



Editorial

Radon in homes

According to WHO, radon is after smoking the second cause of lung cancer in the general population. Evidence from epidemiological studies convincingly shows an association between indoor radon exposure and lung cancer. This association has been observed even at relatively low radon levels usually found in residential buildings. An increase in lung cancer risk after radon exposures has also been clearly demonstrated in underground miners, supporting the risk assessment data from the radon indoor studies. These convincing results from epidemiological studies on people living in homes with increased radon concentrations as well as on underground miners are discussed in more detail in the article by Michaela Kreuzer.

Efforts to draw conclusions from these clear epidemiological results and to evoke political discussions and actions to reduce the number of lung cancers related to radon exposures have, however, so far only been successful in very few countries. As a result of this inadequacy between a proven health risk and the still missing political action on reducing this risk, international institutions and commissions have started new initiatives in recent years to reassess radon risks and to firmly recommend national actions to reduce radon risks in homes and work places.

A new start was the WHO initiative to establish the International Radon Project in 2005. This project finished its work by publishing recommendations in the WHO Handbook on Indoor Radon in 2009. At about the same time, the International Commission on Radiological Protection (ICRP) set up a working group charged with the task to review all the current scientific evidence on radon exposures and lung cancer. The new risk assessment of radon, which went through a public consultation process in 2010,

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has now been published by ICRP (ICRP Publication 115, 2011). Currently, a second ICRP task group is working on new recommendations on radiological protection against radon exposures. The draft report 'Radiological Protection against Radon Exposure' is now open for an extended public consultation up until June 8th, 2012 (www.icrp.org).

Common to all recent recommendations is the advice that national radon action plans should be established by national authorities with the involvement of relevant stakeholders. The objective of such a plan should be to reduce both the collective risk of the population and the individual risk to radon exposures. In such a plan, radon exposures in dwellings, places open to the public and work places should be addressed. Preventive and corrective actions should be intended to achieve a substantial reduction of radon exposures.

The national action plan should establish a framework with a clear infrastructure, determine priorities and responsibilities, describe the steps to deal with radon in the country and in a given location, identify concerned parties, address ethical and legal issues and provide informa-

tion, guidance, support as well as conditions for sustainability.

Central to all mitigation strategies are radon measurements and protocols. Radon measurements in homes are easy to perform. However, to ensure accuracy and consistency they should be based on standardized national measurement protocols. Ideally, long-term radon measurements should be preferred over short-term ones. More details about radon exposure and measurements are given in the article by Bernd Hoffmann and Winfried Meyer.

Currently, the European Commission is discussing an amendment of the Council Directive 96/29/ Euratom of 13 May 1996 on the basic safety standards in radiological protection. The draft directive published in September 2011 states, that reference levels will be given for indoor radon concentrations. Member States will be required to establish a comprehensive and transparent radon action plan, adjusted to

national needs and to the geological features of different regions. Now, the draft of the basic safety standards is in the process of formal approval by the European Parliament and the member states. Outcome of these discussions and the legislative process will show if the European Community and its member states are willing and able to draw the necessary conclusions from the convincing epidemiological association between radon exposure and lung cancer risk. Clear guidelines on radon mitigation in Europe targeting on both the collective and the individual radon caused lung cancer risk in the population should be given to the public.

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Health effects of radon in homes

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Radon is a naturally occurring radioactive gas that is found in varying amounts in rocks and soils all over the world. It is the main source of natural exposure to ionizing radiation. The radon gas itself is inhaled and mostly exhaled again. However, its short-lived alpha-emitting decay products (^{218}Po and ^{214}Po) deposit in the lung and can interact with biological tissue in the lungs, leading to DNA damage and thus increasing the likelihood of developing lung cancer.

The evidence of an increased mortality from respiratory disease among underground miners in central Europe dates back to the sixteenth century. In the nineteenth century it was realised for the first time that the disease was in fact lung cancer, and in the 1950ies that radon and its progenies were the cause. Since then, a series of epidemiological studies in underground miners consistently demonstrated an increased risk of lung cancer. Based on this evidence, radon was classified by the International Agency for Research on Cancer [IARC] as a human carcinogen in 1988.

Extrapolation of the risk of lung cancer from the miners' studies to the risk of lung cancer from low radon exposure in the home involves high uncertainty. For this reason, a series of epidemiological studies directly investigated the association between indoor radon and risk of lung cancer by means of case-control studies. In this type of study, for both – lung cancer cases and controls - detailed information on smoking history and other risk factors for lung cancer is gathered and the radon exposure is assessed retrospectively by measuring radon in the current and previously occupied homes of the study participants.

The majority of the studies showed a positive association between the radon exposure and the risk of lung cancer; however, the risk coefficients estimated in the individual studies often did not reach statistical significance. Moreover, there was a substantial variation in the estimated radon-related risk. For this reason, the original data of the individual studies were brought together and collaborative

analyses of the individual data of 13 European studies [Darby et al. 2005, 2006], 7 North American studies [Krewski et al. 2005, 2006] and 2 Chinese studies [Lubin et al. 2004], respectively, were performed.

Results of pooled epidemiological studies

The largest of these pooled studies is the European pooling study [Darby et al. 2005, 2006]. It includes 7,148 cases and 14,208 controls from 13 European indoor radon case-control studies on lung cancer; for all studies detailed information was available on smoking histories and radon measurements in homes that the individuals had occupied during the past 15 years or more. The available radon measurements covered a mean of 23 years in the relevant radon exposure period 5 - 34 years prior to the interviews. Individual exposure to radon (called "measured" radon concentration) was calculated as the time-weighted average of the radon concentrations in all the homes occupied over the past 5 - 34 years, with missing radon values being substituted by the mean concentration of the controls in that region. A statistical model was fitted in which the additional risk of lung cancer was proportional to the measured radon concentration. In addition, radon exposure was subdivided into categories and the relative risk across categories of measured radon concentrations was plotted against the mean level in these categories. In both models a detailed stratification for study, age, sex, region of residence, and smoking was performed.

