflicts; the first in particular with neighbours, the second with other ethnic groups. The second generation expresses concern about its children regarding violence and drugs at school. The first generation reports regional differences in Berlin and avoids nearby parks in residential areas because of violence and drugs.

1st gen., 1st group, participant E: *In the old days we went blindly through the Hasenheide [Park] and now? I am afraid there. I don't go there any more.*

Sources and reliability of health information

Some of the results are of special importance in view of the previous category, understanding of environment and health. First of all clear differences were found in the approach of the two study generations in collecting information. The first generation has complete confidence in doctors and health care.

Presenter: *Where do you obtain information about health?*

1st gen., 1st group, participant B: *I use the things which my doctor says, and those from older relatives. I then apply them for myself or my children. I also observe the results, but the solution is still with the doctor.*

Second-generation women obtain information about health issues independently and are interested in alternative healing methods rather than in conventional medicine. They use media such as books, magazines and the Internet.

2nd gen., 1st group, participant B: *I get it instead from the Internet. It is very extensive; one can then also read different sources and opinions there. Even the doctors are different; there are homeopaths, there are chemists, and they also argue among themselves.*

The second generation expressed clear scepticism about the German health care system. Women from the second generation have reservations about doctors and try to learn from other sources of information.

Discussion

The cost-efficient qualitative approach selected for the study is suitable for reaching special groups. The study yielded interesting results that can serve as a basis for hypothesis forming for more extensive quantitative research. This is an important step to focus attention on the living conditions of people with immigrant backgrounds.

Albeit for different reasons, neither of the generations feels safe and at ease in their respective residential surroundings. The first generation feels particularly troubled by dirt in their neighbourhoods and a lack of security at local recreational areas. The second generation additionally reports other stressors such as being a single mother, lack of integration in the job market and increased exposure to environmental toxins.

The level of education in the second-generation interviewees was considerably higher than that of the first. This was in part due to the recruitment locations (continuing education sites) and also due to the high level of education in the Turkish-speaking recruiter's personal networks. It is notable that the second-generation women questioned have relatively low incomes. This confirms the empirical findings that people with a Turkish immigration background have

difficulties in the labour market and with higher education (Liebig et al. 2007). A consequence is that they can only afford flats facing the street, which is indicative of an increased exposure to noise (Hoffman et al. 2003), auto exhaust and particulate matter. Single mothers and their children more often live in flats in such areas and spend much more time there due to child rearing (Buchholz 2005).

Both generations mention ethnic conflicts especially with neighbours, violence in the neighbourhood and at school. According to Borde and David (2003) second-generation women of Turkish origin in particular suffer psychosocial stress. The concept of allostatic load means that people with a low socioeconomic status are more frequently exposed to chronic stressors which may lead to an increased release of stress hormones that adversely affects their health (McEwen, Stellar 1993). Morello-Frosch and Shenassa (2006) suggest that increased chronic stressors can increase sensitivity and/or susceptibility towards harmful environmental influences.

Peek et al. (2009) investigated varying allostatic loads in people of Mexican origin in rural Texas. Mexicans born abroad had the lowest allostatic load. Americans of Mexican origin born in the USA had higher values than those of European origin. Kotwal (2010) has found similar results: people with a Turkish immigration background of both generations in Germany more frequently report a feeling of "general emptiness". They also have an increased relative risk for chronic diseases and a subjectively high feeling of malaise.

The results of this study also raise the question of whether the women surveyed exhibit an increased allostatic load as indicated by the reported stress. Applying Morello-Frosch and Shenassa's model to these women, one can see that in particular second-generation women have a greater risk of disease, partly because they are more critical towards the health care system than the first generation.

Outlook

Based on the results of this study we recommend more data be collected on the topic of the environment and health of immigrants. It is important to understand their subjective perception of the environment and health since it has a considerable effect on their behaviour. This appears for example in the use of local recreational facilities such as parks, which is low, due to the lack of a sense of security. The reported ethnic conflicts represent a more complex problem requiring stakeholders from many fields to co-operate. The opportunity for shaping their own living space may create more transparency and serve at the same time as a model for eliminating misunderstandings and mitigating ethnic tensions.

This study shows that mothers, especially single mothers of second-generation Turkish origin, suffer increased stress. In this regard it is of interest to test Morello-Frosch and Shenassa's model in order to verify whether the same relationship applies to people with a Turkish immigration background. In the case of an actual increase in allostatic load, adequate interventions should be planned and implemented. The focus should be on diseases which can be particularly triggered by increased stress hormones, for example depression, elevated blood pressure and diseases caused by a weakened immune system.

Finally, the question arises regarding adequate risk communication with respect to outreach for this group of women and their families. The study has revealed that the women are interested in additional sources of information. Potential approaches to health and risk communication are 1) providing information directly to younger women of the second generation and through them to the Turkish community and 2) the inclusion of the first generation which has a strong social orientation and, above all, better availability in terms of time. This presents, however, the challenge of reading and writing skills, both in Turkish and in German.

Literature

Bezirksamt Friedrichshain-Kreuzberg von Berlin (ed.) (2005): Zur sozialen und gesundheitlichen Lage der türkischen Bevölkerung im Berliner Bezirk Friedrichshain-Kreuzberg. http://www.berlin.de/imperia/md/content/bafriedrichshain-kreuzberg/plan-undleitstelle/zur_sozialen_und_gesundheitlichen_lage_der_t_rkischen_bev_..pdf?start&ts=1278500917&file=zur_sozialen_und_gesundheitlichen_lage_der_t_rkischen_bev_pdf (Accessed: 25.02.2011).

Borde T, David M (2003): Gut versorgt? Migrantinnen und Migranten in Gesundheits- und Sozialwesen. Frankfurt am Main: Mabuse-Verlag.

Buchholz K (2005): Genderaspekte im Bereich Immissionsschutz: Luftverschmutzung und Lärmbelastungen. Sondierung des Themenfeldes. GenaStudien 3. Frankfurt am Main.

Hayes AF, Krippendorf K (2007): Answering the call for a standard reliability measure for coding data. In: Communication Methods and Measures, 1: 77-89.

Hornberg C, Pauli A (2008): Gender, Umwelt und Gesundheit – Neue Sichtweisen auf das Umweltgerechtigkeitskonzept. In: UMID, 2/2008: 22-26.

Hornberg C, Pauli A: (2009): Umweltgerechtigkeit – auch ein Thema in Deutschland? In: Umweltmedizin in Forschung und Praxis, 14: 45-51.

Kotwal AA (2010): Physical and psychological health of first and second generation Turkish immigrants in Germany. In: American Journal of Human Biology, 22: 538-545.

Liebig T (2007): The labour market integration of immigrants in Germany. OECD Social, Employment and Migration Working Paper 47. http://www.oecd.org/dataoecd/28/5/38163889.pdf (Accessed: 23.01.2011).

McEwen BS, Stellar E (1993): Stress and the individual: Mechanisms leading to disease. In: Archives of Internal Medicine, 153: 2093-2101.

Morello-Frosch R, Shenassa ED (2006): The environmental "riskscape" and social inequality. In: Environmental Health Perspectives, 114: 1150-1153.

Morgan D (1997): Focus Groups as Qualitative Research. Qualitative Research Methods Series 16, Sage: Thousand Oaks, California.

Peek MK, Cutchin MP, Salinas JJ et al. (2009): Allostatic load among non-Hispanic whites, non-Hispanic blacks, and people of Mexican origin: effects of ethnicity, nativity, and acculturation. In: American Journal of Public Health, 100: 940-946.

Razum O, Geiger I, Zeeb H, et al. (2004): Gesundheitsversorgung von Migranten. In: Deutsches Ärzteblatt, 101: A2882-A2887.

Statistisches Bundesamt (Hrsg.) (2009): Bevölkerung und Erwerbstätigkeit: Bevölkerung mit Migrationshintergrund – Ergebnisse des Mikrozensus 2007. https://www-ec.destatis.de/csp/shop/sfg/bpm.html.cms.cBroker.cls?cmspath=struktur,vollanzeige.csp&ID=1023127 (Accessed: 23.01.2011).

Contact

Rahsan Yesil
Robert Koch Institute
General-Pape-Str. 62-66
D-12101 Berlin
Email: yesilRa[at]rki.de

The work group „Human Health“ of the EIA association – active commitment for the consideration of the topic in planning processes

Klaus von Zahn[1] and Corinna Berger[2]

Abstract: *The work group „Human Health“ of the EIA Association (Association for the Assessment of Environmental Impacts) has the intention, to enhance the communication between health, environmental and planning experts and thereby to improve the quality of health department representations given in planning processes. In this context currently there are mainly three projects in accruement: a municipal health plan which shows health infrastructure and health targets, giving concrete references especially for town planning and infrastructure projects. The second challenge is the configuration of an internet based knowledge platform for experts searching for information about health matters in planning processes. The last but not less important aim is the creation of a guideline for health experts working on representations, by explaining the different proceeding types for realising projects in Germany and giving concrete hints for possible relevant health aspects. All three products are aimed to be completed in the next year.*

The working group

The Association for the Assessment of Environmental Impact (EIA) was formed in 1987 in Hamm (North Rhine-Westphalia). The association promotes precautionary environmental protection and the deployment of all planning and management instruments needed for it. The EIA association is a general point of contact for all precautionary environmental protection issues. “Human Health” is a working group within the EIA association. It is a nationwide working group, with the objective of improving the quality of expert reports on human health in the context of planning procedures, and particularly environmental audits and environmental impact assessments (EIA) required by German legislature. The working group was created in April of 2008 and meets about four times a year. The all-day meetings take place alternately at the participating institutions.

The group consists of about 30 interested individuals from 15 different organisations. The Universities of Kassel, Muenster, Dortmund, Bochum, Bielefeld are represented, the Federal Environment Agency, State Health and Labour Office of North Rhine-Westphalia, the State Office for Nature, Environmental and Consumer Protection North Rhine-Westphalia as well as several consultants, planning agencies and urban planning and public health authorities.

Origin and aspiration

In recent years, both planners and specialists within health authorities have identified the optimisation potential for health related expert reports in planning proceedings (see MUNLV NRW 2005). This was the reason for founding the “Human Health” working group of the EIA association.

