

The WHO Regional Office for Europe

The World Health Organization (WHO) is a specialized agency of the United Nations created in 1948 with the primary responsibility for international health matters and public health. The WHO Regional Office for Europe is one of six regional offices throughout the world, each with its own programme geared to the particular health conditions of the countries it serves.

Member States

Albania
Andorra
Armenia
Austria
Azerbaijan
Belarus
Belgium
Bosnia and Herzegovina
Bulgaria
Croatia
Cyprus
Czech Republic
Denmark
Estonia
Finland
France
Georgia
Germany
Greece
Hungary
Iceland
Ireland
Israel
Italy
Kazakhstan
Kyrgyzstan
Latvia
Lithuania
Luxembourg
Malta
Monaco
Montenegro
Netherlands
Norway
Poland
Portugal
Republic of Moldova
Romania
Russian Federation
San Marino
Serbia
Slovakia
Slovenia
Spain
Sweden
Switzerland
Tajikistan
The former Yugoslav Republic of Macedonia
Turkey
Turkmenistan
Ukraine
United Kingdom
Uzbekistan

ISBN
WHOLIS number
Original:

The Fourth Ministerial Conference on Environment and Health (Budapest 2004) calls for initiatives and programs that facilitate the integration of health and environmental concerns into housing policies. The development and implementation of Local Housing and Health Action Plans (LHHAP) is a response to that call. Derived from the methodology of the Large Analysis and Review of European Housing and Health Status project (LARES), the LHHAP is a low-cost, simple tool that allows a local level investigation of health related housing conditions.

Many adverse health conditions are linked to inadequate housing environments. Furthermore, there is a strong relationship between housing quality and perceived health: The better the dwelling, the better the health status. Because a house will see three to four generations living in it and humans spend a large part of their lives at home, health dimensions rightfully belong at the core of all housing policies. Using the LHHAP tool to identify health threats and opportunities in the existing housing environment, local authorities can develop and strengthen housing policies to address specific health needs.

The main strength of the LHHAP is that it provides valuable technical evidence important for solid policy development. By asking residents about specific dwelling and neighbourhood elements linked to health, the survey allows authorities to assess the prevailing housing and health conditions. Based on the evidence collected by the LHHAP project, the municipality can identify housing and health priorities and develop policies to mitigate risks. The objective of LHHAP therefore is to improve housing conditions as a preventative strategy for housing-related health effects and injuries and as a means to mitigate social and health inequalities within a population.

This LHHAP Manual is an instruction guide for every aspect of a LHHAP project and provides a summary of the housing-related impacts on health. From the initial planning stages through to the policy recommendations, the LHHAP project coordinator can find step-by-step instructions to successfully completing an LHHAP project on local scale.

World Health Organization Regional Office for Europe

Scherfigsvej 8, DK-2100 Copenhagen Ø, Denmark
Tel.: +45 39 17 17 17. Fax: +45 39 17 18 18. E-mail: postmaster@euro.who.int
Web site: www.euro.who.int



Local Housing and Health Action Plans

A project manual



UE - Fundos Estruturais



Local Housing and Health Action Plans



A project manual

**Supported by the convention between
Directorate-General of Health of Portugal
And World Health Organization, Regional Office for Europe**



UE - Fundos Estruturais

ABSTRACT

The Fourth Ministerial Conference on Environment and Health (Budapest 2004) calls for initiatives and programs that facilitate the integration of health and environmental concerns into housing policies. The development and implementation of Local Housing and Health Action Plans (LHHAP) as a low-cost, simple tool that allows a local level investigation of health related housing conditions is a response to that call.

Many adverse health conditions are linked to inadequate housing environments, and health dimensions rightfully belong at the core of all housing policies. Using the LHHAP tool to identify local housing and health priorities, local authorities can develop and strengthen housing policies to address specific health needs. The objective of LHHAP therefore is to improve housing conditions as a preventative strategy for housing-related health effects and injuries and as a means to mitigate social and health inequalities within a population.

This LHHAP Manual is an instruction guide for every aspect of a LHHAP project and provides a summary of the housing-related impacts on health. From the initial planning stages through to the policy recommendations, the LHHAP project coordinator can find step-by-step instructions to successfully completing an LHHAP project on local scale.

Keywords

HOUSING - standards
URBAN HEALTH
ENVIRONMENTAL EXPOSURE
HEALTH POLICY
HEALTH PLANNING
LOCAL GOVERNMENT
GUIDELINES

Address requests about publications of the WHO Regional Office for Europe to:

Publications
WHO Regional Office for Europe
Scherfigsvej 8
DK-2100 Copenhagen Ø, Denmark

Alternatively, complete an online request form for documentation, health information, or for permission to quote or translate, on the Regional Office web site (<http://www.euro.who.int/pubrequest>).

© World Health Organization 2007

All rights reserved. The Regional Office for Europe of the World Health Organization welcomes requests for permission to reproduce or translate its publications, in part or in full.

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by the World Health Organization in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters.

All reasonable precautions have been taken by the World Health Organization to verify the information contained in this publication. However, the published material is being distributed without warranty of any kind, either express or implied. The responsibility for the interpretation and use of the material lies with the reader. In no event shall the World Health Organization be liable for damages arising from its use. The views expressed by authors, editors, or expert groups do not necessarily represent the decisions or the stated policy of the World Health Organization.

Text editor: Frank Theakston.