In the pooled analysis, the Excess Relative Risk (ERR) of lung cancer per 100 Bq/m³ "measured" radon concentration was 8 % (95 % confidence limits (CI): 3 %-16 %). This proportionate increase did not differ significantly by study, age, sex or smoking history. The corresponding risk estimates for life-long non-smokers, ex-smokers and current cigarette smokers were 11 % (3 % - 28 %), 8 % (3 % - 21 %), and 7 % (-1 % - 22 %), respectively. The exposure-response relationship appeared to be approximately linear with no evidence of a threshold below which there was no risk. Even when the analysis was restricted to individuals with measured radon concentrations below 200 Bq/m³, the exposure-response relationship remained statistically significant. Analysis based on the so-called "long-term average radon concentration", which takes into account the random year-to-year variability in measured radon concentration in the homes, led to an increased ERR of 16 % (95 % CI: 5 % - 31 %) per 100 Bq/m³. Again, the risk did not differ significantly by study, age, sex or smoking status, and the exposure-response relationship was approximately linear (Figure 1).

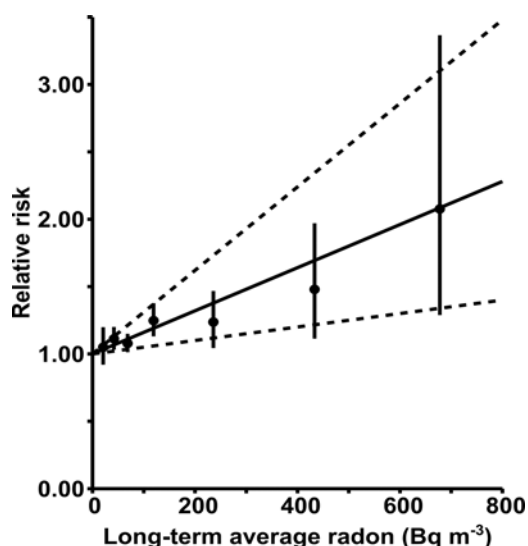


Figure 1: Relative risk of lung cancer versus long-term average residential radon concentration in the European pooling study, based on Darby et al. (2005). Relative risks and 95% confidence intervals are shown for categorical analyses and also best fitting straight line. Risks are relative to that at 0 Bq/m³.

Table 1 provides information on the cumulative risk of death from lung cancer by age 75 years for lifelong non-smokers and continuing smokers of 15 - 24 cigarettes ("current smokers") [Darby et al. 2005, 2006]. For these calculations the estimated ERR of 16 % per 100 Bq/m³ of long-term average radon concentration, which was independent of the smoking status, was used. The relative risk for current smokers of 15 - 24 cigarettes per day compared to lifelong non-smokers was estimated as 25.8-fold. For lifelong non-smokers, it was estimated that living in a home with a long-term average radon concentration of 0, 400 or 800 Bq/m³ was associated with a cumulative risk of death from lung cancer of 41, 67 or 93 in a 1000. For current smokers the corresponding values would be 101, 160 or 216 in a 1000, respectively. For those having stopped smoking, the radon-related risks are substantially lower than for those who continue to smoke, but they remain considerably higher than the risks for lifelong non-smokers.

Table 1: Cumulative risk of death from lung cancer by age of 75 years for lifelong non-smokers and continuing smokers of 15-24 cigarettes per day at various levels of radon concentration after correction for uncertainties in the assessment of radon concentrations (Darby et al., 2006).

Radon concentration in Bq/m ³	Death per 1000 lifelong non-smokers	Death per 1000 current smokers of 15-24 cigarettes
0	4.1	101
100	4.7	116
200	5.4	131
400	6.7	160
800	9.3	216

Absolute risk of lung cancer for lifelong non-smokers taken from the prospective study of the American Cancer Society. Relative risk of lung cancer for continuing smokers of 15-24 cigarettes per day compared to lifelong non-smokers assumed equal to be 25.8. Relative risk of lung cancer assumed to increase by 0.16 per 100 Bq/m³.

The North-American pooled analysis of seven indoor radon case-control studies in the USA and Canada [Krewski et al., 2005, 2006] included a total of 3,662 cases and 4,966 controls. For each individual the time-weighted average of the radon concentrations in the homes was calculated with a focus on the period 5 - 30 years prior to the date of interview. The ERR of lung cancer per 100 Bq/m³ increase in measured radon concentration was 11 % (95 % CI: 0 % - 28 %). The trend was consistent with a linear exposure-response-relationship. Analyses restricted to individuals with presumed "more accurate dosimetry" resulted in increased risk estimates. For example, for individuals who lived in only one or two homes in the 5 - 30 year period and for which measurements covered at least 20 years of this period, the proportionate increase in lung cancer risk was 18 % (95 % CI: 2 % - 43 %).

The Chinese pooled study [Lubin et al. 2004] included 1,050 cases and 1,996 controls from two studies. Similarly to the North-American pooled study, the time-weighted average of the radon concentration in the homes within the exposure period 5 - 30 years was calculated. The increase in risk per 100 Bq/m³ increase in measured radon concentration was 13 % (95 % CI: 1 % - 36 %), and the results were consistent with a linear exposure-response relationship with no threshold. When analyses were restricted to individuals resident in only one home and with complete measurement coverage in the relevant period the proportionate risk per 100 Bq/m³ increased to 33 % (95 CI: 8 % - 96 %).

Overall, the radon-related risk estimates in the three pooling indoor radon studies were very similar (see Table 2). In each study, the exposure-response relationship appeared to be linear, without evidence of a threshold. There was no statistical significant evidence that the radon-related risk varied by age, sex or smoking status. A weighted average of the three pooled risk estimates was recently provided by WHO [2009], with weights proportional to their variances, resulting in a joint estimate of 10 % proportionate increase in lung cancer risk per 100 Bq/m³ measured radon concentration. WHO [2009] estimated that, based on long-term average radon concentration instead of measured radon concentration, this 10 % estimate could even increase to 20 % per 100 Bq/m³, if it is assumed that the effect

of adjusting for year-to-year random variation in the three pooled studies combined is the same as in the European study.