After several state laws had introduced the mandatory inclusion of health authorities in planning proceedings in the 1990s (see e.g. ÖGDG NRW 1997), the respective agencies and institutes were faced with the question of how this new task was to be mastered technically and in terms of personnel. Often no additional personnel resources were made available. Existing staff were required to take on the new

[1] Düsseldorf Urban Planning Office

[2] Ruhr University, Bochum

tasks in addition to their regular work. On the technical side, a number of very diverse sets of planning proceedings with a broad spectrum of topics existed. From urban planning to transport infrastructure planning to hydro-engineering or mining rights projects, documents had to be processed and reviewed from a health perspective. Without sufficient advanced training staff were often confronted with zoning procedures, building codes, planning approval procedures on the basis of various technical laws and different informal planning concepts. Their job was to deliver relevant planning and project related reports on time. It is not surprising that these reports were often either not detailed enough or were too detailed, that relevant aspects were overlooked, or that topics were discussed which had already been dealt with in depth by other authorities. The latter in particular included those environmental issues that had been dealt with by specialised environmental agencies for many years at a much higher level of expertise. Good examples for that are in the areas of noise, contaminated land or groundwater protection.

This situation, unsatisfying for all involved, was to be fundamentally improved by the work of the new working group. The goal was joint analysis and discussion on an equal footing, an open exchange about the potential for optimisation, mutual learning and teaching, without lecturing each other. It quickly became apparent that health, environmental and planning authorities differ greatly in terms of language and terminologies, which, in the absence of open dialogue, would have resulted in a high potential for misunderstandings and ensuing conflict. Therefore, the joint approach was judged by all to be enriching and productive.

Building a new neighbourhood – how can health interests be properly integrated in the planning process early on? (Photo: von Zahn).

Activities of the working group

After a busy start-up phase in 2008, several agenda items were established as standing items, which were then supplemented with other aspects on a case by case basis. A regular item on the agenda was the introduction of individual members with a detailed presentation of their work as it relates to the topic of human health. Becoming acquainted in this manner worked very well given the interdisciplinary and cross-institutional composition of the working group. Arriving at a common understanding for terminology among planners, health scientist and environmental experts often produced surprising Aha! effects. In terms of content, the following topics have been dealt with so far: "heat stress", "electromagnetic fields", "health concerns in EIA proceedings", "contextual health risks", and, on several occasions, "handling public health authority reports in the context of an environmental audit".

In the context of the basic objective of gauging the quality of health related expert reports in planning proceedings, the following are some of the concrete goals that were established for the working group:

- a concept for a "Municipal Health Plan",
- an online expert platform "Human Health",
- a guidance document "Protection of Mankind".

Municipal Health Plan

The State Health and Labour Office of the State of North Rhine-Westphalia (LIGA.NRW) and the consulting firm Enderle-Beratung are working together on a concept for realising a "Municipal Health Plan". It is modelled on specialised plans from other technical disciplines, like the green space control plan, the noise abatement plan or the municipal urban climate analysis. The municipal health plan will compile and graphically represent health interests relevant for planning in a municipality. Initial approaches are currently being pilot tested in municipalities. The "Human Health" working group continuously monitors these activities, integrating the experience of the institutions represented into the development process.

Air monitoring container in Düsseldorf – the expert platform will also include threshold values and precautionary values for different environmental topic areas (Photo: Diehl).

Expert platform "Human Health"

The second project is the expert platform "Human Health", which, in the medium term, is a public online knowledge base for a technical audience. The platform will compile references, guidance, technical essays, legal texts and links which support a comprehensive examination of, and engagement with the topic. The expert platform will also serve as a communication platform for the work within the working group and the EIA association. Registered users will have access to meeting minutes and comments on drafts, as well as a discussion forum. In the long term, the expert platform is to serve as an accessible source of information and shall become a practical tool for all experts working on the topic.

Guidance document "Protection of Mankind"

The "Protection of Mankind" guidance document is to be a practical tool for health experts who are tasked with delivering health related reports in the context of planning processes. The guidance document is intended to include the immediate and subsequent effects of planned projects on human health, well-being and social objectives (e.g. avoidance of excluding and disadvantaging individual subpopulations).

The discussions in the working group showed early on how unusual it is in the environmental assessment practice to consider social influences on health and to include them in the analysis of mankind as a protected subject. Therefore a sub working group was formed on short notice, charged with integrating these issues into the guidance document. The goal is to inform future users of the guidance document about scientific findings and methodologies in public health, sociology and epidemiology, and to make suggestions for the use of this information. This happens in close consultation with group members working in the field, particularly in public health authorities, who explain the options and demands of their everyday work to the scientists. The goal of the practical orientation approach of the sub working group is to promote the deliberate integration of health, health equity and quality of life into planning processes. The papers are written by the members of the working groups and edited together. Completion is targeted for the coming year.

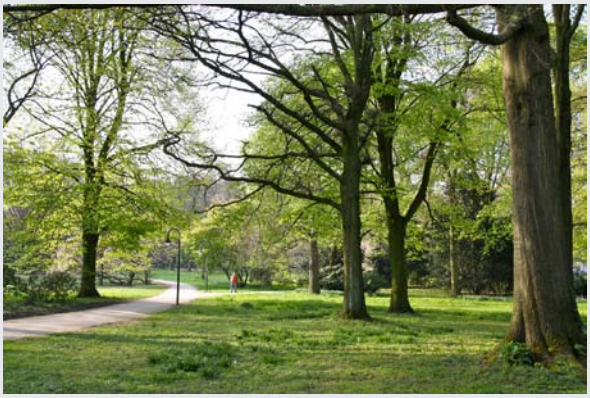
Other accomplishments of the working group

Finally, the group intends to organise conferences and workshops in order to be able to present findings and results to the expert community. The number one task in 2010 was organising an all-day workshop and contributing lectures to the plenary session of the biannual EIA conference which is usually attended by approximately 300 to 400 people. At the 10th EIA Congress in October 2010 in Schwäbisch Hall, the "Human Health" working group presented the first draft of the "Protection of Mankind" guidance document, the online expert platform and the concept for the "Municipal Health Plan".

Outlook

The working group hopes to continue to get closer to its goal of improving the integration of the protected subject of human health into planning processes. Completing the products presented is considered just as important as technical and institutional cross-cutting cooperation in general. Side effects, such as joint urban planning trips for students with health and

Public green spaces have many positive effects on human health (Photo: von Zahn).



planning faculties, which were organised by members of the working group, are most welcome and help create awareness for the topic in the broader expert community.

The working group is aware of the fact that there is a long way to go until the topic of human health is meaningfully integrated into the daily routines of planning processes and fully recognised in that context. But the working group is confident that the effort will eventually be worthwhile. The resounding success of the cooperation between environmental and health experts was proven in the particulate matter discussion for example. Jointly working toward sustainable planning therefore seems to have great potential, which should be taken advantage of more often in the future.

Literature

Ministerium für Umwelt und Naturschutz, Landwirtschaft und Verbraucherschutz (MUNLV) NRW (ed.) (2005): Abschlussbericht „Kommunale Zusammenarbeitsstrukturen zur Berücksichtigung von Umwelt- und Gesundheitsbelangen in Planungsverfahren“, Düsseldorf.

ÖGDG NRW (ed.) (1997): Gesetz über den öffentlichen Gesundheitsdienst des Landes Nordrhein-Westfalen (ÖGDG NRW) vom 25. November 1997, § 8.

Contact

Klaus von Zahn
Düsseldorf Urban Planning Office
Amt 61/2
D-40200 Düsseldorf
Email: klaus.vonzahn[at]duesseldorf.de

Remodelling of the Nauener Platz – participation of residents based on the new concept of socio-spatial orientation in the district Berlin-Mitte

Brigitte Schulte-Fortkamp[1] and Regine Grafe[2]

Abstract: *One key element of the new environmental justice approach in Berlin is its socio-spatial orientation. It is applied to analysing environmental impacts on a small scale as well as in initial measures and projects for entire neighbourhoods as part of a comprehensive socio-spatial strategy. The concept of the remodelling of the Nauener Platz in Berlin Mitte is an example which shows that consistent and early participation of those affected by local planning and decision-making processes can enhance environmental justice in urban neighbourhoods.*

Introduction

The environmental justice approach assumes that environmental issues should be considered in connection with social aspects. In this context a high significance was attributed to appropriate participation in the planning and decision-making processes of those affected (Bolte 2009).

The remodelling of the Nauener Platz in Berlin Mitte district is an example of an innovative and successful involvement of all those affected. The site lies in a densely populated neighbourhood of the Wedding residential area shaped principally at the time it was founded. The amenity value was low; an alcoholic and drug scene had been established over the years and led to displacement processes to the extent that residents, especially children and the elderly increasingly avoided the area. About 12,200 people live in the neighbourhood, 21 % of them are under 18 years of age, 17 % over 65 years and about 43 % are immigrants. 24 % of the inhabitants receive welfare payments. The site lies at the junction of two very busy roads and is exposed to high noise and air pollution. Residential areas bordering the Nauener Platz were considered as problem-ridden neighbourhoods with a high unemployment rate and high proportion of foreigners (BBSR 2011).

Participation of those affected using the example of the "soundscape" model

Apart from a necessary upgrading of the open space, the prime objectives of the remodelling project were to enhance the safety, attractiveness and usefulness of the area. Of essential importance was the early involvement or participation and activation of the residents. Participation was targeted at the generation of ideas in 2007, design specification in 2008, followed by the implementation of the measures. The "Land use and thematic workshops" fostered suggestions and ideas using different participation methods and, together with those affected, developed specific ideas for use and items within the topics of "Cross generational elements", "Light in the public space" and "Sound in the public space". Various events, for example painting the place, monthly flea markets, cleaning campaigns and the "Fantastic Kiez"[3] board game were organised (SenStadt 2011).

[1] Technische Universität Berlin

[2] Berlin-Mitte District Office

[3] Kiez is a historic term for a neighbourhood-like residential area in North-East Germany, especially Berlin.

