

Housing and Health in Europe: Preliminary Results of a Pan-European Study

Xavier R. Bonnefoy, SanEng, Matthias Braubach, MA, Brigitte Moissonnier, SanEng, Kubanychbek Monolbaev, MD, and Nathalie Röbbel, MA

Environmental living conditions, including housing conditions, are among the primary determinants of an individual's health and have attracted the interest of public health scientists since ancient times.^{1–3} There is a substantial body of evidence on the health impacts of specific substances found in the housing environment,^{4–6} including asbestos, radon, lead, molds, and volatile organic chemicals (VOCs).^{7–12} Housing conditions such as air pollution levels and condensation may contribute to seasonal fluctuations in cardiovascular and respiratory mortality.^{13,14} The home is where accidents frequently occur. In the European Union, more than half of the 20 million home and leisure-related accidents that occur each year take place in or around the home.¹⁵

There is less documentation about the relationships among housing conditions, lifestyles, and health. Recent research has focused on specific individual risk factors and housing elements,⁴ whereas the link between housing and psychosocial and mental health issues has been relatively neglected.¹⁶

Few reports exist about the “global” housing conditions of the European population.¹⁷ In both the western and eastern parts of the European Region of the World Health Organization, social, political, and economic changes have affected housing environments and their impacts on health. For example, the quality of outdoor air and drinking water has improved in many big cities, but noise has worsened all over the continent.^{18–20}

In Western Europe, many countries are undergoing fast decentralization, and local authorities have been given more responsibility for housing as a result. Many countries have a large stock of 25- to 30-year-old housing from the postwar reconstruction era that is now showing signs of age. New lifestyles, including a heavy reliance on automobiles, are emerging, and a large proportion of the European population lives in cities lacking the infrastructure required by these lifestyles.

Objectives. The World Health Organization's Regional Office for Europe has undertaken a large study to evaluate housing and health in 7 European cities.

Methods. Survey tools were used to obtain information about housing and living conditions, health perception, and health status from a representative sample of the population in each city.

Results. In Forli, Italy, the first city studied, preliminary findings indicate some important potential links between housing and health.

Conclusions. These findings, when combined with those from the remaining European cities, will likely generate concrete recommendations for the allocation of resources to programs that can improve housing and health. (*Am J Public Health.* 2003;93:1559–1563)

The new political and economic situations that have emerged in Central and Eastern Europe since the fall of the Berlin Wall have created dramatically new housing situations. The percentage of homeowners has increased to more than 95% in some countries.²¹ An emerging affluent middle class and a large population living close to or below the poverty level have led to a new stratification of cities. An unprecedented energy crisis, a near-total absence of regulation for condominium management, and the absence of a tradition for maintaining private and commonly shared properties—which were previously maintained by a state organization—have led to (1) a new distribution of housing conditions (e.g., an increased number of bad houses and an emerging new stock of high-luxury houses), (2) an accelerated deterioration of the housing stock, and (3) dramatic changes in the urban landscape.^{22,23}

Aware of these trends, the World Health Organization's (WHO) Regional Office for Europe embarked on a study to review and, when needed, enlarge the body of evidence regarding the relationship between housing conditions and health. An informal working group was convened to discuss the health effects that could be influenced by housing conditions and to identify any confounding factors that could mask these effects during a study.²⁴ This group provided recommendations on which factors in a housing complex should be surveyed. The group also recommended how those factors should be measured to draw conclusions about

possible cause–effect relationships. A symposium took place in Bonn, Germany, to validate the study.²⁵

Our study started with a pilot project during the winter of 2000 in selected neighborhoods in Schwedt-Oder, Germany; Vilnius, Lithuania; and Bratislava, Slovakia, containing dwellings made of pre-fabricated blocks. The pilot project focused on a housing type that was deemed likely to provide the most inadequate housing conditions. It identified major gaps in the survey tools that were developed for analyzing both housing conditions and health conditions of the inhabitants. The project helped local authorities throughout Europe to identify the qualitative housing needs of their citizens. The results of the pilot project informed the development of the current study.

Study Objectives

The current project has several objectives. First, it seeks to establish clearer links between housing conditions and health. There is strong evidence of the link between health and such substances as radon, asbestos, and formaldehyde. But many other associations lack strong evidence, including the impact of indoor temperature and the quality of indoor air on respiratory and other systems, the influence of housing conditions on mental health, and the pathogenicity of chronic noise exposure in homes. This study will examine those issues.