Table 2: Summary of risks of lung cancer from indoor radon based on international pooling studies that have combined individual data from a number of case/control studies and on studies of radon exposed miners

Pooled residential radon studies	# of studies included	# of lung cancers	Exposure window (Years) ^a	% ERR per 100 Bq m ⁻³ (95%CI) observed radon	% ERR per 100 Bq m ⁻³ (95%CI) corrected for exposure uncertainties
European (Darby et al, 2005, 2006)	13	7148	5-35	8 (3-16)	16 (5-31) ^b
North American (Krewski et al 2005, 2006)	7	3662	5-30	11 (0-28)	18 (2-43) ^c
Chinese (Lubin et al, 2004)	2	1050	5-30	13 (1-36)	33 (8-96) ^c
Weighted average of above results (WHO, 2009)				10	20 ^d

^a ie considering radon concentrations during the period starting 35 years before and ending 5 years before the date of diagnosis for cases of lung cancer, or a comparable date for controls.

^b ie adjusting for year-to-year random variability in indoor radon concentration

^c estimate corresponding to higher coverage of measurements

^d Informal estimate, indicating the likely effect of removing the bias induced by random year-to-year variation in radon concentration

Conclusion

In 2009, the WHO Handbook on Indoor Radon [WHO, 2009] was published. It includes the following five key messages on the health effects of radon in homes:

- Epidemiological studies confirm that radon in homes increases the risk of lung cancer in the general population. Other health effects of radon have not consistently been demonstrated.
- The proportion of all lung cancers related to radon is estimated to lie between 3 % and 14 %, depending on the average radon concentration in the country and on the method of calculation.
- Radon is the second most important cause of lung cancer after smoking in many countries. Radon is much more likely to cause lung cancer in people who smoke, or who have smoked in the past, than in lifelong-nonsmokers. However, it is the primary cause of lung cancer in people who have never smoked.
- There is no known threshold concentration below which radon exposure does not result in a health risk. Even low concentrations of radon can result in a small increase in the risk of lung cancer.
- The majority of radon-induced lung cancers are caused by low or moderate radon concentrations rather than by high radon concentrations, because in general less people are exposed to high indoor radon concentrations.

The recently published WHO Indoor Air Quality Guidelines [Kreuzer and Laughlin 2009] reached similar conclusions:

- There is sufficient evidence that radon causes lung cancer even at concentrations typically found in indoor air.
- There is suggestive evidence of an association with other cancers, in particular leukaemia and cancers of the extra-thoracic airways.

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Relevant links

<http://www.bfs.de/en/ion/radon>

Protection against increased radon concentrations

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Radon is a naturally occurring radioactive noble gas which is colourless, odourless and tasteless. It results from the decay of radium, i.e. a decay product of uranium which is found in rocks and soils all over the world in various concentrations. In Germany, radon concentrations ranging from less than 10,000 up to 100,000 Becquerel per cubic meter (Bq/m³) in the soil air are usual, although considerably increased concentrations might occur locally. From the subsoil, radon finds its way into the atmosphere and also into buildings if the soil contacted surface (such as the basement and rooms without underground level) leaks. The radon concentration outdoors varies regionally. Concentrations are low in the North German Plain, but most commonly increased in mountainous areas. The annual mean values are usually in a range of 5 Bq/m³ up to 30 Bq/m³, but there are also higher concentrations on a small scale (Figure 1).

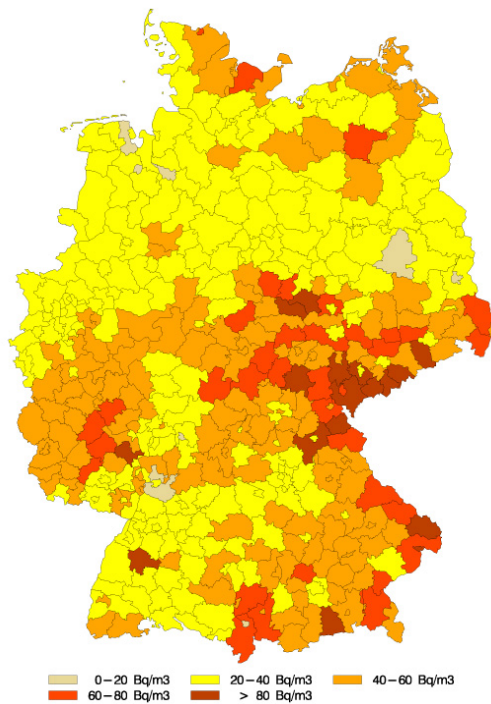


Figure 1: Average Radon concentrations (geometric mean) in homes in Germany (Menzler et al. 2006).

Health effects of increased radon concentrations

More recent studies demonstrate that many years of exposure to enhanced radon concentrations indoors increase the risk to develop lung cancer by about 10 per cent per 100 Bq/m³ rise in radon concentration. For example, an individual's lung cancer risk associated with permanent exposure to radon concentrations of 100 Bq/m³ or 200 Bq/m³ is higher by about ten, or 20 per cent, respectively, compared to that of an individual who has never been exposed to radon. The relative lung cancer risk due to radon for smokers is similar to that for lifelong non-smokers. However, since the baseline risk for lung cancer is significantly increased in smokers, a similar level of relative risk involves a clearly higher absolute risk for smokers than for non-smokers. Most of the radon-induced lung cancers, therefore, represent smokers. According to latest estimates, approximately five per cent of all lung cancer deaths per year are caused by radon in homes in Germany. This corresponds to approximately 1,900 radon-induced deaths per year by absolute numbers. It is therefore recommended to keep radon concentrations in occupied spaces as low as possible and design new buildings so as to avoid radon concentrations exceeding 100 Bq/m³.

Radon indoors

Radon is also found indoors. Most of it finds its way into the building from the subsoil. Fissures in the brick work or base plate, leaking joint gaps between building parts, insufficiently sealed cable or pipe ducts and other failure points in the building encourage radon entry into the house. By contrast, buildings with a concrete floor slab and the technically correct protection against ground humidity as customary today provide only few possibilities for radon to enter the building from the soil. The level of radon concentrations occurring indoors depends on the radon generation in the subsoil, the properties of the locally occurring materials decisive for radon transport and the design of the building. Radon finding its way from the subsoil into the interior of the building is able to reach superior spaces of the building in particular via staircases, cable channels and supply shafts, but also via ceilings. Most houses in Germany have been erected based on compact design mainly using mineral building materials. These latter building materials generate radon, like soils and rocks, which is partially released into interior spaces. Radon is also released when using drinking water. However, these two sources generally contribute only a few tens of Bq/m³ to the radon concentration indoors. Radon concentrations inside buildings are variable due to both site-dependent variations in the occurrence of radon in

the subsoil and the particular constructional conditions. Even in neighbouring buildings with similar architecture and use may appear totally different radon concentrations indoors. Radon concentrations indoors are also influenced by the inhabitants' habits, above all their ventilation behaviour. Change of use may alter radon concentrations in the rooms. The actual situation within a building can only be detected by measurements. These should be performed in occupied spaces (e.g. living room, bedroom, children's room) over a year's time because concentrations are normally higher in winter than during warmer seasons. The annual means of radon concentration in living spaces in Germany are 50 Bq/m³ on average. In approximately 10 per cent of the one- or two-family houses, radon concentrations exceeding 100 Bq/m³ are to be expected in ground floor rooms. Enhanced radon concentrations indoors are more frequently found in areas exhibiting increased radon concentrations in the soil air and good perviousness for radon. However, annual mean values exceeding 1000 Bq/m³ are rare.