Photo 1: The gabion wall protecting the area with 3 dB(A) against the road traffic noise (Carla Schlösser).

The innovative survey concept „Soundscape“, based on noise effect research, was developed in close co-operation with the Berlin Technical University and different target groups. Soundscape is, in particular, considered as the core module of the remodelling and is regarded nationwide as an outstanding example of a health-oriented concept to enhance amenity value. Apart from strategies involving those affected, the Soundscape concept provides information strategies to provide solutions and enables the reliable determination of noise quality in the environment. Soundscapes opens the forum for new trans-disciplinary research processes which include those affected – to inform on the assessment of living space and sound sources. Within the meaning of a health-related environmental justice approach, local residents are the new and real experts, especially in view of their experience and expectations towards the neighbourhood to be investigated (Schulte-Fortkamp, Dubois 2006). They are familiar with the noise sequences and noise events and are passively or actively involved.

The multidisciplinary character required during the implementation was guaranteed by using sound propagation measurements, traffic counting, soundwalks and interviews. For the purposes of the new socio-spatial approach to environmental justice, the ”Remodelling of the Nauener Platz“ project followed the principle of ensuring that those residents affected were involved right from the start. This enabled the „participatory acoustic analysis” to be integrated seamlessly into the concept. The remodelling of the Nauener Platz in Berlin Mitte district is an example of how stakeholders shared the decision making and were involved in the implementation. The project combined the local government expertise, landscape designers, specialist designers, local stakeholders and the residents as “new experts“. Through the process of justice and equity, particularly through the co-operative approach and the systematic and deliberate integration of stakeholders, interactive measures could be developed to ensure that the health and well-being in the neighbourhood will sustainable increase. On the initiative of the Berlin Mitte district, the “Nauener Platz“ project was included into the “Experimental Housing and Urban Architecture“ research programme (ExWoSt), whereby additional funds became available for the renovation and remodelling measures. The commitment of the Berlin Mitte district helped to create an important basis for implementing the socio-spatial approach to the environmental justice.

Socio-spatial orientation in the Berlin Mitte district: a target for all specialist district planning offices

The interactive remodelling of the Nauener Platz in the Berlin Mitte district is an example of a successful action plan in the context of a general spatial and organisational restructuring of the district – the socio-spatial orientation –, specified by the district office resolution of 05.04.2011 for the specialist district offices. Neighbourhood based methods have been discussed for some time in the Mitte district where their innovative approaches have been supported by the Social Urban Development framework strategy. In this strategic framework, socio-spatial orientation is obligated as a principle of social urban development. The implementation of the newly developed environmental justice approach in the Berlin Mitte district as a pilot project is to take place from 2011 to 2014. Against this background it is of great importance that the district office decided in 2011 that socio-spatial orientation is a “key structural element of the district’s future performance responsibility“.

Socio-spatial orientation flies straight to the heart of the needs and expertise of the citizens in the district and is the basis for including local people into the entire process of urban development and environmental planning. The authorities and residents are in the centre of a new network structure. Available knowledge of the neighbourhood and local skills will be interlinked by spatial and multidisciplinary plans and actions of the professional bodies, and used for improving the quality of life and environment within the district. This long-term living environmental and/or socio-spatial orientation of the district’s responsibilities, structures and processes, will become more important in the future, particularly in such areas as interdepartmental and interdisciplinary ways of

Photo 2: The audio islands – listening in the rings to self selected natural sounds like bird singing and shingle beach (Regina Rossmanith).

working – for example the integration of health issues into the areas of urban development, environment and local community work. This offers the opportunity to consider individual neighbourhoods and local circumstance according to their variability, for example in the preparation of local development strategies, environmentally friendly neighbourhood design and health promotion in the district. Interdisciplinary socio-spatial orientation will create additional opportunities in the Berlin Mitte district in the future which will enable complex living environmental problems and needs of the citizens to be handled, bringing the offers closer to the residents and improving the quality in their immediate living environment.

This fundamental restructuring in the Berlin Mitte district relies on a number of local communication structures that were formed in recent years and which created new opportunities for co-operation. The implementation of socio-spatial orientation with a view to producing more environmental justice in the neighbourhood, especially given the "bottom up" approach, is of central importance. This approach applies particularly to picking up ideas and civic engagement at various levels to exploit these resources for the implementation of projects. In particular, local planning expertise should be used by interactively involving them in the planning. Local knowledge should be used to find new ideas and solutions. And the same local knowledge should be combined with the specialist skills of management (Berlin Mitte District Office 2011).

Outlook

The small-scale analyses of the situation of "Environmental justice in the State of Berlin" are now available in the paper "Environmental Pressure Analysis" (see paper on p. 44) and should be further developed and implemented as models in the framework of strategies and projects in Berlin Mitte district over the coming years. Against this backdrop, future socio-spatial alignment of district responsibilities, structures and processes will substantially contribute to implementing the newly developed environmental justice approach in the district. The mandatory socio-spatial direction as specified affects all levels of district administration and puts in place the framework for the development of practical strategies and measures in the neighbourhoods and the district to mitigate unequally distributed environmental burdens. By this means, the small-scale Berlin environmental justice approach will obtain a strongly founded administrative, legal and organisational basis for improvements to content and specification. This is especially true for interdepartmental and interdisciplinary approaches and ways of working, for which a better coordination of various sectoral planning is required. The new socio-spatial orientation in Berlin Mitte district creates a cohesive and complementary basis while specifying the implementation framework for the complex and interdisciplinary field of „environmental justice in the Berlin Mitte district".

Literature

Bezirksamt Mitte von Berlin (2011): Bezirksamtsbeschluss zur Umsetzung der Sozialraumorientierung im Bezirk Mitte und Vorbereitung der Einrichtung der Organisationseinheit Sozialraumorientierte Planungskoordination im Bezirksamt Mitte vom 05.04.2011.

Bolte G (2009): Umweltgerechtigkeit – Datenlage und Stadt der wissenschaftlichen Diskussion zum Thema Umweltqualität, soziale Ungleichheit und Gesundheit in Deutschland: In: Umweltgerechtigkeit – Die soziale Verteilung von gesundheitsrelevanten Umweltbelastungen, Dokumentation der BMU/UBA-Fachtagung am 27. bis 28.10.2008 in Berlin, Bielefeld.

Photo 3: The audio islands – listening at the bench to self selected natural sounds like bird singing and shingle beach (Carla Schlösser).

Bundesinstitut für Bau-, Stadt- und Raumforschung (BBSR) (ed.) (2011): Nauener Platz – Umgestaltung für Jung und Alt, Innovationen für familien- und altengerechte Stadtquartiere – Modellvorhaben. http://www.bbsr.bund.de/nn_21888/BBSR/DE/FP/ExWoSt/Forschungsfelder/InnovationenFamilieStadtquartiere/Modellvorhaben/10__MV-B__BerlinNauenerPlatz.html (Accessed: 25.05.2011).

Schulte-Fortkamp B, Dubois D (eds.) (2006): Acta Acustica united with Acustica, Special Issue, Recent advances in Soundscape research, Vol 92 (6).

Senatsverwaltung für Stadtentwicklung (SenStadt) (ed.) (2011): Handbuch zur Partizipation (unpublished).

Contact

Prof. Dr. Brigitte Schulte-Fortkamp
Topic Area „Soundscape“
Technische Universität Berlin
Psychoacustics and Noise Effects
Einsteinufer 25 TA 7
D-10587 Berlin
Email: b.schulte-fortkamp[at]tu-berlin.de

Dr. Regine Grafe
Topic Area “Environmental justice in the context of socio-spatial orientation“
Berlin-Mitte District Office
Head of Performance and Responsibility Centre
Environment and Nature Protection
Karl-Marx-Allee 31
D-10178 Berlin
Email: regine.grafe[at]ba-mitte.verwalt-berlin.de

Thermal strain in residential areas – prevention of heat-related health risks of the elderly

Beate Blättner[1], Markus Heckenhahn[2], Henny Annette Grewe[1]

Abstract: *Due to climate change heat related health effects are expected to become a serious public health problem even in Germany. Factors that influence the exposure towards heat as well as factors that influence the susceptibility towards external heating determine individual risks. Current evidence suggests that, due to the cumulation of influencing factors, aged people are at highest risk. When planning measures on community level, residential areas where interventions seem to be of highest priority can be identified by microclimatic indicators, the regional density of aged people and the thermal conditions of the buildings in the area. Experience made in the Project PräKom suggest that mapping the public health risks may even help to convince local stakeholders. In PräKom, some measures concerning the support of vulnerable people in case of heat waves and the reduction of exposure towards heat have been implemented.*

Introduction

As a result of climate change an increase in heat-related health risks is expected over the coming decades for large parts of Europe (IPCC 2007). The individual health damage risk from heat depends on intensity and duration of the exposure, and the level of personal susceptibility to the risks (**Figure 1**). This may result in horizontal and vertical health inequality, because socio-demographic and socio-economic factors come into play.

In a heat wave, the intensity of the exposure is primarily influenced by microclimatic conditions (Blättner et al. 2010; Steinrücke et al. 2010). Metropolitan areas and urban heat islands are more susceptible than sparsely populated rural regions. Higher density small towns also exhibit high levels of thermal stress. How well buildings can protect one from heat exposure depends largely on the thermal behavior of the building, but also the ventilation and shading behavior of the users. Since people spend an average of 16 to 17 hours a day in their apartment, the elderly and children even longer (WHO Europe 2007), the indoor climate of residences is particularly interesting. Physiological factors, such as very old age (above 75 years) or chronic disease (Josseran et al. 2009, Vandentorren et al. 2006), social and socio-economic factors, such as active neighborhood and the availability of material resources (Basu 2009), and behavioral factors such as wearing appropriate clothing, determine personal susceptibility to health risks (Kovats and Hajat, 2008). Overall, being very old seems to be a suitable indicator for an accumulation of unfavorable susceptibility factors. The findings so far indicate that 'very old people' is the population group with the highest mortality rate during heat waves.