LOCAL HOUSING AND HEALTH ACTION PLANS

A project manual

This manual guides you through a local-scale project on housing and health.

It provides information on the preparation of the project, data collection and analysis, and policy options for taking action.

Introduction and background

The Fourth Ministerial Conference on Environment and Health, held in Budapest in 2004, called for initiatives and programmes to facilitate the integration of health and environmental concerns into housing policies. The development and implementation of Local Housing and Health Action Plans (LHHAP) is a response to that call. Derived from the methodology of the Large Analysis and Review of European Housing and Health Status (LARES) project, LHHAP constitute a low-cost, simple tool that allows a local-level investigation of health-related housing conditions.

Many adverse health conditions are linked to inadequate housing. Furthermore, there is a strong relationship between housing quality and perceived health: the better the dwelling, the better the health status. Because a dwelling will house three or four generations and people spend a large part of their lives at home, health considerations rightfully belong at the core of all housing policies. Using the LHHAP tool to identify threats to and opportunities for health in the existing housing environment, local authorities can develop and strengthen housing policies to address specific health needs.

The main strength of the LHHAP is that it provides valuable technical evidence that is important for solid policy development. By asking residents about specific aspects of their dwelling and neighbourhood that are linked to health, the survey allows authorities to assess the prevailing housing and health conditions. Based on the evidence collected by the survey, the municipality can identify housing and health priorities and develop policies to mitigate risks. The goal of LHHAP is therefore to improve housing conditions as a preventive strategy for housing-related health effects and injuries, and as a means of mitigating social and health inequalities in the population.

This LHHAP Manual is a guide to every aspect of a LHHAP project and provides a summary of the housing-related impacts on health. From the initial planning stages through to the policy recommendations, the LHHAP project coordinator can find step-by-step instructions to successfully completing a LHHAP project.

Structure of the manual

	Page
Section 1. – Local Housing and Health Action Plans (LHHAP)	1
What are LHHAP?	1
What are the reasons for carrying out a LHHAP?.....	1
What resources are required?	1
What support is available?	2
Section 2. – Urban health and housing: a review of the evidence	3
Urban health.....	3
Housing conditions and their impact on health	7
Suggested reading	17
Section 3. – Project preparation (Step 1)	19
General background and coordination	19
Identifying project goals.....	19
Timeline development	20
Selection of neighbourhood(s)/survey area(s)	21
Selection of households (sampling)	21
Selection of survey team members.....	23
Media campaigns	24
Training and working group meetings	25
Expected participation and response rates	25
Confidentiality requirements	26
Preparing for the survey.....	27
Follow-up after the survey.....	28
Section 4. – Data collection (Step 2)	30
How to collect local housing and health data	30
How to arrange neighbourhood and home visits	33
How to collect municipal data	35
Working group meetings	35
Section 5. – Data analysis and interpretation (Step 3).....	37
Overview of tasks and expected outcomes	37
LHHAP data analysis	38
How to link data sources	39
Working group meetings	40
Drawing conclusions.....	40
Section 6. – Action and policy-making (Step 4)	42
Mechanisms and strategies for action.....	42
National campaigns/projects to link to.....	44
Appendix 1: Timelines for the LHHAP project	46
Appendix 2: Example schedules for data collection exercise	47
Appendix 3: Contact Sheet	49
Appendix 4: Data summary table for LHHAP.....	50
Appendix 5: Sample text for letter to selected households.....	51
Appendix 6: Sample text for press release.....	52
Appendix 7: Sample list of LHHAP topics for Press Conference	53
Appendix 8: Interviewer training document.....	54
Appendix 9: Interview introduction sheet	66
Appendix 10: SWOT protocol for neighbourhood visits	67
Appendix 11: Home visit worksheet	69
Appendix 12: Analysis I – frequencies.....	71
Appendix 13: Analysis II – cross-tabulations.....	78

Section 1. – Local Housing and Health Action Plans (LHHAP)

What are LHHAP?

A Local Housing and Health Action Plan is a tool that will support local authorities in identifying and addressing those features of the local housing conditions that are potentially harmful to the health of the residents. In summary, it will enable local authorities to prepare a small-scale project with limited resources that will identify:

1. the main challenges of the housing stock from a public health perspective;
2. neighbourhoods with specific needs or housing problems; and
3. potential priorities for political action.

The tool is divided into four components: project preparation, data collection, data analysis and interpretation, and recommendations for action and policy-making.

What are the reasons for carrying out a LHHAP?

The reasons for carrying out a LHHAP are to:

- ✓ identify local housing issues that could adversely influence health;
- ✓ prioritize and guide local action to protect and promote health through both housing improvements and education;
- ✓ inform and enrich local planning processes in the field of urban development and housing construction; and
- ✓ contribute to the commitment to support and develop action plans and policies on housing and health at local and national levels.

What resources are required?

The LHHAP is designed to be low-cost, so that even municipalities with limited resources will be able to carry out a LHHAP project. The methodology was created to be flexible and to accommodate the specific needs of a municipality, so that it can directly contribute to the local planning processes and data needs of a municipality.

Staff resources

The LHHAP will require the following staff:

- ✓ one coordinator, responsible for the preparation, logistics, supervision and follow-up of the project (3–4 weeks' full-time involvement);
- ✓ five staff members for data collection (one week full-time or two weeks part-time); and

- ✓ one staff member for data analysis (two weeks full-time or the equivalent as part-time work).