Planning of measures for protection against radon

Radon protection is based on the same principles and tools, whether in newly constructed or existing buildings. For new construction projects, appropriate protection measures can be defined reliably and will basically be successful if properly implemented. Such measures are reliably calculable both technically and in terms of money. The effort required is relatively low even in regions with high radon concentrations in the soil air and in sophisticated construction projects. It amounts to about 1 per cent of the construction costs.

When existing buildings are subject to radon remediation it is imperative to carefully consider alternative possibilities, and success at the first attempt is not always certain. An appropriate technical solution related to each individual case is required for every building subjected to remediation. While measures such as unclosing existing vent openings might suffice to solve the problem in some cases, even mounting of a ventilator-driven exhaust system may not be enough to produce satisfactory results in other cases, for example because some feature had not been detectable initially. Likewise, the effort required cannot be foreseen clearly in every case. Therefore, especially with old buildings, a financial upper limit corresponding to the value of the building should be considered when deciding on measures to reduce the radon concentration in order to avoid inadequate costs. For new buildings and for mitigation of existing buildings it is recommended to observe the strategic basic rules below. The five steps encompass aspects varying from case to case, give rise to specific questions and lead to situational solutions.

Initial situation

In addition to the different possible sources of radon it has to be considered that every building is situated within a specific environment (permeability of the ground, influence of mining, ground water level etc.) and that each object exhibits constructional specifics (such as state of construction, interior structure, isolation of the building etc.).

Conceptual measures

Crucial decisions have to be made already during the early planning phase of construction works. These decisions may heavily influence or even solve the radon problem not only in new buildings but also during alteration or expansion of existing buildings, e.g. by "architectural solutions" such as appropriate structuring of the building, heat and moisture proofing, or purposeful influencing of the air pressure conditions within the building.

Constructional measures

Impervious structural design of new buildings and sealing measures for rooms with soil contact are able to prevent radon permeation.

Ventilation measures

Appropriate vents or ventilation systems are able to influence the pressure situation inside the building or between the building subsoil and interior in the desired way. Specific build-up of a defined pressure difference (depression, excess pressure) is able to limit radon permeation into the building.

Control of success

Without metrological monitoring, there is never certainty as to the efficacy of the measures taken.

Radon protection by sealing measures

Radon can permeate a building both convectively as a part of soil air through leaks or vents in soil contacted building components or by diffusion from the floor and walls. Enhanced radon concentrations usually are attributed to convective transport of radon containing soil air. Therefore, sealing of the building against the subsoil is an important starting point of radon protection measures. Basically this can be fulfilled by the barrier against soil moisture. It is important that this latter provides a closed barrier against the subsoil. Leakage-proof design of coatings, interfaces and cable bushings is even more important for radon tightness than for water vapour. Even small leakage areas in the order of 1 cm² in the cellar floor may bring about enhanced radon concentrations in the cellar in cases of high radon concentrations. Generally care should be taken to prevent the sealing membrane from being damaged. Sealing can be made both from inside and from the outside. Radon-tight materials should be used to prevent radon diffusion due to built-in large-scale dam tight blankets. In regions with very high radon concentrations in the soil air, enhanced radon concentrations within the building cannot be excluded even with professional sealing. In such cases a combination of constructional and ventilation measures should be used.

Radon protection by ventilation measures

Soil air containing radon permeates the building primarily as a result of the pressure gradient between the subsoil and the adjacent interior spaces. There are different causes of the pressure gradient:


- Difference in temperature between interior and exterior (chimney effect),
- Wind-induced pressure differences,
- Technical facilities such as exhaust fans for bathrooms, fume hoods,
- Boilers, instantaneous gas-fired heaters, furnaces and fireplaces.

The possible ventilation strategies to influence the pressure conditions can be assigned to five principles:

- Reduction or elimination of depression by means of sufficiently dimensioned vents for exhaust air units and direct outside air supply for furnaces and boilers,
- Elimination of pressure gradient between subsoil and interior spaces by passive or active suction of soil air from the area of immediately below the building area,
- Discharging radon containing air from the cellar by an increased air exchange rate,
- Discharging radon containing air from individual lounges by means of ventilation facilities mostly with heat recovery.

Other than radon protection by sealing, ventilation measures cause permanent operating costs but the effectiveness may also be modified after installation. Discharging radon containing air may require additional sealing measures in cases of very leaky buildings. Some hundreds of radon remediation or prevention measures based on ventilation facilities have already been carried out on an international level. However, since the starting situations are always very different, radon protection measures based on ventilation always require adjustment to the individual situation, particularly for existing buildings.