Second, the results of this study will provide the Ministers of Health and Environment of the

WHO's Regional Office for Europe with a basis for a discussion of housing during the next Environment and Health Ministerial Conference, which is scheduled to be held in Budapest in June 2004. During the conference, the ministers will examine the issue of housing and health in the European region. The evidence from this study will allow the ministers to endorse strong resolutions for government housing policies that favor health and are environmentally sustainable.

Third, this study will provide local authorities with instruments they can adopt and use to better understand both their housing stocks and the influence that existing housing conditions have on the health of their citizens. The instruments also will help local authorities to identify housing priorities that can be satisfied through local policies and projects. These instruments must be accessible at a reasonable cost, and local experts or consultants must be able to use them readily.

Fourth, officials in the participating cities will be given a diagnosis of their housing stocks. They will learn about residents' perceptions about housing conditions, and they will receive a preliminary assessment of the possible impacts those conditions may have on residents' health. These diagnoses will help the officials adjust their housing policies to ensure that the policies are oriented toward achieving significant gains in improved health.

Finally, where possible, the dose-effect relationship between given housing conditions, or a mix of housing conditions, and health will be quantified. In other words, the groundwork will be laid for calculating a first estimate of the global burden of disease resulting from housing conditions.²⁶

METHODS

Terminology

Four factors were examined under the general term *housing conditions*—the house, the home, the immediate neighborhood, and the community—and these factors formed the working bases for identifying potential impacts on health.⁴ The *house* represents the actual physical shelter in which an individual lives and includes such variables as heating adequacy and maintenance of the structure. The *home* (or the household) consists of all individu-

als living under the same roof and includes such variables as family size, lifestyle of household residents, and socioeconomic status. The *immediate neighborhood* comprises commonly shared spaces—such as the elevators, staircases, waste chutes, and cellars—and the close vicinity of the house, including the green space around the building, parking spaces, and the pavement immediately outside the building.²⁷ The *community* means those individuals identified as neighbors by the residents.

Sampling Method

The sample in each city was randomly generated. A list of the target survey population was selected from the residents' registry in Germany, Lithuania, Italy, and Portugal; in all surveyed cities a list of the target population was selected from the residents' registry. In Angers, France, where these registers are inaccessible for legal reasons, we selected the sample from the cadastre (an official register of the quantity, value, and ownership of real estate used in apportioning taxes). A random-number generator assigned a number to each person on the list; these random numbers were then sorted in ascending order. The first 800 to 1300 persons (depending on the expected nonanswer rate) on the list who were living in different dwellings were selected for the survey.

Data Collection

We used 3 survey tools to assess housing conditions and their links to health status. First, a housing questionnaire was used to collect subjective data during a face-to-face interview with the occupant who received the surveyor. This questionnaire addressed the respondent's perception of his or her house, home, immediate neighborhood, and community, and it gathered general information about the building, the socioeconomic status of the household, the housing-related costs, and the lifestyles of the inhabitants. The respondent was used as a proxy for all other members of the household.

Second, trained surveyors used inspection sheets to record their observations about housing conditions and the immediate environment. No measurements were made of variables such as temperature, humidity, and noise during the survey. Because of the international nature of the project, the technical constraints—and the financial limitations—would have increased the

complexity beyond what the available resources allowed. Instead, we relied on visible consequences of these measurable factors (e.g., the presence of molds, draft-proofing devices, and supplemental heating devices), which were noted on the inspection sheets.

Third, each occupant of the dwelling was asked to complete a health questionnaire. We collected data about each resident's self-perceived health as well as descriptive information about his or her health status. Whenever possible, the health questionnaire was completed while the surveyor was in the dwelling; for occupants who were not present, questionnaires were left and collected later. In rare cases, a stamped, preaddressed envelope was provided.

The surveyors were either students in a field related to health or housing or students who had previously worked for the national census. They were recruited for the survey period, which lasted 10 to 25 days, depending on the sample size. All surveyors attended a 3-day training seminar that was taught by the same trainers in all cities. This training included a 1-day practical phase to reduce inter-rater variability.