When looking at risks at the local level, residential areas can be distinguished on the basis of the following indicators: hyperthermal area, building structure and age structure. In regards to appropriate prevention options, the principle is: for the population, exposure reduction results in sustainable effects – reducing susceptibility contrast produces shorter-term effects.

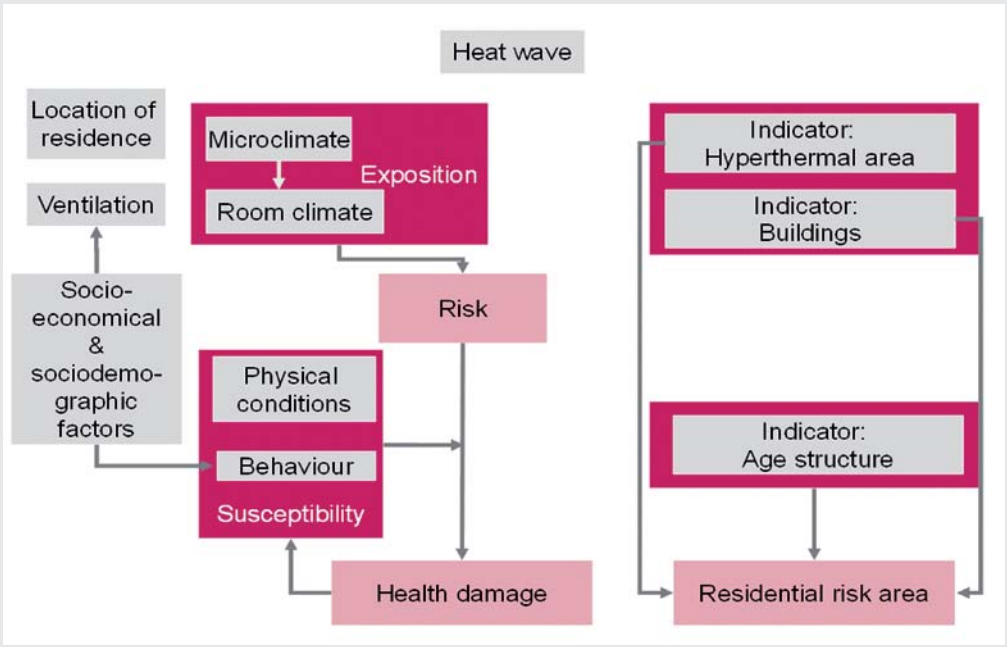
As part of the Regional Network for Climate Change Adaptation – Northern Hesse („Klimzug-Nordhessen"), project PräKom[3] was to develop and test measures for the targeted prevention of heat-related health problems. The primary target group is

[1] Fulda University of Applied Sciences, Department of Nursing and Health Sciences

[2] Health Department of the Kassel Region

[3] Full title: Targeted prevention of heat-related health risks in old age in municipalities.

Figure 1: Risk indicators for residential areas.



'very old people', living in hyperthermal areas and who cannot be easily reached using the protection strategies developed to date. First it had to be established where a particularly large number of potentially exposed people live in the city and district of Kassel. Subsequently, exemplary and suitable intervention strategies were developed in residential areas. The paper discusses these approaches and prevention strategies.

Identification of at-risk residential areas

Microclimate

A functional climate map was developed by the Environmental Meteorology Department of the University of Kassel for the city of Kassel and nine adjacent communities (Katzschner et al. 2010). It was based on mapping topographic factors, the specific use of these topographies and the associated thermal effects and meteorological parameters. For assessing health risks due to heat, it made it possible to identify low-risk and risk zones, known as hyperthermal areas, in a small area. The topographical location and size of an area, adjacent compensatory areas, surface sealing and building structure, and, in valley locations, barriers to air outflow, influence heating and limit ventilation and reduce or delay nocturnal cooling. The key criteria for microclimatic conditions are decreased ventilation due to built structures, and/or a high degree of surface sealing in residential areas. The map shows two levels of hyperthermal areas (**Figure 2**). Similar maps are now also available for several other cities. If no map is present, the degree of surface sealing can be used as a rough guide.

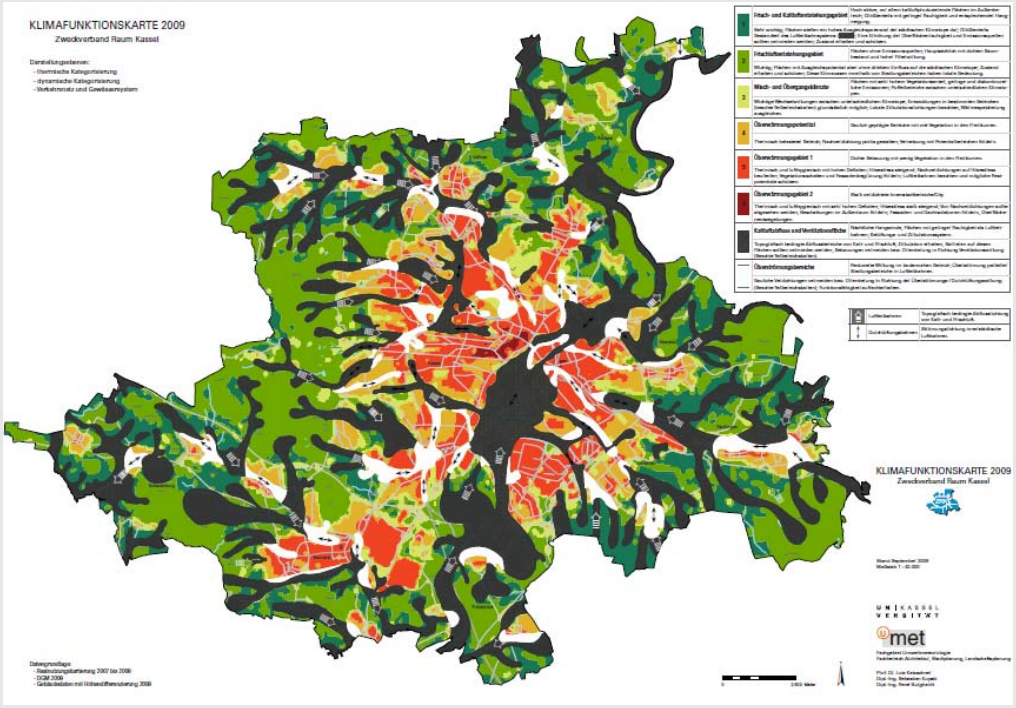
Building structure

Systematically collected data on the buildings or even the thermal behaviour of residential buildings are not yet available for the city and the district of Kassel. Therefore one had to resort to a ‚Rapid Assessment' (World Health Organization, 2011) in the residential areas rated as microclimatically at risk. For this purpose streets were examined and mapped according to architectural style, building type, direction of windows, external shading options, penthouses and shading by trees. Areas were classified as very unfavorable when they primarily consisted of buildings from the 1970s to the 1990s (Pfafferott, Becker 2008), with windows facing south and west, containing penthouses and a lack of trees. However, due to a lack of expertise in the area of building physics, the data of the Rapid Assessment were treated as uncertain.

Age structure

The age structure analysis was based on data from the municipal statistics of the city and district of Kassel,

Figure 2: Climate map for the Kassel area 2009, Source: Zweckverband Raum Kassel.



data from the population statistics of the Hessian State Statistical Office (HSL) and data from municipal elderly care planning (district of Kassel, 2003), which provided additional information about the nursing care offered in the region. Depending on the data source and the requirements of data protection, the data was available at different aggregation levels. The ideal level is that of the statistical districts. To get an idea of the small-scale distribution of the target group of the very old living independently, the number of beds in care homes in the city and county of Kassel, was subtracted from the total of all 'very old people'. The result is not exact because care dependency can occur even below 75 years of age, but allows a more accurate view.

The number of over 75-year-olds in relation to the area of the residential area in square kilometres (density of the very old) and the number of the over 75-year-olds in proportion to total population (population ratio) were established as crucial indicators. High senior citizen densities combined with a high senior citizen population ratio were characteristics of residential areas with increased levels of susceptibility to heat exposure. The data can thus be used for the optimal use of prevention resources. Residential areas, each with above average density and population were classified as demographically at risk in this project.

City districts with a particularly dense population of over 75-year-olds trend towards the Kassel average in terms of population ratio. In contrast, city districts with a higher than average proportion of the very old were sometimes only thinly populated. Overall, senior citizen density therefore seems to be a more relevant feature for heat as a risk factor in a residential area than population ratio, since low population density generally indicates a lower degree of surface sealing in a residential area. This would have to be re-examined for other urban areas.

Distortions may arise in neighbourhoods with a high proportion of green space. A clearer picture emerges when using a geographic information system to take into account the actual use of the area, isolating residential areas from other types of land uses. **Figure 3** shows the district based density of over 75-year-olds in potentially habitable areas, living in private homes.

Superimposing the results of this age structure mapping on the results of the neighbourhoods identified as climatically at risk, allows the identification of priority action areas. In the city of Kassel, this is primarily the district of Vorderer Westen.

Targeted prevention network in the district

Intervention in a multi-level model

Under the auspices of the Kassel region public health department, a 'heat prevention network' was founded in the Vorderer Westen district in 2009, consisting of representatives from local politics, the housing industry, elderly care, parishes and the outpatient care sector. The network aims to develop and implement measures to minimize both the exposure and the susceptibility of older people in the district. So far, the following has been implemented in the network:

- Measures that raise senior citizens' awareness of heat-related health risks and encourage them to adapt their health regimen to high thermal stresses, also on short notice, if necessary,
- Measures that, in the medium to long term, contribute to the improvement of micro-climatic conditions in the district and thereby should help minimize thermal stress.

Measures were developed at an individual level, the setting and the population level and first tested in 2010 (**Table 1**).Two contrasting examples are the „Sunshade hotline" and „Criteria for neighborhood redevelopment".

Sunshade hotline

As an initiative of the Vorderer Westen prevention network, a toll free service was established for all citizens in Vorderer Westen by the Kurhessische Diakonissenmutterhaus Kassel (Vorderer Westen location) with the support of the Kassel region public health department. From 15 June to 31 August of 2010, incoming heat warnings from the Deutsche Wetterdienst (DWD) (German Weather Service) for the city of Kassel were immediately, i.e. before 10:00 am the following day, passed on to users of the hotline by the Deaconess on duty. Callers were advised about the health risks of heat and provided with a contact for medical care providers.