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Abschätzung des attributablen Lungenkrebsrisikos in Deutschland durch Radon in Wohnungen.
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Relevant links

http://www.bfs.de/en/ion/radon/radon_in_haeusern.html 

Publications and Resources

Housing for the elderly - market processes and the need for housing policy action Research project

Demographic change confronts homeowners and housing policymakers with new challenges. The shrinkage and ageing of society will also change the housing sector and the requirements for a supply of housing that meets the needs of the market. By 2030, 28 percent of the population of Germany will be older than 65 - more than one in four persons. In the future, the supply of housing will have to focus more on the requirements of elderly people. This includes forms of housing which, thanks to the totally or partially accessible design of dwellings and residential environments and the provision of amenities that are within walking distance, also enable people with reduced mobility to lead an independent life. But it also includes forms of housing that are linked to comprehensive assistance and provide services for social inclusion. The study quantifies the need for age-appropriate residential services and formulates housing policy strategies.

http://www.bbsr.bund.de/cIn_032/nn_168756/BBSR/EN/Publications/BMVBS/Forschungen/2011/147a_bstract.html

Municipal housing stocks from different perspectives

The privatisation of housing in Europe. Strategies, procedures and impacts in Great Britain, Poland and the Netherlands *from Andrej Holm*

Taking the extensive privatisation of public housing stocks since the end of the 1990's as a point of departure, there has been an engaged discussion about the possible impacts for the social provision of housing and the socio-spatial structures in municipal administrations, the housing industry and science. In this context an international comparison makes it clear that the dominating privatisation in the framework of en-bloc sales to international investors takes up a special position in Germany. In spite of all differences, a consideration of the experiences in other countries is worthwhile. With examples of London, Warsaw and Amsterdam, this article discusses three very different practices of privatisation and intends to contribute to a deeper understanding of the logics of privatisation in the housing sector. In the foreground is less the search for a better strategy of privatisation but rather the consideration of the very different problem situations of different forms of privatisation. The three case studies show very different procedures and processes and indicate different effects on housing provision and urban development. Furthermore, the examples show that the privatisation of housing is not only the result of changes in urban policy, but mainly creates new challenges for urban policy.

http://www.bbsr.bund.de/cIn_032/nn_340720/BBSR/EN/Publications/lzR/2011/Abstracts/12_Holm.html

What Makes a Neighborhood Walkable - Walk Score pinpoints areas offering a walking lifestyle

A growing body of research shows that walkable, compact communities can promote good health and a healthier planet by promoting exercise and reducing the risk of obesity. Walkable neighborhoods lower car crash fatalities, reduce greenhouse gas emissions and vehicle-related air pollution. Walk Score.com is a publicly-available web-based tool that rates the walkability (ease of walking and biking) and access of amenities of U.S. neighborhoods and communities by a patent-pending system. The Walk Score algorithm awards points based on the distance to amenities in each category, using a variety of data sources including Google, Education.com, Open Street Map, and Localeze. No points are awarded for amenities farther than one mile. Areas with scores between 90 and 100 points are called a "Walker's Paradise" - daily errands do not require a car. However, scores between 0 and 24 are labelled as "Car-Dependent" built environments.

<http://www.walkscore.com/walkable-neighborhoods.shtml>

Cycle like the Danes to cut carbon emissions, says study - the Guardian, 12 Dec 2011
EU could cut its total greenhouse gas emissions by more than 25% if every country's cycling rate was the same as Denmark's

If the EU cycling rate was the same as it is in Denmark, where the average person cycles almost 600 miles (965 km) each year, then the bloc would attain anything from 12 % to 26 % of its targeted emissions reduction, depending on what forms of transport the cycling replaced, according to the report by the Brussels-based European Cycling Federation (ECF).

Increasing continent-wide cycling to Danish levels would, nonetheless, be quite an enterprise. The EU average is just under 120 miles per person per year, while in the UK it is a mere 46 miles, less than 8 % of that in Denmark.

The European commission requested that the ECF carry out the research to provide the first specific figures for emissions produced by bicycles over their lifespan, as against motorised vehicles. The calculations for bikes included manufacture – the ECF took a heavier, European-style bike as its model, assuming each used 14.6 kg of aluminium, 3.7 kg of steel and 1.6 kg of rubber – maintenance and even the impact of producing extra calories consumed by someone cycling rather than driving, estimated at 175 an hour, on average. This came up with a total of 21 g of carbon emissions per passenger kilometre travelled for a bike, as against 271 g for people in a car and 101 g for a bus. The impact of electric-assisted bicycles, a boon for older or infirm riders, was almost as low, at 22 g.

According to ECF, major changes will be required if the EU is to meet its emissions target, which calls for a drop of between 80 % and 90 % on 1990 levels by 2050, and transport is the ideal place to start. From 1990 to 2007, transport-based emissions on the continent rose 36 %, while those from other sources fell 15 %. It also points to the example of cities such as Seville in Spain, where the construction of segregated bike lanes and other policies saw cycling increase tenfold in just three years.

[European Cyclists' Federation](#)

World Radon Solutions Database

The website "World Radon Solutions" is an electronic platform for the exchange of information and experience on existing methods used to reduce radon in buildings. It consists of a database of technical solutions, extending the original work initiated by Chris Scivyer within ERRICCA2 "European Radon Research and Industry Collaboration Concerted Action".



[About | World Radon Solutions Database](#)

Swiss national radon action plan - Nationaler Radonaktionsplan der Schweiz 2012-2020

The risk of lung cancer associated with radon exposure in homes is higher than it might be expected from the extrapolation of epidemiological studies of miners. In light of the new state of knowledge, WHO issued updated recommendations and laid down a maximum value of 300 Bq/m³. Accordingly, Switzerland has to check the reference and limit values. This new situation requires that an action plan shall be adopted and implemented in the years 2012-2020.

[Bundesamt für Gesundheit - Radonaktionsplan 2012-2020](#)

Literature

In this section we will provide a collection of recent housing and health publications from a variety of backgrounds. Literature published in German or French, respectively, is indicated with the German flag  or the French flag .

If you have suggestions for interesting journals that we should screen for the literature collection, please let us know!

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Allergies and Respiratory Diseases

[Peruvian highlands, fume-free.](#)

Bodereau PN.

Science. 2011 Oct 14;334(6053):157. *Free Article.*

[Methodological lessons and pilot data on the effect of proximity of homes and schools to highways on pediatric asthma and lung function.](#)

Brugge D, Hong JS, Schiff D, Hui C, Moy S, Palella M, Buchner V, Woodin M.

Rev Environ Health. 2011;26(2):119-25.