Each evening, all completed questionnaires were examined; in the case of inaccurate or incomplete questionnaires, the surveyors were asked to make corrections the next morning. For quality assurance, the surveyors were checked randomly in the field, and 4 households per survey team were contacted by phone to verify the collected data. A software company was hired to develop a data entry program that would reduce language-related problems. Single data entry was used with a systematic validation of around 15% of the previous day's work; if a member of the data entry staff was found to have made more than 1 mistake, all of his or her work was double-checked. Finally, the ASCII file generated from the entered data was imported into SPSS (SPSS Inc, Chicago, Ill) for further analysis.

RESULTS FROM FORLI, ITALY

The results presented here are preliminary and represent a very small subset of the data that can be expected from this survey. Additional analyses are being conducted and will be conducted for these data and the data collected

in other survey cities. Many more results will be presented to local leaders in survey cities and in future literature.

Response Rates

Eight hundred households were contacted initially by mail and then by telephone or by a first visit by a team of 2 surveyors; 403 households agreed to participate. Of the residents living in dwellings in which at least 1 person agreed to complete the health questionnaire and the housing questionnaire was completed, 95.6% (n=1172) also completed health questionnaires. The best response rates were among people aged 45 to 60 years and among those with households of more than 3 members. People with higher socioeducational background and well-maintained houses also seemed more willing to participate.

According to the surveyors, residents had a variety of reasons for not participating. Among older residents (age not specified) who did not participate, fear that the surveyors had criminal intentions was the primary reason; younger residents (age not specified) reportedly did not want to spend time. Other reasons included fear that unauthorized construction would be discovered, belief that the house or the health of its occupants were perfect, the fact that the survey was not compulsory, and the lack of interest in any kind of survey. Additionally, some of the residents in the sample had moved or died.

Household Size

The average household size in our sample was 3.0 persons per dwelling, whereas the average household size in Forli was 2.4 persons. This overrepresentation of large families is the result of the sampling procedure. The results are based on a nonstandardized sample.

Housing Conditions

Adverse stairway conditions. On the basis of both residents' perception and surveyors' observations, the frequency of adverse stairway conditions, such as height differences, broken steps, and the absence of handrails, was high. Of the 403 dwellings in our sample, 157 had inside steps or stairs, 14.6% of which had no handrails and 3.8% of which had damaged or loose steps. Of the 315 accidents reported in sample households, 88 (27.9%) were related to falls, which primarily occurred among

younger residents, aged 0–19 years (n=41) and older (n=20) residents, aged 60 years and older.

Time away from home and physical activity among children and teens. Figure 1 shows the time children (aged 5–11 years) and teenagers (aged 12–18 years) spent away from their dwellings. More than three quarters spent 8 hours or less per day out of their homes; the time at home was spent sleeping, eating meals, doing homework, and watching television. This finding was confirmed by the responses to the questionnaire: 37.6% of the children reported participating in no sports at all or participating only occasionally, and only 21% exercised intensively on a regular basis.

Mold growth. Molds were present in 11.7% of the kitchens and 13.9% of the bedrooms. In 4.1% of the bedrooms, the contaminated area was larger than 42 cm by 30 cm.

Noise, air quality, and drafts. The data on perception of noise, indoor air quality, and drafts, and their possible influences on health, confirmed what was found in the pilot project.²⁸ Many residents reported drafty windows and an inability to maintain a comfortable temperature, and respiratory diseases were more common among those who reported drafts or inadequate heating. The prevalence of respiratory disease was higher among persons who perceived the air quality in their dwelling to be poor. Noise nuisances also were frequently reported and contributed to lower satisfaction with housing.

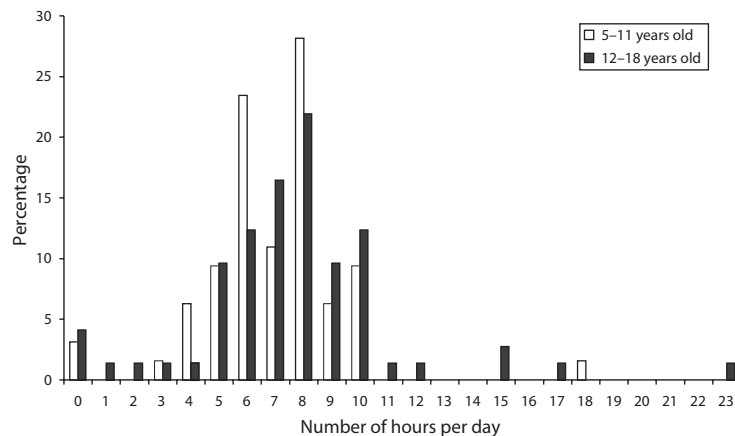


FIGURE 1—Amount of time children and teenagers spend outside of their dwellings during weekdays in Forli, Italy.