Material resources

The LHHAP will require the following equipment and facilities:

- ✓ a computer with Microsoft Excel for each staff member administering the survey (approximately five computers);
- ✓ a computer with Microsoft Excel for data analysis;
- ✓ a telephone line for each staff member administering the survey (approximately five phones/phone lines);
- ✓ transportation for field visits on one or two days;
- ✓ a meeting room for team meetings during the project, particularly during the data collection phase; and
- ✓ identity cards for the working group members for identifying themselves as municipal staff during field visits.

What support is available?

The LHHAP documents that can be downloaded from the website of the Directorate-General of Health of the Ministry of Health of Portugal (www.dgs.pt) provide a complete tool box for carrying out a LHHAP project. The LHHAP tool box consists of the software for the telephone survey and the data entry; a guidance paper on data analysis with some pre-set examples; several documents needed for the preparation and implementation of the survey; and this manual that provides an overall structured approach with all required information to the coordinator of a LHHAP project.

In addition, any LHHAP project may benefit from the following sources of support:

- ✓ Regional Health Administration: overall support in preparing and running LHHAP projects; support in data analysis and interpretation;
- ✓ Directorate-General of Health: download of survey documents and tools (www.dgs.pt); political support in the implementation of LHHAP projects; support in data analysis and interpretation; information on action and interventions addressing identified priorities; provision of LHHAP data from other municipalities for comparing individual cities (using LHHAP database); and
- ✓ World Health Organization, European Centre for Environment and Health, Bonn Office: support in data interpretation and identification of local priorities; provision of international case studies and examples of housing and health actions.

Section 2. – Urban health and housing: a review of the evidence

This section provides an overview of the health impacts of urban settings and housing conditions. It is intended as a summary of the current evidence and has been drawn from a number of WHO and other scientific publications. Nevertheless, this summary is far from exhaustive and covers only some of the most commonly considered housing and health challenges.

For ease of reading, no references have been included. For any questions on detail and content, please contact the WHO Housing and Health programme or turn to the list of publications provided under “Suggested reading” at the end of this section. Several of these are publicly accessible on the Internet.

Urban health

Historical view

Since the Middle Ages, towns and cities have been at the centre of Europe's social, cultural and economic development. In the 21st century, cities continue to generate the great majority of a country's wealth. However, the small streets and alleys of mediaeval cities have given way to traffic congestion and urban motorways. Catalysed by the Industrial Revolution, people migrated in droves from rural to urban areas, forcing cities to expand to accommodate the influx. The resulting urban development is a departure from traditional human settlements and is still not entirely understood in terms of its positive and negative impacts on health.

In some ways, cities have contributed to the improvement of health. Urban health concerns led to the Public Health Act of 1848 in England and Wales, which responded to the sickening sanitary conditions. This seminal document legislated, for the first time, to give local authorities the responsibility for dealing with threats to health and environmental quality. Through the Public Health Act, local government was granted the resources and a mandate to achieve certain environmental standards in terms of water quality, sewage and other sanitary conditions with the intention of safeguarding the health of the population.

In 1900, 80% of the world's population lived in rural areas. As of 2007, one in every two people lives in a city. On a global scale, the shift from rural to urban settlements is staggering and is expected to continue. In the European Union, four out of every five people live in an urban area. The characteristics of modern cities include excessive land consumption, increased use of private cars, lack of public spaces, low-density development on the urban fringe with high density in central areas, and the decline of historic city centres. Yet in many parts of Europe, mixed land use, high density and population diversity have been the long-standing standard, and deviation from that standard is the result of various policies. As we examine the environmental issues symptomatic of contemporary urban living and their influence on people's health, it is also important to question the political and economic decisions that are the root of the matter.

In the modern context, environmental threats and related health problems attributed to the urban environment are less obvious and therefore generate less concern. The leading causes of death in developed countries have shifted from

infectious diseases to chronic conditions. Instead of poor environmental health conditions causing cholera and tuberculosis, they contribute to obesity, respiratory conditions, diabetes, cancer, cardiovascular disease, stroke, hearing loss, stress, aggressive behaviour, sleep loss and mental health problems. Because of the complexity of factors and outcomes, the connection between the environment and human health is not always clear. While geography, economic development, language, culture and other demographic factors make each European city unique, many commonalities exist. Characteristics of a healthy environment that promotes and protects human health are universal and can be applied everywhere.

It is important to note that most land use, development and city/regional planning decisions are based on economic or programmatic objectives and seldom on health objectives. Health has effectively taken a back seat to economics in many of the public, private and individual decisions that have influenced the development of cities. The urban environment is a complex mix of interrelated systems that include land use and construction, transportation infrastructure, energy and social affairs. Any action to address health issues from the urban environment must take a multisectoral, integrated approach.

The urban environment can be presented in many valid ways. In its 1990 "Green paper on the urban environment" the European Commission outlined the urban environment under three themes: urban pollution, the built environment, and nature in the city. This paper uses these themes as the basis for launching a discussion of the relationship between urban planning and human health.

Urban pollution

Air, water and noise pollution all have adverse effects on health. As centres for population and economic activity, cities generate a disproportionate amount of the world's pollution. The associated health effects include respiratory diseases, cardiovascular disease, cancer, and skin and eye irritation.

Lowering particulate air pollution reduces the number of respiratory and cardiovascular deaths. For example, after the 1990 ban on coal sales and coal burning in Dublin, black smoke concentrations fell by 70%. Just one year after the ban, deaths from respiratory causes had decreased 15.5% and deaths from cardiovascular causes by 10.3%. For each year after the ban, it is estimated that 116 fewer respiratory deaths and 243 fewer cardiovascular deaths occurred.