The call service was promoted through outpatient health care facilities, pharmacies, churches and beverage stores in the district. The evaluation of the project found that the „Sunshade hotline" reached particularly vulnerable population groups in the district and raised their awareness of the health hazards associated with heat waves. Due to the positive response to the service, it will be extended to include the entire metro area in 2011 with the support of the Senior Advisory Council of the City of Kassel.

Figure 3: Senior citizen density in the habitable metropolitan areas of Kassel.

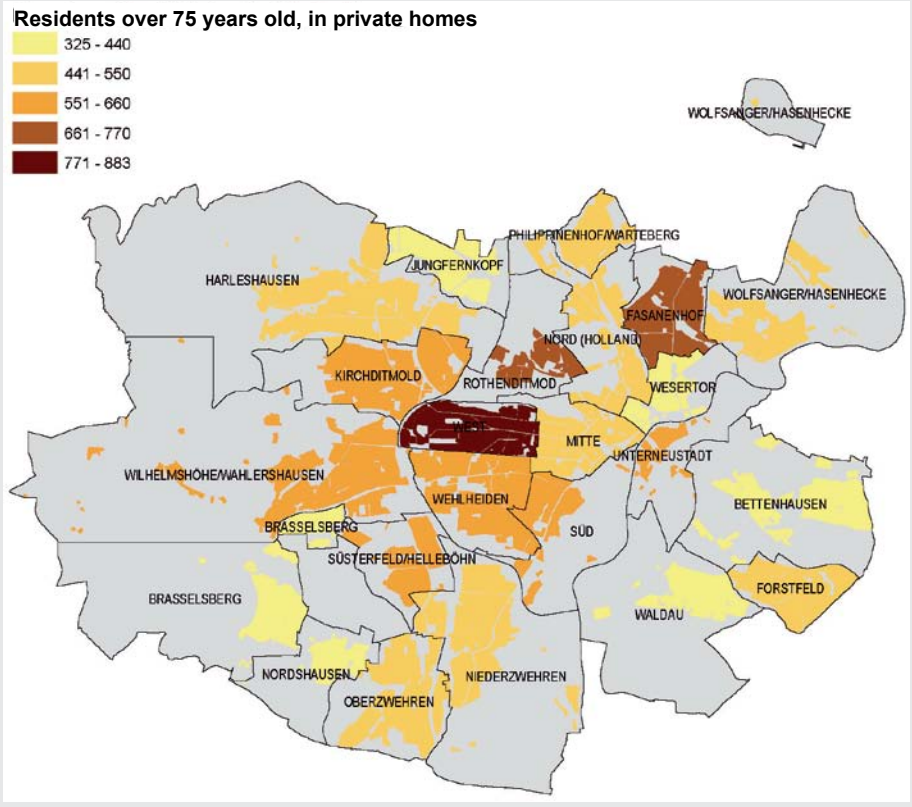


Table 1: Activities of the prevention network in the multi-level model for 2010/2011.		
Strategy / Intervention level	**Minimising susceptibility**	**Minimising exposition**
Individual (Micro level)	• Sunshade hotline	• Preventive home visits
Setting (Meso level)	• informational afternoon events in retirement communities	• City district conference „The older generation and climate change" • City district inspection walks for vulnerability analysis
Population (Macro level)	• Information and education of local press during summer	• list of criteria for the city district redevelopment in the sponsored region „Aktive Kernbereiche Friedrich-Ebert-Straße" (Active core areas Friedrich-Ebert-Straße) • Information source „Thermal protection in summer"

Criteria for urban redevelopment

In parallel, the prevention network aims to improve microclimatic conditions in the district over the medium to long term. In an initial survey of several city districts, factors which support and adversely impact microclimate were identified and necessary adaptive measures derived. These were documented in a list of criteria, which will be taken into account in future planning of construction and renovation projects in the district. As the main criteria for planning heat exposure reductions, the list specifies

- identifying and/or setting up cooler places in the district (microclimatically favourable recreation areas, e.g. green spaces, shaded sitting areas),
- Using appropriate surface materials (e.g. light coloured road surfaces),
- the preservation or expansion of green spaces,
- the preservation and improvement of good ventilation and
- heat protection of buildings in summer.

Currently, the list of criteria is used in the context of plans for the sponsored region „Aktive Kernbereiche Friedrich-Ebert-Straße" (Active core areas Friedrich-Ebert-Straße), which includes about two-thirds of the district area and which will be sponsored by the „Aktive Kernbereiche in Hessen" (Active core areas in Hesse) sponsorship programme from 2010 to 2019. The integrated action plan for the sponsored area (Kassel 2011) includes, among other things, extensive construction and renovation measures in the areas of open space and traffic. The redesign of major traffic routes and main squares begins in 2012. The plans are currently being coordinated with all relevant managers in the district. The network is focused on guiding the selection of surface materials, tree species (e.g. broad crowned, heat resistant) and the design of recreational sites (e.g. shaded benches in green spaces).

Discussion

The mapping of microclimate and socio-demographic data makes it possible to identify residential areas that require priority preventive action, thus providing a justifiable, clearly outlined field for prevention projects. In order to verify the results, small-scale monitoring of adverse health effects during heat waves would be useful. However, this will likely prove impracticable for data protection reasons.

The mapping was found to be useful not only for selecting areas for intervention, but also for activating city district stakeholders as part of a network development, because the results are easy to communicate. In particular, because climate change adaptation in the community is currently not easily communicated to the general public, verifiable, causal relationships for the success of adaptation measures are important, as demonstrated by recent experience. The differentiation of residential areas according to the density of 'very old people' only justifies prioritisation, not the general limitation of actions.

In addition to identifying residential areas, mapping all hyperthermal areas would be useful, since exposure risks could be located more easily that way. It has already been possible to derive necessary adaptive measures for public and private open space and housing. Under the aspect of health inequality it would be interesting to examine who, according

to socio-demographic and socio-economic factors, lives in hyperthermal areas and who lives in the better ventilated residential areas.

Literature

Basu R (2009): High ambient temperature and mortality: a review of epidemiologic studies from 2001 to 2008. In: Environmental Health, 8: 40-53.

Blättner B, Heckenhahn M, Georgy S, Grewe HA, Kupski S (2010): Wohngebiete mit hitzeabhängigen Gesundheitsrisiken ermitteln. Soziodemografische und klimatische Kartierung als Planungsinstrument gezielter Prävention. In: Bundesgesundheitsbl – Gesundheitsforsch – Gesundheitsschutz, 53: 75-81.

Gordis L (2008): Epidemiologie. Kilian, Marburg.

IPCC (2007): Zusammenfassung für politische Entscheidungsträger. In: Solomon S, Qin D, Manning M, Chen Z, Marquis M, Averyt KB, Tignor M, Miller HL (eds.): Klimaänderung 2007. Wissenschaftliche Grundlagen. Beitrag der Arbeitsgruppe I zum Vierten Sachstandsbericht des Zwischenstaatlichen Ausschusses für Klimaänderung (IPCC), Cambridge University Press, Cambridge, United Kingdom und New York, NY, USA. Deutsche Übersetzung durch ProClim-, österreichisches Umweltbundesamt, deutsche IPCC-Koordinationsstelle, Bern/Wien/Berlin.

Josseran L, Caillère N, Brun-Ney D et al. (2009): Syndromic surveillance and heat wave morbidity: a pilot study based on emergency departments in France. In: BMC Med Inform Decis Mak, 9: 14.

Katzschner L, Kupski S, Burghardt R (2010): Klimafunktionskarte Zweckverband Raum Kassel 2009 mit Zukunftsprognosen. Fachgebiet Umweltmeteorologie, Kassel, Universität Kassel.

Kovats RS, Hajat S (2008): Heath Stress and Public Health: A Critical Review. In: Annu. Rev. Public. Health, 29: 41-44.

Landkreis Kassel (2003): Sozialatlas für den Landkreis Kassel – Analysen und Prognosen – Teil B Altenhilfe, Kassel.

Magistrat der Stadt Kassel (2008): Kassel Daten.

Pfafferott J, Becker P (2008): Erweiterung des Hitzewarnsystems um die Vorhersage der Wärmebelastung in Innenräumen. In: Bauphysik, 30 (4): 237-243.

Stadt Kassel (2011) Aktiver Kernbereich Friedrich-Ebert-Straße – Ein Quartier macht sich fit. http://www.stadt-kassel.de/projekte/kernbereiche/ (Accessed: 17.01.2011).

Steinrücke M, Dütemeyer D, Hasse J, Rösler C, Lorke V (2010): Handbuch Stadtklima. Maßnahmen und Handlungskonzepte für Städte und Ballungsräume zur Anpassung an den Klimawandel. Ministerium für Umwelt und Naturschutz, Landwirtschaft und Verbraucherschutz des Landes Nordrhein-Westfalen. Düsseldorf.

Vandentorren S, Bretin P, Zeghnoun A et al. (2006): Heat-related mortality. August 2003 heat wave in France: risk factors for death of elderly people living at home. In: Eur J Public Health, 16(6): 583-591.

WHO Europa (2007): Large analysis and review of European housing and health status (LARES). Preliminary overview. Copenhagen www.euro.who.int/__data/assets/pdf_file/0007/107476/lares_result.pdf (Accessed: 08.02.2011).

World Health Organization (2011): Rapid Assessment and Response Technical Guide TG-RAR. http://www.who.int/docstore/hiv/Core/Chapter_2.html (Accessed: 05.01.2011).