[MeDALL \(Mechanisms of the Development of ALLergy\): an integrated approach from phenotypes to systems medicine.](#)

Bousquet J, Anto J, Auffray C, Akdis M, Cambon-Thomsen A, Keil T, Haahtela T, Lambrecht BN, Postma DS, Sunyer J, Valenta R, Akdis CA, Annesi-Maesano I, Arno A, Bachert C, Ballester F, Basagana X, Baumgartner U, Bindslev-Jensen C, Brunekreef B, Carlsen KH, Chatzi L, Cramer R, Ereno E, Forastiere F, Garcia-Aymerich J, Guerra S, Hammad H, Heinrich J, Hirsch D, Jacquemin B, Kauffmann F, Kerkhof M, Kogevinas M, Koppelman GH, Kowalski ML, Lau S, Lodrup-Carlsen KC, Lopez-Botet M, Lotvall J, Lupinek C, Maier D, Makela MJ, Martinez FD, Mestres J, Momas I, Nawijn MC, Neubauer A, Oddie S, Palkonen S, Pin I, Pison C, Rancé F, Reitamo S, Rial-Sebbag E, Salapatas M, Siroux V, Smagghe D, Torrent M, Toskala E, van Cauwenberge P, van Oosterhout AJ, Varraso R, von Hertzen L, Wickman M, Wijmenga C, Worm M, Wright J, Zuberbier T.

Allergy. 2011 May;66(5):596-604. *Review.*

[Perinatal exposure to endotoxin and the development of eczema during the first 6 years of life.](#)

Chen CM, Sausenthaler S, Bischof W, Herbarth O, Borte M, Behrendt H, Krämer U, Williams HC, Wichmann HE, Heinrich J; LISA Study Group.

Clin Exp Dermatol. 2010 Apr;35(3):238-44.

[Modulation of asthma by endotoxin.](#)

Doreswamy V, Peden DB.

Clin Exp Allergy. 2011 Jan;41(1):9-19.

[Home environment, asthma, and obesity: how are they related?](#)

Halloran DR.

J Pediatr. 2011 Jul;159(1):3-4.

[Pet exposure and the symptoms of asthma, allergic rhinitis and eczema in 6-7 years old children.](#)

Karimi M, Mirzaei M, Baghiani Moghadam B, Fotouhi E, Zare Mehrjardi A.

Iran J Allergy Asthma Immunol. 2011 Jun;10(2):123-7.

[Exposure to biomass smoke as a cause for airway disease in women and children.](#)

Kodgule R, Salvi S.

Curr Opin Allergy Clin Immunol. 2011 Dec 9. [Epub ahead of print]

[Neighborhood differences in exposure and sensitization to cockroach, mouse, dust mite, cat, and dog allergens in New York City.](#)

Olmedo O, Goldstein IF, Acosta L, Divjan A, Rundle AG, Chew GL, Mellins RB, Hoepner L, Andrews H, Lopez-Pintado S, Quinn JW, Perera FP, Miller RL, Jacobson JS, Perzanowski MS.

J Allergy Clin Immunol. 2011 Aug;128(2):284-292.e7.

[Effect of reduction in household air pollution on childhood pneumonia in Guatemala \(RESPIRE\): a randomised controlled trial.](#)

Smith KR, McCracken JP, Weber MW, Hubbard A, Jenny A, Thompson LM, Balmes J, Diaz A, Arana B, Bruce N.

Lancet. 2011 Nov 12;378(9804):1717-26.

"Pneumonia is the chief cause of death for children aged five years or under worldwide, responsible for about 20 % of total deaths in these age groups. It is caused by viral and bacterial infections. Smoke from burning solid fuels, such as wood and animal dung, reduces the lung's defences against infections, particularly bacterial," said Dr Nigel Bruce, a consultant with WHO and Reader in Public Health at the University of Liverpool, UK. "Increasing awareness of the effects of wood smoke on health will help us to significantly reduce the numbers of cases of severe pneumonia, as well as respiratory disease in adults." The use of open fires and inefficient traditional stoves for cooking is also a cause of burns and can have a negative impact on the environment and increase pressures on natural resources. In this article, researchers have reported that cases of severe pneumonia among young children are reduced by one third in homes with smoke-reducing chimneys on cooking stoves. A smaller decrease was reported in all pneumonia cases – both severe and non-severe – possibly because the reduction in smoke from these stoves was not sufficient enough to result in a significant change. The research highlighted the health effects of exposure to smoke from open fires and dirty cooking stoves, the primary source of cooking and heating for 43 % of the world's population, affecting some three billion people.

[Asthma and obesity in three-year-old urban children: role of sex and home environment.](#)

Suglia SF, Chambers EC, Rosario A, Duarte CS.

J Pediatr. 2011 Jul;159(1):14-20.e1.

[Ventilation and dampness in dorms and their associations with allergy among college students in China: a case-control study.](#)

Sun Y, Zhang Y, Bao L, Fan Z, Sundell J.

Indoor Air. 2011 Aug;21(4):277-83.

[The significance of environmental exposure on the progression of allergic diseases.](#)

Wahn U.

Allergy. 2011 Jul;66 Suppl 95:7-9.

[Allergens in household dust and serological indicators of atopy and sensitization in Detroit children with history-based evidence of asthma.](#)

Williams AH, Smith JT, Hudgens EE, Rhoney S, Ozkaynak H, Hamilton RG, Gallagher JE.

J Asthma. 2011 Sep;48(7):674-84.

Indoor Air[Analysis of brominated flame retardants in house dust.](#)

Abb M, Stahl B, Lorenz W.
Chemosphere. 2011 Dec;85(11):1657-63.

[Lead speciation in indoor dust: a case study to assess old paint contribution in a Canadian urban house.](#)

Beauchemin S, MacLean LC, Rasmussen PE.
Environ Geochem Health. 2011 Aug;33(4):343-52.

[Organophosphate and phthalate esters in indoor air: a comparison between multi-storey buildings with high and low prevalence of sick building symptoms.](#)

Bergh C, Magnus Åberg K, Svartengren M, Emenius G, Östman C.
J Environ Monit. 2011 Jul;13(7):2001-9.

[Personal endotoxin exposure in a panel study of school children with asthma.](#)

Delfino RJ, Staimer N, Tjoa T.
Environ Health. 2011 Aug 2;10:69. *Free Article.*

[Analysis of chemical and physical effects of ultraviolet bulbs on cooking emissions.](#)

Farrell FM, Fitch TM, Bicking MK.
J Air Waste Manag Assoc. 2011 Oct;61(10):1005-14.

[Chlorinated paraffins in indoor air and dust: concentrations, congener patterns, and human exposure.](#)

Fridén UE, McLachlan MS, Berger U.
Environ Int. 2011 Oct;37(7):1169-74.