City-wide mains water supply and sewerage systems have improved urban sanitation and increased life expectancy. But ageing systems are not equipped to manage the volume and variety of waste generated by population expansion and industrial development in urban areas. Impermeable paved surfaces quickly carry rainfall runoff that is a cocktail of urban pollutants. Rivers and groundwater are increasingly receptacles for runoff that is harmful to water quality. Water quality is usually considered a problem of developing nations, but the summer rains of 2007 in England demonstrated that water quality is also a concern for industrialized nations. The summer floods of 2007 inundated a water treatment plant and cut the water supply to some 350 000 residents of Cheltenham, Gloucester and Tewkesbury in western England. Even after water services were restored, residents were advised not to drink the water without first boiling it because of risks to health such as noroviruses. While the rains in England were

unprecedented, impermeable surfaces, vulnerable infrastructure and urbanization contributed to the devastation.

Noise, or unwanted sound, is perhaps the most easily identified type of urban pollution. The main sources of noise include: road, rail and air traffic; industrial plants; construction and public work; the immediate neighbourhood; ventilation systems; office machines; home appliances; and neighbours. In addition to affecting the cardiovascular system, excessive noise is known to affect sleep, mental health, concentration and stress levels, to increase the incidence of aggressive behaviour, and even to reduce people's willingness to help each other. These health effects can lead to social handicap, reduced productivity, lower learning performance, workplace and school absenteeism, increased drug use, and accidents.

The built environment

The built environment differs from the natural environment in that it involves buildings and spaces that are created or modified by humans. It includes homes, schools, workplaces, parking spaces, post offices, streets, parks, stadiums, places of worship and all other man-made constructions. Many of the historical centres of European cities have street patterns and architectural styles that are linked to the city's heritage and provide a unique sense of place. In recent decades, however, urban sprawl has been the result of building outside the centre in the urban outskirts.

The contemporary built environment reflects an urban planning system based on compartmentalization. This means that housing, business centres, commercial areas, green spaces, etc. tend to be separated according to function, with new developments often sited on the periphery of the city where land is more available and affordable. The separate zones, linked by extensive roads and other transportation networks, are not always accessible or friendly to pedestrians and bicycles. A built environment that eliminates transportation options and creates dormitory suburbs constitutes the highly problematic, quintessential urban sprawl. The resulting public health issues are complex and related to pollution and emissions, physical activity, availability of services and commodities, and social capital.

Whereas, in the not-so-distant past, the built environment promoted pedestrian traffic and physical activity, compartmentalization and the construction of urban roadways lead to the private car becoming the transport of choice. Emissions from cars contribute to asthma and other respiratory conditions, leading to emergency department visits, hospitalization, and absenteeism from school and work. Urban areas generate almost 70% of total fuel emissions, and are the most affected by traffic noise. Improvements in the built environment have the potential to reduce air pollution by promoting walking and cycling as a viable, if not the ideal, means of transportation. The added benefit of brisk walking and gentle cycling is the exercise, which not only helps to manage obesity, osteoporosis, diabetes and some forms of cancer but also reduces the risk of coronary heart disease and other illnesses. Furthermore, walking and cycling are habits that can be maintained throughout life and even retard impairments associated with aging. An urban environment policy that supports multiple-use land development, as well as various transportation options, is one step towards creating healthier cities and healthier citizens.

Urban sprawl has also pushed the built environment into high-risk areas such as floodplains. Building on floodplains is risky because sometimes unpredictable and violent weather phenomena can cause disaster to even the best infrastructures in such areas, as demonstrated by Hurricane Katrina in 2005 and the English floods of 2007. To minimize future risks, new constructions on floodplains should simply be avoided.

Nature in the city

Natural settings and green spaces are important elements of the urban environment and essential to the quality of life of urban residents. In addition to mitigating pollution and making the urban landscape more attractive, natural features and green spaces have considerable influence on the physical, mental and perceived health of residents. Simply being able to see nature improves health. Merely having a view of a natural area through the window can facilitate healing, reduce stress and support emotional well-being. By reincorporating nature into the built environment, mundane tasks such as commuting or time spent at the office, home or hospital have the potential to improve health.

Beyond the visual, a person can also physically engage with nature. Public parks, gardens, tree-lined avenues, semi-natural forests, nature sanctuaries, green belts, etc., grant urban residents the opportunity for recreation and exercise outdoors. Outdoor physical activity is egalitarian: it does not require gym membership, club fees, special equipment or uniform. Every age group can participate. Activities such as walking, cycling, gardening, cross-country running, horse-riding, camping and hiking become viable lifestyle choices for urban residents when green spaces and other natural settings are incorporated into the environment. Physical activity enhances mental health and reduces health risks such as obesity, heart disease, diabetes, hypertension and colon cancer, which are associated with sedentary and indoor lifestyles. Moreover, exercise in a natural environment has been shown to have a greater effect on blood pressure, self-esteem and mental health than exercise alone.