Mental health. The pilot project demonstrated that our survey tools were weak in evaluating some of the aspects of mental health. The current survey used instruments such as the Sleep, Anhedonia, Low Self Esteem, Appetite questionnaire,²⁹ which asks respondents whether they have experienced sleep disturbances, anhedonia (inability to experience pleasure), low self-esteem, or decreased appetite. The preliminary results, which indicated that 9.7% of the total adult population suffers from depression, confirmed figures previously estimated for Italy.³⁰ An epidemiological analysis is being performed on these data.

Physical activity, body mass index (BMI), and proximity to a park. Findings from the Forli survey indicate that, among adults, persons who live close to a park are more likely than persons living far from a park to engage in regular physical activities (Table 1). Conversely, persons living far from a park are more likely than persons living close to a park to report never exercising. Additionally, the results suggest that persons who live far from a park and who do not exercise regularly are likely to have higher BMIs (Table 2).

DISCUSSION

Preliminary data represent some new and potentially important indications of the links between housing and health. For example, the data show that many children and teenagers spend little time away from their homes

TABLE 1—Relationship Between Exercise and Proximity to a Park Among a Sample Adult Population: Forli, Italy

	Live Less Than 100 Meters From a Park	Live More Than 100 Meters From a Park
Regularly engage in moderate or intense exercise, %	32.7	26.4
Never exercise, %	21.8	24.7

and do not exercise regularly. Is this behavior the result of a lack of green spaces or a lack of sports fields and playgrounds? Is it the result of a lack of organized activities for these age groups? Or is there some other reason for this behavior? The city health authorities in Europe need to investigate this important problem.

Physical activities have an impact on obesity,³¹ and the early results support this hypothesis. Among adults, data indicate a link among regular exercise, BMI, and distance from parks. Perhaps when this study is completed, we will be able to demonstrate that lack of access to green space and public parks decreases residents' levels of physical activity and increases their BMIs.

The surveyors found mold in many homes. The most contaminated rooms were bedrooms, where the children—who are most sensitive to allergens—spent the most time. Ideally, information about mold should be analyzed in conjunction with several other considerations: presence or absence of airtight or double-glazed windows, socioeconomic status of the family, complaints about heating expenditures, and presence or absence of allergic diseases, especially asthma. Unfortunately, the sample from the survey was too small for such an analysis; however, this analysis may be possible when the surveys are completed in all of the cities.

The surveyors found problems with the stairways in the sample dwellings. Additionally, more than one quarter of the accidents that occurred in the sample homes were related to falls. Additional analysis is needed to determine whether those falls were linked to adverse stairway conditions. If such a link is found, an economic analysis may lead to a reconsideration of subsidies for housing rehabilitation; large gains in improved health from moderate housing improvements may well be expected from housing rehabilitation.

This survey has a number of limitations that must be considered when interpreting data. First, as in all studies of this nature, the representativeness of the sample is the most crucial issue. In Forli, 403 (50.2%) of the households chosen through random selection agreed to answer the housing questionnaires, and all but 4.4% of the residents living in these dwellings completed the health questionnaire as well. In Vilnius, Lithuania, 688 (62.5%) of the 1100 randomly selected households agreed to complete the housing questionnaire, and 1798 (83.1%) of the 2164 residents living in these dwellings also completed the health questionnaire. Participants' willingness to answer the questionnaires varies from city to city. Further analysis of the nonanswer distribution and its significance to the representativeness of the sample is needed.

During the next survey phase of the study, the surveyors will be asked to complete a questionnaire for each household to determine why some households did not agree to participate. Additionally, the surveyors have suggested that response rates might be improved if sample households received a letter informing them of the survey, signed by the WHO and the mayor of the city, before any other contact is made. The surveyors also suggested that response rates might be improved if the interviewers maintain a pleasant demeanor.