[Indoor coal use and early childhood growth.](#)

Ghosh R, Amirian E, Dostal M, Sram RJ, Hertz-Picciotto I.
Arch Pediatr Adolesc Med. 2011 Jun;165(6):492-7

[Determinants of agricultural pesticide concentrations in carpet dust.](#)

Gunier RB, Ward MH, Airola M, Bell EM, Colt J, Nishioka M, Buffler PA, Reynolds P, Rull RP, Hertz A, Metayer C, Nuckols JR.
Environ Health Perspect. 2011 Jul;119(7):970-6.

[Health effects of an efficient vented stove in the highlands of Guatemala.](#)

Harris SA, Weeks JB, Chen JP, Layde P.
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[Harmonised Regulation and Labelling of Product Emissions – A New Initiative by the European Commission.](#)

Harrison P, Crump D, Kephelopoulos S, Yu C, Däumling C, Rousselle C.
Indoor and Built Environment. 2011 Dec;20: 581-583. *Free Article.*

[Levels of household particulate matter and environmental tobacco smoke exposure in the first year of life for a cohort at risk for asthma in urban Syracuse, NY.](#)

Hunt A, Crawford JA, Rosenbaum PF, Abraham JL.
Environ Int. 2011 Oct;37(7):1196-205.

[Streptomyces in house dust: associations with housing characteristics and endotoxin.](#)

Johansson E, Vesper S, Levin L, LeMasters G, Grinshpun S, Reponen T.
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[Chemical and bioanalytical characterization of dioxins in indoor dust in Hong Kong.](#)

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[Adding fuel to the fire: increasing evidence for developmental toxicity of indoor solid fuel combustion.](#)

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Arch Pediatr Adolesc Med. 2011 Jun;165(6):565-6.

[Exposure to formaldehyde and its potential human health hazards.](#)

Kim KH, Jahan SA, Lee JT.

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[A review of diseases associated with household air pollution due to the use of biomass fuels.](#)

Kim KH, Jahan SA, Kabir E.

J Hazard Mater. 2011 Aug 30;192(2):425-31. *Review.*

[Polychlorinated biphenyls in vacuum dust and blood of residents in 20 Wisconsin households.](#)

Knobeloch L, Turyk M, Imm P, Anderson H.

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[Comparison of dust released from sanding conventional and nanoparticle-doped wall and wood coatings.](#)

Koponen IK, Jensen KA, Schneider T.

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[Comparisons of Indoor Air Quality and Thermal Comfort Quality between Certification Levels of LEED-Certified Buildings in USA.](#)

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[Occurrence of bisphenol A in indoor dust from two locations in the eastern United States and implications for human exposures.](#)

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[Incidence of polybrominated diphenyl ethers in central air conditioner filter dust from a new office building.](#)

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[Analytical solutions for exposures and toxic loads in well-mixed shelters in support of shelter-in-place assessments.](#)

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Qi M, Wang R, Ning C, Li X, Zhang L, Jian F, Sun Y, Xiao L.
Exp Parasitol. 2011 Aug;128(4):336-40.

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[Oral bioaccessibility of trace metals in household dust: a review.](#)

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[Dechlorane Plus in house dust from E-waste recycling and urban areas in South China: sources, degradation, and human exposure.](#)

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[Residential insecticide usage in northern California homes with young children.](#)

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Yun YK, Kim HK, Kim JR, Hwang K, Ahn YJ.
Pest Manag Sci. 2011 Nov 18. doi: 10.1002/ps.2327.

Mould and Dampness

[Fungal DNA, allergens, mycotoxins and associations with asthmatic symptoms among pupils in schools from Johor Bahru, Malaysia.](#)

Cai GH, Hashim JH, Hashim Z, Ali F, Bloom E, Larsson L, Lampa E, Norbäck D.
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[Fungal DNA and pet allergen levels in Swedish day care centers and associations with building characteristics.](#)

Cai GH, Mälärstig B, Kumlin A, Johansson I, Janson C, Norbäck D.
J Environ Monit. 2011 Jul;13(7):2018-24.

[Investigation of indoor molds and allergic diseases in public primary schools in Edirne city of Turkey.](#)

Celtik C, Okten S, Okutan O, Aydogdu H, Bostancioglu M, Ekuklu G, Asan A, Yazicioglu M.
Asian Pac J Allergy Immunol. 2011 Mar;29(1):42-9. *Free article.*

[Limitations of practitioner mold testing \(response to Holme et al. 20: 329-340\).](#)

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[A Survey of Fungal Contamination on Books in Public Libraries with Mechanical and Natural Ventilation.](#)

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[Indoor airborne fungi and wheeze in the first year of life among a cohort of infants at risk for asthma.](#)

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[Respiratory health in children, and indoor exposure to \(1,3\)-β-D-glucan, EPS mould components and endotoxin.](#)

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[Beyond dose assessment: using risk with full disclosure of uncertainty in public and scientific communication.](#)

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Health Phys. 2011 Nov;101(5):591-600.

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[Testing an empowerment intervention to help parents make homes smoke-free: a randomized controlled trial.](#)

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[Direct health costs of environmental tobacco smoke exposure and indirect health benefits due to smoking ban introduction.](#)

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Wind power has been harnessed as a source of power around the world. Debate is ongoing with respect to the relationship between reported health effects and wind turbines, specifically in terms of audible and inaudible noise. As a result, minimum setback distances have been established world-wide to reduce or avoid potential complaints from, or potential effects to, people living in proximity to wind turbines. The purpose of this paper is to review the peer-reviewed scientific literature, government agency reports, and the most prominent information found in the popular literature.

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Event Announcements

In this section we will inform you about upcoming events with relevance to housing and health. If you know of any international event, please let us know!