Green spaces and natural settings also build social capital, which contributes to health and well-being. Reading in the garden, meeting friends in the park, or sitting on a bench on a tree-lined avenue encourages friendship and creates occasions for neighbours to interact and build relationships. Green spaces and natural settings are much more than places to exercise. They are also spaces that can promote health by enhancing social connections and fostering a sense of community. The more green space in a person's environment, the better is the self-perceived health. In fact, the relationship between health and green space is stronger for those most vulnerable in society – people of lower socioeconomic status, young people and the elderly. This may be due to increased physical activity, more social capital or just basic exposure to nature, but certainly, green spaces and natural settings are crucial to health.

Housing conditions and their impact on health

The fact that housing affects the health of individual occupants was accepted long ago. Florence Nightingale recognized that "The connection between health and the dwellings of the population is one of the most important that exists" and Winston Churchill said, "We shape our houses, and in turn they shape us". In 1974, WHO stated, "It has been shown that people who live in bad housing and poor environmental conditions experience higher mortality rates and are generally less healthy than those who live in districts where the housing is good".

Damp and mould

Next to climate, the number and behaviour of residents in a dwelling as well as the temperature and ventilation have an impact on the amount of water vapour in the indoor air. In addition, inadequate dwellings and especially structural faults may lead to an accumulation of damp inside the home. This can facilitate the release of chemicals from building products and increase the problem of house dust mites, which are a known source of allergy. Nevertheless, the relevance of damp for health is mostly related to the fact that it very often leads to mould growth. Mould is recognized as one of the major allergens in the home environment, and can lead to mild or severe allergic reactions, mainly related to respiratory health (including infections and bronchial obstruction) and reactions by the immune system. Specifically, moulds have been identified as a factor in the origin and exacerbation of asthma attacks. In addition to allergic and respiratory problems, strong associations have been found with headache, fatigue, anxiety and depression.

The health risk of mould is especially relevant for children, who spend more time indoors and have a vulnerable immune system. Exposure to damp and mould significantly increases the risk of asthma and other respiratory effects in children; some 13% of childhood asthma may be attributable to dampness in the home.

In the European Union, exposure to damp and mould in the home varies greatly among countries, ranging from over 30% in Portugal) to under 5% in Finland, with an average of 16% (EUROSTAT, 2001 data).

Indoor air quality

Since Europeans spend most of their time indoors, indoor air quality is a major determinant of health. A person's exposure to different pollutants in the indoor environment is determined by the amount of time spent indoors and the pollutant concentration. Owing to the many sources of indoor air pollutants and their accumulation where ventilation is inadequate, indoor pollutant levels can significantly exceed those encountered outdoors.

Carbon monoxide

Carbon monoxide (CO) is produced by combustion processes, be it tobacco smoking, gas heating, or coal or wood fires. Health effects caused by exposure to CO mostly occur in relation to combustion for cooking and heating. The main sources of CO exposure are gas combustion (the predominant source in industrialized countries) and wood fires.

Exposure to low levels of CO does not have toxic effects, but can affect task performance and produce headaches and nausea. Nevertheless, without adequate air exchange, CO concentrations can quickly rise and reach toxic or even lethal concentrations. Increasing exposure will lead to more severe health effects such as dimness of vision or an increased heart rate. Ultimately, CO poisoning may lead to convulsions, a slow pulse and low blood pressure, the most severe consequences being coma, respiratory failure and death. Such health effects require CO levels that are generally only possible in closed environments but can easily occur in the case of faulty domestic appliances or their improper use.

Radon

Radon is formed by the natural radioactive decay of uranium in rock and soil and in some construction materials. Once produced, radon moves through the ground to the air above and may enter the indoor air. It has been estimated that exposure to indoor radon and radon decay products is, on average, the most important source of human exposure to ionizing radiation. However, as radon exposure is related to specific geological conditions in the ground, in many countries it does not represent a problem. For those countries in which significant radon exposure is possible, the easiest solution is to avoid the construction of buildings in radon-prone areas and/or to provide impervious foundations and good ventilation to prevent radon entering the building.

Radon is classified by the International Agency for Research on Cancer (IARC) as a Group 1 carcinogen, and exposure to high levels of radon gas may cause lung cancer. Overall, it is estimated that for some countries, up to 10% of all lung cancer cases may be attributable to radon exposure. The risk to health is higher in smoker's households, as a combination of radon and smoking produces a synergistic risk of lung cancer.

Environmental tobacco smoke

Smoking indoors leads to exposure to environmental tobacco smoke (ETS), which is made up of different chemicals (gases and particles). ETS can be split up into mainstream smoke (inhaled by the smoker, then exhaled) and sidestream smoke, which is directly emitted into the surrounding air. Around 40 of the approximately 4000 individual ETS compounds identified are carcinogenic, while others can be toxic. Nevertheless, ETS is usually dealt with as a single complex mixture rather than in terms of its single compounds.

ETS can be harmful to human health, particularly for children. Effects include eye, nose and throat irritation, asthma, sudden infant death syndrome, ear infections, bronchitis, pneumonia and other chronic respiratory diseases. It may also affect the cardiovascular system. It has also been found that ETS has an adverse effect on the developing fetus and may affect birth weight. In addition, it has been established that even passive exposure to tobacco smoke can cause lung cancer.

Exposure to ETS within the home varies greatly among countries, but a conservative estimate is that that in most countries some 10–25% of people are

affected. Data from the Global Youth Tobacco Survey suggest that 58% of children in the WHO European Region are exposed to ETS.