A second limitation of the survey related to the sampling procedure which allowed house-

holds to be selected with a probability directly proportional to their size. However, this aspect of the sample can be easily standardized, because the exact distribution of dwellings by number of occupants is known in each city.

Third, the target population within a city includes illegal immigrants, nonregistered persons, and persons who are not represented in our sample. This lack of representation is a shortcoming for targeting specific risk groups. Surely, the population excluded from our study experiences environmental conditions that are much worse than those experienced by the surveyed population. Special studies are being conducted—and more will need to be undertaken—to address these groups.³²

Fourth, this survey procedure did not allow for analysis by neighborhood, because those neighborhoods with a small population will be represented by a very small sample. No adjustments are planned to correct this limitation. Whenever possible, the total sample size was increased to allow neighborhood comparisons.

Fifth, difficulties with the translation and interpretation of the survey tools exist in any international study. We have tried to overcome these difficulties by conducting a systematic pilot project with the translated questionnaires. In each country, 20 households representing elderly, low- and high-education, migrant, urban, and rural populations were or will be selected. Also in each country, an expert in the native language helped answer questions from the surveyors during both the training and the surveying. We did not undertake a reciprocal translation to test the quality of the translation.

Finally, cities in Eastern Europe, the Caucasus, and central Asia are not well represented compared with Western Europe. This lack of representation is a matter of financial restrictions. Perhaps future surveys can address these regions.

When a preliminary analysis of the data from Forli was completed, it was provided to the city council and the local press during a press conference. The release of this information triggered substantial interest both in the media and among city leaders. It is anticipated that the presentation of data in other cities will be met with a similar response. The survey has been completed in 5 cities and is under way in 2 others; officials in a third city have been approached about participating in the survey.

TABLE 2—Relationship Between Body Mass Index (BMI) and Exercise Among a Sample Adult Population Living Near a Park: Forli, Italy

	BMI < 20	BMI = 20-25	BMI = 25-30	BMI > 30
Live close to a park, %	48.8	45.9	40.3	37.2
Regularly engage in moderate or intense exercise, %	32.8	33.7	23.9	16.0

The data have not yet been fully analyzed or transferred into a usable database.

CONCLUSIONS

The main conclusion of this preliminary phase is that this type of cross-sectional study satisfies the expectations of the city council and generates interest from the local press and the public. The preliminary phase of the study also reveals the important potential links between housing and health and will likely generate concrete recommendations about the following: mental health and housing; poverty, housing, and health; noise and health; allergies and housing; perceptions of housing conditions and associated perceptions of health; and immediate-environment conditions and health status.

We anticipate that the recommendations developed as a result of the survey data will guide policies related to housing and health not only in the survey cities but also in cities worldwide. For example, survey results will help local and national authorities identify areas in which housing rehabilitation programs will achieve the greatest gains in improved health. The survey results also will (1) help set priorities within these programs, (2) help policymakers develop new, and revise existing, legislation related to both new housing and rehabilitated housing, (3) demonstrate how the immediate environment can affect health, and (4) help community leaders better address housing conditions in their area to improve the health of the population. The results also may help community groups develop effective health education and accident prevention programs. Finally, if a dose–effect relationship, or at least a causal link, can be established between housing and health, the results of this study may establish the economic value of gains in improved health that can be achieved by improving housing conditions. ■

About the Authors

The authors are with the World Health Organization, Regional Office for Europe, European Center for Environment and Health, Bonn office.

Requests for reprints should be sent to Xavier R. Bonnefoy, World Health Organization, EURO ECEH Bonn Office, Görrestrasse, 15, 53113 Bonn, Germany, (e-mail: xbo@ecehbonn.euro.who.int).

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Contributors

X. R. Bonnefoy coordinated the work and is the main author of the text. M. Braubach designed the pilot study and contributed significantly to the design of the survey tools concerning housing and environmental conditions. B. Moissonier coordinated and performed most of the data analysis. K. Monolbaev developed the health and energy efficiency aspects of the questionnaire. N. Röbbel conducted the field work and prepared the first report to the city council of Forlì.

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Human Participant Protection

No protocol approval was needed for this study.

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