Haus und Energie

Housing and Energy
Date: January 26-29, 2012
Venue: Sindelfingen, Germany
Further Information: [Messe Sindelfingen](#)

17. Kongress Armut & Gesundheit

Congress on Poverty and Health
Date: March 9 -10, 2012
Venue: Berlin, Germany
Further Information: [gesundheitliche-chancengleichheit: Kongress Armut & Gesundheit](#)

Air Quality 2012

8th International Conference on Air Quality – Science and Application
Date: March 19-23, 2012
Venue: Athens, Greece
Further Information: [Air Quality 2012](#)

CEP® Clean Energy & Passivehouse 2012

International Trade Fair for Renewable Energy and Energy Efficient Buildings
Date: March 29-31, 2012
Venue: Stuttgart, Germany
Further Information: [CEP® CLEAN ENERGY & PASSIVEHOUSE](#)

2012 Healthy Housing Confernces

Indoor Environmental Health & Technologies Conference and the
Lead and Healthy Homes Grantees Conference
Date: May 1-4, 2012
Venue: New Orleans, USA
Further Information: [healthyhousingconfernces](#)

IFEH 12th World Congress on Environmental Health

“New Technologies, Healthy Human Being and Environment”

Date: May 22-27, 2012

Venue: Vilnius, Lithuania

Further Information: [WELCOME - 12th World Congress on Environmental Health](#)

ICSBE 2012

2nd International Conference on Sustainable Built Environment

Date: 23-25 May 2012

Venue: Yogyakarta, Indonesia

Further Information: [ICSBE 2012](#)

Rio+20 - Earth Summit 2012

United Nations Conference on Sustainable Development

Date: June 4-6, 2012

Venue: Rio de Janeiro, Brazil

Further Information: [Rio+20 - United Nations Conference on Sustainable Development Earth Summit 2012 - Earth Summit 2012](#)

Housing 2012

Conference & Exhibition

Date: 12-14 June 2012

Venue: Manchester, UK

Further Information: [Leading UK housing conference and exhibition - CIH 2011 home page](#)

Indoor Air Quality 2012

10th International Conference

Indoor Air Quality in Heritage and Historic Environments

Date: June 17-20, 2012

Venue: London, UK

Further Information: [IAQ 2012](#)

Nationale Radonkonferenz 

National Conference on Radon: Saxon State Ministry of the Environment and Agriculture

Date: June 25-26, 2012

Venue: Bad Schlema, Germany

Further Information: not yet available.

Healthy Buildings 2012

10th International Congress

Date: July 8 -12, 2012

Venue: Brisbane, Australia

Further Information: [Healthy Buildings 2012 — ISIAQ](#)

7th National Housing Conference - Brisbane 2012

Date: October 30, – November 2, 2012

Venue: Brisbane, Australia

Further Information: [Brisbane 2012 - National Housing Conference](#)

Intelligent Cities Expo 2012

Date: October 30 - November 1, 2012

Venue: San Francisco, USA

Further Information: [Intelligent Cities Expo 2012 | HOME](#)

BAU 2013 - World's Leading Trade Fair for Architecture, Materials, Systems

Date: January 14-19, 2013

Venue: Munich, Germany

Further Information: [BAU – World's Leading Trade Fair for Architecture, Materials, Systems](#)

Message Board

In this section we will inform you about activities and projects related to housing and health that are being carried out by WHO or the WHO CC. This may relate to ongoing activities and projects, as well as invitations to participate in data collections or case study projects.

WHO work on indoor and built environments

WHO Social Determinants of Health Sectoral Briefing Series: Housing Sector Brief (1) published

Public health is built on effective interventions in two broad domains: the biomedical domain that addresses diseases; and the social, economic and political domain that addresses the structural determinants of health.

Complex social, economic and political factors affect health equity and health policy-making. As emphasized by the WHO Commission on Social Determinants of Health, health inequities are often driven by policies in other sectors.

By providing information on other sectors' agendas and policy approaches, and their health impacts, and by illustrating areas for potential collaboration, the Series aims at encouraging a systematic dialogue and collaboration between health and other sectors in order to achieve mutual gains.

The target audience for the Series is public health officers, who very often are not experts on determinants of health (like housing) but must interact with a broad range of sectors.

The first briefing focuses on the housing sector. It summarizes knowledge from key informants from the health and housing sectors, as well as from the literature. The briefing highlights evidence of impacts and interventions with emphasis on health equity. It makes the case to health authorities for more proactive and systematic engagement with the housing sector to meet health and broader societal aspirations including equity and human development.

The Series (comprising so far briefings on the housing, transport, education and social protection sectors) will be launched in early 2012. The housing briefing can already be accessed at http://whqlibdoc.who.int/publications/2011/9789241502290_eng.pdf.

LARES project now reflected by more than 50 publications

The WHO-coordinated LARES project (Large Analysis and Review of European housing and health Status) was carried out in 2002 and 2003 in eight European cities to report on the associations between housing conditions and health. The database is available for interested researchers and has been used by a variety of academic and governmental institutions since 2004. LARES-based publications have been issued in a variety of health, housing and social journals. By the end of this year, LARES has provided a basis for around 30 publications in peer-reviewed journals, a monograph on the LARES findings with ten chapters presenting results for specific housing risks, and ten WHO reports related to housing and health.

LARES information can be found at <http://www.euro.who.int/en/what-we-do/health-topics/environment-and-health/Housing-and-health/activities/the-large-analysis-and-review-of-european-housing-and-health-status-lares-project> and the main results, together with the list of associated publications, is available at http://www.euro.who.int/_data/assets/pdf_file/0007/107476/lares_result.pdf

WHO involvement in European Commission-funded projects

The WHO programme on living environments and health is currently involved in work funded by the EC to

- develop guidelines for ventilation in buildings (HEALTHVENT); and
- assess the health impact of climate change mitigation in urban settings (URGENCE).

Both projects look at the health impact of housing and urban interventions and how changes carried out to save energy and reduce greenhouse gas emissions can be associated with health benefits for the population. Further information on these projects can be obtained at

<http://www.healthvent.byg.dtu.dk/> and at

http://cordis.europa.eu/fetch?CALLER=FP7_PROJ_FR&ACTION=D&DOC=9&CAT=PROJ&QUERY=012f4fb4adc5:7423:44025253&RCN=98726

WHO commentary on key challenges of housing and health

The recent issue of the International Journal of Public Health (Vol. 56, Issue 6) focuses on housing and health, presenting studies and findings from a variety of countries. The special issue also includes a commentary by WHO presenting “Key challenges of housing and health from WHO perspective” and calling for a more holistic approach to housing and health, leaving the focus on separated risk factors behind.

Further information and direct access to the commentary can be obtained at

<http://www.springerlink.com/content/r2871301806r/>

Imprint

Publisher

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The work of the WHO CC on housing and health is funded by *Bundesministerium für Gesundheit*, Germany.

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