Domestic combustion of solid fuels

In many countries of the WHO European Region, solid fuels – mainly coal and wood – are used for daily cooking and seasonal heating. Although this problem is more usually associated with developing countries, the combustion of solid fuel is relevant to health even in the WHO European Region and the European Union. In areas where wood or other biomass fuels are available, they are commonly used as the main or additional sources of heating. In eastern European countries, poor quality coal is used in domestic heating, with effects on overall air quality and leading to high population exposures. For all combustion processes, however, the key factor is to what extent harmful emissions are being produced, and to what extent they are led out of the dwelling through adequate venting.

Emissions from the incomplete combustion of solid fuels contain a mixture of harmful pollutants, such as fine particles and CO, and carcinogens such as polyaromatic hydrocarbons, which have been found to affect respiratory illness. A link with pneumonia among children under five years of age, and with chronic obstructive pulmonary disease and lung cancer (in relation to coal use) among adults has been firmly established. Other potential health effects include an increased susceptibility to asthma, tuberculosis and changes in lung function. In addition, combustion processes often provide a specific risk of burns and scalds.

For all appliances using solid fuels, it is important to only use (and regularly maintain) vented appliances so that smoke is removed from the dwelling. Next to solid fuels, this cautionary principle also applies to gas combustion.

Volatile organic compounds

Volatile organic compounds (VOC) are organic chemicals that evaporate into the air at room temperature (e.g. benzene, toluene, formaldehyde). The majority of health-relevant VOC stem from materials inside the building (furniture, paints, carpets, etc.), from human activities (smoking and use of deodorants and detergents) and from outdoor air and attached garages. Owing to the many possible sources of contamination, there is almost no indoor environment that is free of exposure to VOC, and the concentration of VOC measured in indoor air is often significantly higher than that outdoors. In particular, new or refurbished buildings may carry a high VOC burden, as the off-gassing of VOC from materials into indoor air is very high in the first years.

Owing to the complexity of VOC mixtures, it is difficult to isolate the observed effects on health and ascribe them to specific compounds. A whole range of VOC is present in indoor air and can – as a mixture – have a severe impact on human health. Some VOC are known to cause harmful effects on health, such as eye and nose irritation, headache and fatigue, reduced lung function, asthma, and respiratory symptoms. Several of them are known carcinogens (e.g. benzene, formaldehyde) and can cause leukaemia, for example.

Particulate matter

Particulate matter (PM) is made up of solid or liquid compounds produced by combustion or mechanical or chemical processes. Cooking, smoking and vacuum

cleaning, and especially combustion of solid fuels, have been identified as some of the main indoor sources of PM, in addition to the infiltration of particles from outdoors. Small particulates can remain suspended in the air for long periods.

Different groups of particulates can be distinguished according to their size; with decreasing size, particles can penetrate deeper into the lung. Particles above 10 µm in diameter are held in the upper respiratory system (nose and throat), whereas those below 10 µm (PM₁₀) are able to access the bronchioles. Particles below 2.5 µm in diameter (PM_{2.5}) are able to penetrate the alveoli. These particles have recently been recognized as the main concern for health.

The potential health effects of PM range from inflammation, airways congestion, bronchitis, bronchospasm and emphysema to cancer. Long-term exposure effects such as bronchitis and reduced lung function can occur even at very low annual average exposure levels. For PM, the largest burden of disease at the population level is related to an increase in cardiovascular disease and mortality. PM exposures have been estimated to shorten life expectancy in the European Union by 9 months on average and 15 months in the most polluted areas (these estimates are based on ambient exposures and do not account for the effects of indoor exposures).

Noise

Dwellings and the residential setting are commonly seen as a "victim" of noise exposure and especially of traffic noise. A large part of the population is exposed to traffic noise levels of 55 dBA or more, and in most countries 10% or more suffer from exposure to noise levels of 65 dBA and above. However, dwellings are also a source of noise from, for example, vacuum cleaning, pets, music, television and, social activities; in some countries these can lead to more than 20% of the population reporting neighbourhood noise.

As noise levels in dwellings rarely exceed 80 dBA, the risk of physical damage to the hearing is rather low. Thus, the main issue of community noise lies in periodic or permanent exposure to low or mid-range noise levels; these create annoyance and mental effects, but can also trigger effects on the cardiovascular system. Cardiovascular effects are seen as the most relevant stress-related health effects triggered by noise exposure; empirical research has revealed changes in heartbeat frequency, increased blood pressure and an increased risk of heart attack with higher noise levels. Studies have also identified a higher prevalence of hypertension in adults living close to airports, and mental and cognitive effects in schoolchildren living close to airports or busy streets. Impairment of mental health, triggered by severe noise annoyance and by emotional responses to noise, can result in aggression and anxiety. Empirical studies found links between, for example, exposure to noise and aggression, unfriendliness and depression.

Night-time noise is thought to be a particular problem, as it can affect sleep with subsequent effects on health. Such sleep disturbance can lead to insufficient physical recovery and reduced physiological and mental function. Sleep

disturbance can manifest as inability to fall asleep, changes in the normal sleeping pattern or depth of sleep, or sudden awakening from sleep.

The European Commission has estimated that 80 million people in the European Union live with unacceptable levels of noise, while for another 170 million noise conditions are defined as critical.

Lead

Lead has been widely used in the production of consumer goods such as paints and pipes and as a fuel additive. It is now ubiquitous in the environment. Within the home, it is especially lead-based paints (used until the 1970s) and lead-containing water pipes that are today's major sources of contamination. There are few European data on domestic exposure to lead or on detailed sources of increased blood lead levels, but available data shows that in exposed homes, the blood lead level of residents is strongly correlated with settled contaminated house dust and deteriorated lead paint.