Contact

Prof. Dr. Beate Blättner
Fulda University of Applied Sciences
Department of Nursing and Health Sciences
Marquardstr. 35
D-36039 Fulda
Email: beate.blaettner[at]hs-fulda.de

"Environmental justice right from the beginning" – a consultative project for socially deprived families and families with a migration background

Johanna Hausmann

Abstract: *The German Environmental Survey for Children of the Federal Environment Agency (UBA) confirms that children from families with lower social status are at a higher exposure to passive smoking, and disinfectants. WECF pilot project "Environmental justice right from the beginning" places the focus upon improving the skills of the families affected by these issues. Via family centers in Berlin and Munich WECF offered consultations and lectures on simple measures that create a healthy living environment and that can be realized by the families on their own. To better reach the families in a more direct way, WECF trained multipliers (family nurses, midwives, etc.). WECF provides bilingual information leaflets, specifically designed by WECF on the subjects „Ecological cleaning" and „Prevention and handling of mould" in Russian/German, Turkish/German, Arabian/German, Vietnamese/German and Serbo-Croatian/German languages. The project will continue in other cities. The project was funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and the Federal Environment Agency.*

Introduction

Protecting children from harmful environmental impacts right from birth is one of the key objectives of "Women in Europe for a Common Future", WECF NGO. In particular, it pays special attention to the children in our society because as the German Environmental Survey for Children (Kinder-Umwelt-Survey, KUS) of the Federal Environment Agency (UBA) has shown, they are especially vulnerable to environmental stressors (Schulz et al. 2010). Within the pilot project "Environmental justice right from the beginning" – an advice service for socially disadvantaged families and families with an immigrant background carried out from April 2009 to December 2010 – WECF established and developed a counselling and information service to young families in Berlin and Munich on the following topics:

- mould in the home – health risks due to mould, minimisation and avoidance of mould growth through adequate ventilation;
- healthy and environmentally friendly but thorough cleaning. Information on effective ecological detergents and what is superfluous in the cleaning cupboard;
- Passive smoking – health risks to infants.

The main objective of the project was to reduce the environmental pressures on babies and infants in the home environment in affected families through access to simple information. For this purpose, the sensitivity and understanding of the parents in matters of healthy housing and environmental pressures were raised. The project targeted families in difficult circumstances with low socio-economic status and in particular families with an immigrant background. In addition, the project addressed intermediaries who have already been in contact with these families and authorities, associations and organisations that offer projects for this target group. The project was funded by the Federal Ministry of the Environment (BMU) and the Federal Environment Agency (UBA).

Motivation thrust: becoming parents

Environmental pressures and health risks for children are unequally distributed throughout the population according to the results of KUS. Accordingly, children from families in a difficult social situation are increasingly exposed to the harmful effects of passive smoking, lead, disinfectants and harmful substances from disinfectants and cleaning agents. The issue of child health is important to many families, but the connection between environmental pressures

and health risks for children is not of primary interest. This may be because parents often have difficulty in accessing understandable information on the topic and practical advice about how they can reduce and/or prevent exposure.

The birth of a child usually results in a major change to the families' lifestyle. Young parents often only then start to think about the effects certain behaviours or consumer patterns and attitudes may affect their child's health or the environment. For example, expectant and new mothers and fathers are ready to take a more critical look at the use of certain detergents or harmful behaviours (e.g. smoking) which they have previously been willing to accept, when considering their effects on their children.

These findings formed the basis of the project "Environmental justice right from the beginning" and were the starting points for a target group-oriented information service. Expectant parents and young families, especially those families in difficult social situations and with an immigrant background, should find it easier to start a healthy life with their newborn having been given practical tips and advice about the health risks in their domestic environment.

The project challenge

The challenge of the project was to develop ways and strategies on how families can obtain targeted information about environmental health risks as required. Socially disadvantaged households often have a greater need for this type of advice. Beyond traditional information and advisory services, such as brochures, the Internet and information sessions, it is difficult or impossible to reach them. It is especially difficult when language barriers are added. Low-level services which reach those concerned in their homes and/or living environment using outreach support, is one important way. In addition, WECF also wanted to provide practical advice to families to help them minimise environmental health risks on their own and without major expense thus ensuring better health for their children.

Figure 1: WECF's information stand (Photo: WECF).

Direct approach

And how have these challenges been met? By the counselling service, consultations, workshops and training of intermediaries in Berlin and Munich, WECF project staff have closely co-operated with different neighbourhood and Healthy City Network institutions. Neighbourhood management Facilities which were ready to act as partners in implementing the project usually had good access to families with low socio-economic status and those with an immigrant background. This strategy opened the door for WECF workers to the target groups. An additional benefit was that collaborating institutions became sensitised to environmental health protection issues. Previous topics such as nutrition or exercise were supplemented with others such as reducing indoor exposure to chemicals by using harmless detergents and avoiding passive smoke and mould growth in the home (**Figure 1**).

One approach of the project was "to elevate the mothers and fathers from their existing situation". Many smoking parents for example are well aware that passive smoke is also harmful to children's health. The primary goal however, was not to quit smoking – even if that was the healthiest solution for everyone – but working with parents to find ways and strategies on how they can protect their children from passive smoking. Parents were encouraged to offer their children a healthy, clean and safe living environment according to their present circumstances.

The theme "Smoking in the home" has always been presented with a focus on the health of passive-smoking children. On the subject of "Ecologically cleaning", cultural differences in the understanding of cleanliness frequently had to be overcome. Breaking the attitude that only disinfectants can provide proper cleanliness was a task similar to clarifying that mould growth is not merely an aesthetic problem but a housing problem which infers health risks concerning "Mould fungi". It was also necessary to

encourage people to turn to the landlord or to advice centres in the case of mould growth. For this purpose, practical tips, addresses and sample letters were provided which could be adapted to the individual situations.

Three pillars of the project

Advice

Regular discussions, consultations, lectures and small workshops on the three project topics were provided both in Berlin and in Munich. The participants were usually women with immigrant backgrounds (over 90 %) and with different education levels and linguistic skills, but with a great interest in the topics. Most of them had toddlers or school children. In a few cases men also used the service. Special events such as weekend seminars in the conference centre in Josefstal (Bavaria) attracted a larger number of men with immigrant backgrounds and so they became aware of the issues. First information materials on the subjects were offered in Turkish-German and Russian-German. Accordingly the meetings were attended by people from these language areas. After the institutions involved in the project and the mothers in the districts of Berlin asked for the materials in Arabic and Vietnamese, these were then provided and so the target group expanded to include women and men of Vietnamese and Arabic origin.

Training courses, workshops, lectures and individual consultations were offered locally – primarily in disadvantaged neighbourhoods. So it was easy to reach the intended target groups. Existing contacts (in Munich e.g. MiMi Project, Foreign Parents Association NGO, IG Initiative Group, Bavarian Centre for Transcultural Medicine, schools, kindergartens, district counselling centres) helped in large part to advertise the meetings and offer them to those interested.

In order to compensate for the different levels of education and lack of linguistic skills, the topics were explained using simple, easy-to-understand visual representations. For example, the topic “Ecological cleaning“ was illustrated using actual objects. Equipped with cleaning tools and cleaning products, micro fibre cloths, mops and other products, the project workers explained in practical terms what to look for when buying and using cleaners, which products

Figure 2: German-Arabic information flyer (excerpt).

are unnecessary and what behaviour can help avoid the use of aggressive chemicals. The vivid and lively events were well attended both in Munich and in Berlin and often follow-up events were requested. Language barriers were overcome with the help of a translator when needed.

Bilingual information flyers

The second pillar of the project, bilingual information flyers on the topics "Ecological cleaning" and "Avoiding mould fungi" which provided brief and concise tips, graphically adapted to the cultural background of the target groups, was also innovative and very successful. The flyers are available in five language combinations: Turkish-German, Russian-German, Vietnamese-German, Arabic-German (**Figure 2**) and Serbo-Croatian-German. The bilingual feature of the flyers ensures information can be compared to references of the (German) products. Furthermore, the intermediaries can explain the information with the help of the flyer, even if they do not speak the immigrants' language. The total circulation of all flyers amounted to 33,000 and they were distributed during the project's lifetime. Institutions such as BUND, the Federal Environment Agency (UBA) and the Federal Ministry of the Environment (BMU) were also happy to distribute them at their events.

Training of intermediaries

The third pillar of the project was the training of intermediaries who co-operate with socially disadvantaged families and in particular families with immigrant backgrounds. In Berlin for example "district mothers" were trained in the districts of Neukölln and Kreuzberg to provide outreach support to families with immigrant backgrounds. They use the training as a qualifying measure to extend their advisory services and to integrate the knowledge gained to reduce indoor pollution through their work. In the city of Munich, together with the Munich Health Action Workshop (MAG´s), two large intermediary events were organised in 2009 and 2010 where more than 200 people attended the two seminars "Environmental justice right from the beginning".

Materials for sharing

The project will affect wider circles! From the beginning, WECF was keen to turn this project into something with lasting effects. Ideas, knowledge, experience and materials should be shared and be made available for all those who want to promote the theme. Information kits were produced and handed out to all intermediaries. They cover basic knowledge, references and practical templates such as sample letters to landlords with regard to mould growth, a check list "tour through the cleaning cupboard" and an address guide for partners in the Kiez*. The folders are meant as basic information which can be added to and should serve as copy templates. Similar to the intermediaries' folder, there is an extensive download module on the WECF website with templates, presentations, links and interesting information on the subject. The documents can be reproduced with WECF's permission, which is encouraged. The same applies to the bilingual flyer. WECF intends to maintain sustainably of the project beyond the actual project period.

Sustainability by city tours

There is already a sequel to the project thanks to the so-called city tours which were integral components of the project and helped introduce it free of charge to other city administrations. The Agenda 21 Office of the City of Hanover has modified and reprinted the bilingual flyer to adapt it to local uniqueness. Events on the topic "Environmental justice right from the beginning" are in preparation in Hanover, supported by WECF.

Conclusion

The key success of the project is that the topic "Environmental justice right from the beginning" and the shaping of a healthy living environment could be brought to the attention of the target groups' interest and that an awareness for environmental justice and pollution from harmful and environmentally damaging cleaning agents, mould and passive smoking was created. This was confirmed by the great demand for the individual modules and themes at the concluding second seminar in Munich. About 1,000 families and 600 intermediaries were reached during the project period. The Healthy City Network and the "city tours" expanded the presentation of the project to authorities and organisations in other cities. It was also very helpful to have training sessions, workshops and advice taking place in existing institutions and meeting places which were regularly attended by the

* Kiez is a historic term for a neighbourhood-like residential area in North-East Germany, especially Berlin.

target groups. The practical, interactive training sessions and workshops enabled lively, cross-cultural meetings which were constructively accepted by the participants. Not infrequently did participants leave the meetings – equipped with a wealth of information – with the aim of disseminating the knowledge gained for the protection of the health of all children.