Lead does not exist naturally in the human body; when imported from artificial sources it is stored especially in the bones, but also in the blood, liver and kidneys where it has toxic effects. Nevertheless, long-term exposure to lead mainly affects the nervous system. Young children can suffer a decline in intellectual performance: with increasing blood lead concentrations, the IQ decreases and neurological, cognitive and developmental deficiencies increase. With increased exposure levels, lead can cause adverse health effects such as anaemia. Early symptoms of lead poisoning are, for example, apathy, reduced mental capacity, loss of appetite, high blood pressure and abdominal pain. Severe cases of lead poisoning may produce psychological and behavioural changes, permanent brain damage, seizures and death. In addition, inorganic lead has been classified by the IARC as a probable human carcinogen.

The group most sensitive to lead poisoning are children; their low body weight and developing nervous systems make them vulnerable even to low doses. Also, lead contained in paint or dust can be easily ingested by small children crawling on the floor of exposed homes. Therefore, in homes with lead exposure, mitigation is often possible only by removing or covering building components coated with lead-based paint.

Sanitation and water supply

Access to water has been recognized as a fundamental human right. A supply of clean water and the provision of sanitation are key elements for a dwelling and are basic requirements for both personal and food hygiene. Therefore, many public health experts believe that water supply and sanitation have had more impact on health than medical science. Nevertheless, even highly developed countries know the challenge of contaminated drinking-water and outbreaks of water-related disease triggered by biological contamination and bacteria. Contamination by chemicals remains a concern as well: toxic metals such as arsenic continue to pose a problem in many countries in the WHO European Region, while older water pipes may release lead and modern fittings may

release metals such as nickel. The effects on human health of long-term exposure to low concentrations of chemicals are as yet unclear.

Poor drinking-water primarily affects children, but may also be dangerous for people with weakened immune systems, including the elderly. A very common health effect of drinking contaminated water is diarrhoea, which leads to more than 13 000 deaths per year among children in the WHO European Region. However, a large number of other waterborne diseases, such as legionellosis and campylobacteriosis, often remain unrecognized by health systems and therefore tend to be largely underestimated.

A supply of clean drinking-water is not in itself sufficient, as it needs to be accompanied by basic sanitary conditions. Adequate sanitation and hygiene can help to avoid severe pathogens that cause infectious and foodborne diseases, and that can lead to sometimes severe or life-threatening conditions and food poisoning.

In many European countries, over 90% of dwellings are connected to the public water supply. Nevertheless, some countries fall short of this and may provide mains water to only 80% or less of the population (EUROSTAT, 2002 data). In addition, connection to a water supply is mostly a problem in rural areas, where the percentage of connected households can be much lower than in urban areas and may – according to data from the Joint Monitoring Programme of WHO and UNICEF – be only 60–70%. For sanitation, the situation is even worse: adequate systems are not necessarily the norm (even in urban areas) and may be inadequate for more than half of rural dwellings.

Pests

Once pests have entered one dwelling they may infest the whole building and can become a small-scale epidemic if no countermeasures are taken. Apart from the impact on hygiene in general, many such pests are human parasites.

The relatively warm and humid indoor conditions often provide a perfect habitat for many domestic pests such as mites, cockroaches, ants, bugs, lice and fleas. The design and quality of the building will also have an influence on the occurrence of rats and mice.

While the consequences for health of infestation with pests such as ants and cockroaches ranges from typhoid fever diarrhoea, leprosy and dysentery to food poisoning, others such as lice and fleas bite and can cause allergic reactions, inflammations or infections. The greater threat lies in their ability to infect humans with parasitic or viral diseases such as malaria and dengue fever.

The best strategy for avoiding pest infestation in homes is adequate hygiene and building maintenance.

Thermal comfort

Temperature (and humidity) inside dwellings are measurable aspects of housing and health, and are directly related to the structure and quality of the building and its amenities (insulation, weatherproofing, heating and ventilation). Humidity plays a significant role in the perception of heat, as most people can better endure lower or higher temperatures in dry than in humid air. This means that the perception of thermal comfort can require different temperature levels, depending on the humidity.

Thermal conditions may cause considerable health effects when they fall below or exceed the comfort range (18–24 °C).

Effects of cold

Exposure to temperatures under 18 °C will first of all lead to physical discomfort and an increased sensitivity to air movement, which increases the perception of cold. Under 16 °C there is an increased risk of respiratory infections such as influenza, pneumonia and bronchitis, which can be triggered directly by the inhalation of cold air or indirectly by a reduction in the capacity of the immune system. The impact of temperature on health is enhanced by the level of humidity: a relative humidity under 30% will increase the risk of respiratory infections, while a relative humidity of more than 65% may increase the risk of allergic reactions and respiratory diseases. Severe health effects may occur at temperatures below 12 °C, which is the threshold temperature below which fatal cardiovascular disorders such as stroke and infarction can occur.

Specific risk groups are children and the elderly, as both have a limited capacity for thermoregulation and can cool down very quickly. Both risk groups are particularly at risk during winter nights when the rooms cannot be heated.

As old and poor-quality housing is difficult and expensive to heat, problems with indoor temperature are typical for old buildings and those inhabited by the poor. Studies have shown that heating costs are relatively much higher in eastern than in western Europe but, in all countries, a variable proportion of poor and disadvantaged people (in some countries as high as 40% and more) are not able to heat their homes adequately.