More information

More information on the „Women in Europe for a Common Future“, WECF NGO is available on the http://www.wecf.eu website. Further details on the project can be found on the web at http://www.wecf.eu/english/about-wecf/issues-projects/projects/umweltgerechtigkeit.php.

Literature

Schulz C et al. (2010): Kinder-Umwelt-Survey (KUS) 2003/06: Innenraumluft – Flüchtige organische Verbindungen in der Innenraumluft in Haushalten mit Kindern in Deutschland. Reihe Umwelt & Gesundheit, 03/2010. Umweltbundesamt, Dessau-Roßlau.

Contact

Johanna Hausmann
WECF – Women in Europe for a Common Future
Press and Public Relation
Project coordinator “Environmental justice right from the beginning“
Sankt-Jakobs-Platz 10
D-80331 Munich
Email: johanna.hausmann[at]wecf.eu

Environmental justice: exploring capabilities instead of focusing on deficits

Elke Jumpertz[1] and Michael Wehrspaun[2]

Abstract: *Environmental justice offers new opportunities for exploration and using synergies among environmental and social policy. Therefore, it is necessary not to focus on deficits but to explore the capabilities of environmental justice. The synopsis of apparently incoherent issues, e.g. promoting human health and preservation of biodiversity, can reveal many unused social potentials. Regarding the ambivalent public perception of economic instruments in environmental policy, it is of the utmost importance to demonstrate the social potentials of ecological urban developments. The results of the surveys "Environmental Awareness in Germany" give evidence, that nowadays many people, especially socially less privileged, do not primarily evaluate the production of negative social and ecological externalities by the polluter as socially unjust, but the problems of adaptation associated with the internalisation of environmental costs.*

Introduction

Increasingly, research results show that the specific environmental quality of human settlements and housing can be understood as one aspect of the existing patterns of social inequality. Since this relationship also affects factors such as health and average life expectancy, the research and action area "environmental justice" is now gaining more significance in Germany. However, the topic is primarily being accessed via a deficit perspective whose core is the finding that in our society those socially and economically disadvantaged often lack access to a healthy environment and – more often than other social milieus – are exposed to a sickening living environment, often polluted with noise and air pollutants. Meanwhile, new pressures are added which arise from the increasing social polarisation such as „heating poverty": in 2005, almost 15 % of single parent households in Germany were unable to afford a sufficiently warm home (Statistisches Bundesamt 2005).

Other social inequalities are caused by the fact that socially and economically disadvantaged people often have a more distant relationship to nature, and associate their rare rest and relaxation time with it (BMU/BfN 2010). So the socially disadvantaged do not benefit to the same extent as those socially better-off from the preventive effect which may arise from the use of semi-natural urban open spaces.

The increasing significance of environmental justice in the news recently provides us with the opportunity for simultaneous promotion of social justice and environmental protection. Such consideration based on synergies can also successfully be applied to problems that seem at first sight far apart such as the promotion of human health and the conservation of biological diversity. When such issues are considered together, a mere analysis of deficits in the field of environmental justice can be overcome and new opportunities revealed for the discovery and exploitation of synergies between environmental and social policy.

Nature in the city: ecological system service and quality of life

Urban green spaces in cities not only take on ecological functions, but also play an important economic and social role. They provide improved quality of life, upgrade the living environment and conditions, thus add value to neighborhoods and prevent the better-off social milieu from moving away from the cities to take advantage of new housing options in the suburbs. Otherwise, social segregation and the

[1] German Environmental Aid (Deutsche Umwelthilfe, DUH)

[2] Federal Environment Agency (UBA)

Photo: Bernd Sterzl / pixelio.de.

emergence of problem areas in the cities are often the result, which accordingly reduces the attractiveness of towns and countryside, and the identification of residents with their homes. The preservation of green space, however, was – and often still is – sacrificed to purely economic interests, so it increasingly threatens to disappear from the public space. The number of animal and plant populations in the city decreases, and at the same time – first unnoticed, then more conspicuously – so do the benefits of nature within the city for the people. These ecological services are often not perceived directly, but they are an important part of the quality of urban life. Plants, for example reduce dust and noise emissions by their filtering, they improve the microclimate in neighbourhoods and reduce gaseous and particulate air pollutants. These benefits are eventually noticeable through their positive effect on human health. They are also called the ecosystem services of biodiversity.

In the latest national and international debate, the fact that biodiversity's economic benefits for people are often underestimated it is often discussed. One of the benefits is the avoidance of costs in the health system. Above all, the positive effects of nature and urban nature on the improvement and preservation of human health have up to now been insufficiently appreciated, which means they are not yet adequately integrated into the relevant decision-making and planning processes. Scientific findings on the significance of nature and parks for human well-being and health, such as stress reduction or boosting the immune system, are available (Maller et al. 2009). Studies from the Netherlands, for example, show that children who have good access to green spaces, less high-rise buildings in the area and opportunities for outdoor sports activities, are physically more active. Comparative studies in eight European cities show that people who live in green area rich districts, are physically three times more active and the probability of overweight and obesity disease is 40 % lower (Ellaway et al. 2005). It is also remarkable that school children who have access or can even look at a semi-natural environment, show higher attention levels than children without these natural benefits (Velarde et al. 2007).

Ambivalences in the perception of environmental justice

Previous studies show that there is considerable social inequality in terms of access to urban green space. Even the „Health report for Germany" by the Federal Statistical Office in 1998 stated that disadvantaged groups in the housing market often live in neighborhoods with little green space (Statistisches Bundesamt 1998). There is now abundant evidence showing this dual disadvantage. It was found that in the city of Kassel in 2008 there is a connection between the green space supply and the unemployment rate (Köckler 2008). Various study results show that people with low income find less biodiversity in their neighbourhood (Ciliers 2010). Melles (2005) found that neighborhoods with the lowest average family income and the highest population density have the comparatively lowest variety of birds. Birds are considered as good ecological indicator species, meaning that they signpost the quality of other natural features.

Such unambiguous results do not necessarily mean that the people affected really recognise their social disadvantage in terms of green space use and actually consider it a problem. Within the regular representative surveys on „Environmental Awareness in Germany" in 2010, respondents were asked to compare their own exposure to environmental problems with the average exposure of the German population. Only 1 % of the respondents feel a „much stronger" exposure than the average, an additional 7 % report a „somewhat stronger" stress situation. In contrast, 11 % said that they were „definitely less stressed" and about one-third felt „rather less stressed". Thus more than 40 % are assumed to belong to the group of better-off with respect to environmental justice. The general opinion about social justice in Germany is different today: in 2010, 42 % believed that they received less than they deserved as their „fair" share. Only a very small minority feels privileged in this respect (BMU/UBA 2010).

Furthermore, an in-depth analysis of data from previous surveys demonstrates that a sense of personal exposure to environmental problems in one's own

living environment does not only depend on objective data. Although the objective living situation assessed by the interviewers plays a major role in the interviews, the people's normative value systems are no less important. Therefore, a high level of environmental awareness and the active search for environmental information and a customarily higher level of education are also important variables in assessing environmental quality and one's own stress situation (Kuckartz et al. 2007). However, the socially disadvantaged population groups living mostly in the poorer neighbourhoods do not generally have a higher education degree and a resulting higher level of environmental awareness. Consequently, the effect was observed in 2010 that again subjective environmental stress may even increase with a rising income. These issues have been pursued as a part of the in-depth analysis of the data from 2010. The results were published in June 2011. Initial evaluations of the Sinus Institute's environment model indicate that these ambiguities have become even more important due to the effects of the financial crisis. This has political consequences: today some preventive environmental policy measures are suspected to increase the social injustice still further. The environmental awareness surveys show that this is especially true for economic (incentive) measures whose implementation often faces serious problems of acceptance. Accordingly, many people do not consider the cause of environmental pollution and the passing (externalisation) of their social and environmental costs primarily as socially unjust today. It is rather the adaptation needed in the frequently occurring internalisation of environmental costs which increases social injustice. In such a cultural situation, a preventive environmental policy can be caught in a dangerous defensive. If, for example, air pollution control or noise abatement measures make motoring more expensive, acceptance may drop, especially in the economically weaker social groups. This is all the more reason to highlight the positive effects which can be achieved by environmental policy measures and to improve social justice at the same time.

Recognising, promoting and using potentials

Meanwhile there is much evidence that environmental protection can make an important contribution to promoting social justice by making improvements in the living environment in disadvantageous neighborhoods. In 2009, the German Environment Assistance (DUH) presented several relevant examples at the conference "Options for action for more social justice through municipal environmental protection" (DUH, 2009). The problem areas of traffic and noise, climate protection and green city were investigated.

With regard to the linkage between environmental justice and biodiversity, the relevant issues were looked into and examined from different perspectives in order to be able to better take into account the various interactions between research and action fields of environmental justice and biodiversity in future projects, currently mostly treated in an isolated fashion (DUH, 2010). It has been found that several positive effects can be achieved with sufficient urban „green" in people's direct living environment: First, nature conservation benefits because the new green belts within the settlements provide an important contribution to the conservation of biological diversity. Furthermore, a green city can also enhance the experience and acceptance of nature within the population. But above all, starting points can be identified to leave the purely compensatory way of handling social issues, particularly, in hot pot neighbourhoods, and to initiate action for self-help. It is possible to achieve long-term effects and improve living conditions for people in situ permanently. This helps overcome a mere deficit perspective towards the promotion of untapped or undiscovered creation potential among the people affected.

All people and communities have a fundamental right to a safe and healthy environment, and all population groups should equally benefit from access to nature. However, this requires adequate planning and environmental design. In densely populated urban districts it is often just children, the elderly and sick whose needs have not been taken into account in urban planning, for example with regard to public safety and proper access to public transport. In addition,

Photo: Daniel Litzinger / pixelio.de.

semi-natural play and recreation areas are far too rare in urban areas. However, not only is the presence but also the quality of green spaces of significance. Similarly, the question of the maintenance and management of parks must be assessed from the perspective of environmental justice. Overexploitation, crime and drug use are factors which reduce the usability of green space. Safety perception is an important component for the areas to be used by residents. Such areas may provide a great potential for the district when the city manages to save them from degradation and to exploit them for the residents.

Exploring and communicating synergies

The transformation to a society whose living and economic conditions are sustainable, must keep social justice in mind. Environmental protection should not be at the expense of people who are disadvantaged in society in anyway. Ecology and social affairs cannot be played out against each other either. It is therefore necessary to explore the potential synergies between research and action areas such as with regard to the social dimension of urban nature.

These considerations are the starting points for the project „Environmental justice and biodiversity", carried out currently by DUH and funded by the Federal Ministry of the Environment (BMU) and the Federal Environmental Agency (UBA). The background is „Germany's capital of biodiversity" competition in 2010, in which the participating municipalities could represent their efforts to promote local environmental justice with regard to biodiversity. The DUH project on environmental justice, which connects to this competition, intends to disseminate the project's basic issues and the good examples and present the positive effects from the socio-ecological urban design in a practical way. At the end of 2011, as part of this project, a conference on the theme „Environmental justice and biodiversity – Semi-natural open spaces and their social significance" will take place where the problems and interesting solutions, submitted for the contest, will be discussed.

Literature

BMU/BfN (Bundesumweltministerium/Bundesamt für Naturschutz) (eds.) (2010): Naturbewusstsein 2009 – Bevölkerungsumfrage zu Natur und biologischer Vielfalt, Berlin/Bonn. www.bfn.de/0309_kommunikation.html (Accessed: 21.04.2011).

BMU/UBA (Bundesumweltministerium/Umweltbundesamt) (eds.) (2010): Umweltbewusstsein 2010 – Ergebnisse einer repräsentativen Bevölkerungsumfrage, Berlin/Dessau. www.umweltbundesamt.de/umweltbewusstsein (Accessed: 21.04.2011).

Ciliers (2010): Social Aspects of Urban Biodiversity – An Overview. In: Müller N, Werner P, Kelcey JG (eds.): Urban Biodiversity and Design, Wiley-Blackwell: 81-100.

DUH (Deutsche Umwelthilfe) (ed.) (2009) : Handlungsmöglichkeiten für mehr soziale Gerechtigkeit durch kommunalen Umweltschutz, Radolfzell. www.duh.de/umweltgerechtigkeit.html (Accessed: 21.04.2011).

DUH (ed.) (2010): Dokumentation: Workshop Natur-Stadt-Mensch – Expertenworkshop zu den Zusammenhängen zwischen Biodiversität in urbanen Räumen und der sozialen Bedeutung von naturnahen Freiräumen, Radolfzell. www.duh.de/umweltgerechtigkeit.html (Accessed: 21.04.2011).

Ellaway A, Macintyre S, Xavier B (2005): Graffiti, greenery and obesity in adults: secondary analysis of European cross sectional survey. In: British Medical Journal, 331: 611-612.

Köckler H et al. (2008): Umweltbezogene Gerechtigkeit und Immissionsbelastungen am Beispiel der Stadt Kassel. CESR-Paper 1, Kassel University Press, Kassel.

Kuckartz U, Rheingans-Heintze A, Rädiker S (2007): Das Spannungsfeld Umwelt und Gerechtigkeit in der öffentlichen Wahrnehmung. Dessau-Roßlau. www.umweltbundesamt.de/umweltbewusstsein/umweltbewusstsein (Accessed: 14.01.2011).

Maller C et al. (2009): Healthy Parks, Healthy People: The Health Benefits of Contact with Nature in a Park Context. In: George Wrigth Forum, 26 (2): 51-83.

Melles S (2005): Urban bird diversity as an indicator of human social diversity and economic inequalitiy in Vancouver, British Columbia. In: Urban habitats, 3 (1): 25-48.

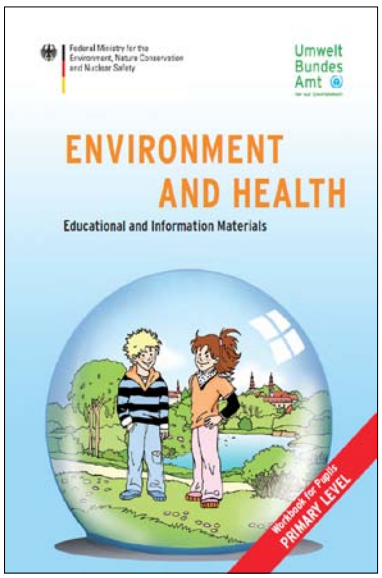
Statistisches Bundesamt (ed.) (1998): Gesundheitsberichterstattung für Deutschland.

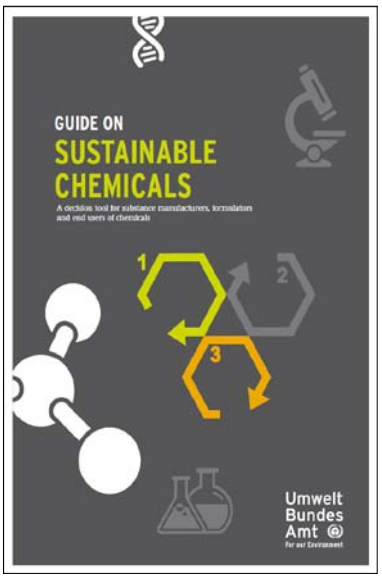
Statistisches Bundesamt (ed.) (2005): Armut und Lebensbedingungen – Ergebnisse aus LEBEN IN EUROPA für Deutschland 2005.

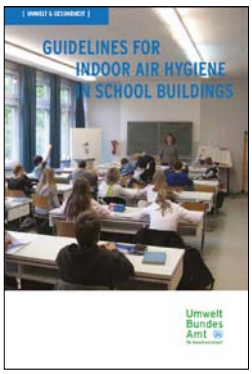
Velarde MD, Fry G, Tveit M (2007): Health effects of viewing landscapes: landscape types in environmental psychology. In: Urban Forestry & Urban Greening 6: 199-212.

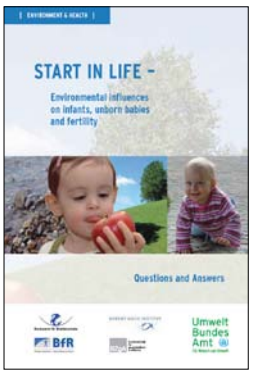
Contact

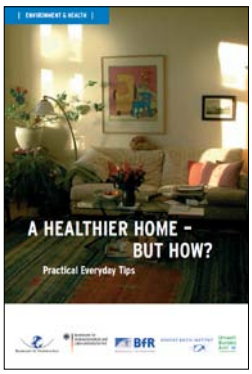
Elke Jumpertz, M.A.
Project Manager, Communal Environmental Protection
German Environmental Aid
Federal Agent's Office, Radolfzell
Fritz-Reichle-Ring 4
D-78315 Radolfzell
Email: jumpertz[at]duh.de

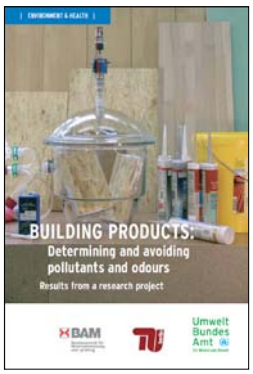


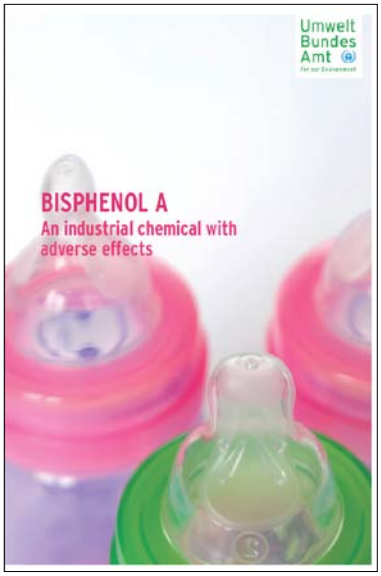


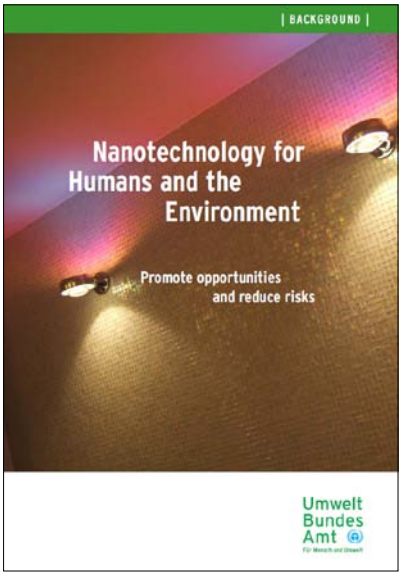


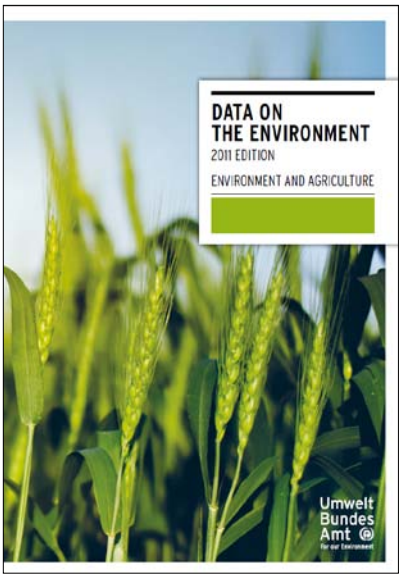












These publications are available free of charge – even in larger numbers – at:

Umweltbundesamt
Fachgebiet II 1.1
Geschäftsstelle „Aktionsprogramm Umwelt und Gesundheit“ (APUG)
Corrensplatz 1
D-14195 Berlin
Internet: www.apug.de
E-Mail: apug@uba.de