Effects of heat

With climate change becoming a reality, Europe has seen an increasing number of heatwaves in recent years. There are few research data on this relatively new but serious health challenge for urban and built environments, but those that do exist indicate that heatwaves are associated with a clear, short-term increase in mortality. The European heatwave in 2003 resulted in an unprecedented death toll of over 30 000. In addition, such extreme weather conditions increase the risk of other harmful exposures, such as to outdoor air pollutants (ozone, fine particles, etc.) and trigger a number of respiratory and cardiovascular episodes.

There is clear evidence that the quality of buildings is a key factor for indoor temperatures. Housing characteristics such as location immediately under the roof, single-glazed windows, inadequate insulation and a large window area are

associated with high indoor temperatures. The urban environment also plays a role, as densely built areas heat up more easily than those that are less dense. However, this can be influenced by, for example, the amount of green space in urban settings or the orientation and construction characteristics of the buildings.

The elderly have been identified as those most at risk from heat. In France, around 60% of the heatwave deaths in 2003 occurred in those aged 75 years and over, with mortality in this age group increasing by 70% over this period. Increased mortality during the 2003 heatwave (both in general terms and among the elderly) also occurred in, inter alia, Portugal and the United Kingdom. Evidence shows that densely built areas and large cities tend to be more strongly affected than rural areas.

Home safety

Unintentional home injuries are a serious public health problem. Around 20 million home and leisure injuries requiring medical attention occur each year in the European Union. Some 2 million of these lead to hospital admission and around 83 000 result in death. Over half of these accidents occur in or around the home. Data from the United Kingdom show that more people die from accidents the home (4006 cases in 2000) than on the roads (3598 cases). In a Dutch study, it was found that the number of home accidents was much higher than traffic or sport accidents. In 2000 in Italy, 4.38 million home accidents led to 6000 casualties and 7.3 million working days lost.

Two factors are relevant to home accidents – human behaviour and dwelling design/maintenance. Behaviour can contribute, to a greater or lesser extent, to a home accident or it can be the sole cause. Also, occupiers can create hazards by leaving obstacles on stairs, having loose carpets, and leaving medicines and cleaning products easily accessible to young children. Poor design, such as inadequate design of staircases and doors, low window sills, slippery floor materials and sharp furniture edges, can also increase the risk of an accident.

Small children and the elderly are the most vulnerable population groups. The main types of accident in private homes are falls, which account for nearly half of all accidents and are mainly due to steps or unfixed carpets. Other possible causes are mechanical contact and collisions (around a quarter of all accidents) and cuts from materials such as glass. It has been found that most home accidents happen during everyday activities such as cooking, washing and playing, while only a small proportion can actually be traced back to activities with obvious risk such as window cleaning.

Accidents can have a whole range of consequences, from short-term pain or discomfort to injuries such as open wounds and broken bones, hospital admission, permanent handicap and death. Accidental injuries rank fifth among the leading causes of death, and data from the WHO European Region consistently show that accidents account for the largest number of deaths among young people.

Crowding and density

An overcrowded household is one in which the number of people living in a dwelling exceeds the dwelling's capacity to provide adequate shelter and services. There is, however, no agreed international definition or standard for "overcrowding".

A high density situation depends on two quantitative factors: the number of available rooms (or living area in square metres) and the number of people living in the dwelling. Overcrowding, however, is a more qualitative concept, as the perception of a specific level of density can vary from person to person and depends on the particular context. Also, it contains a cultural aspect, as some societies tend to have more individual or some more collective lifestyles. Thus a certain density may be considered "crowded" in one family or country but not in another.

The potential consequences of insufficient living space on the health of residents must be divided into (a) the physical effects of high population density and (b) the psychological effects of overcrowding. For physical effects, the objective population density is decisive. High densities increase the risk of morbidity from communicable diseases owing to the proximity of people living together. The shared use of hygiene and cooking facilities also increases the risk of exposure to pathogens. Specific concern has recently been put on the issue of tuberculosis and its dissemination in poorer population groups, which tend to live in tight housing conditions. On the mental health level, overcrowding and the resulting living conditions (e.g. lack of space, privacy and control; confusion; disturbances; noise) may cause stress and depression. Furthermore, they can lead to social problems such as low levels of tolerance, aggression and interpersonal conflicts, and thus limit social relationships. Multi-occupant dwellings and flats, particularly high-rise flats, are the housing risk factors most strongly associated with poor mental health.

Within the European Union, densities that may lead to overcrowding have been identified for between 10% of the population (Netherlands) to over 25% (Greece and Portugal).

Accessibility

Accessibility represents the idea of the complete use of a dwelling and its immediate environment. It is based on accessible/barrier-free design and usable equipment and design features. Apart from residents with functional limitations, elderly people are the most likely to have problems of accessibility, and this increases with age. Adequate accessibility is therefore important for enhancing the possibility of older and/or disabled people living independently as much as possible.

Serious problems of accessibility and the existence of environmental barriers are related to a reduced capacity to carry out activities of daily living, such as washing, cooking and getting dressed. With greater constraints, dependence on external services rises and institutionalization rates increase. In this context,

accessibility problems have been linked with low subjective well-being, poor perceived health and poor psychological well-being. In addition, older residents are exposed to increased risks of accidents when carrying out tasks for which their capacity is no longer sufficient.

In Europe, data from some empirical studies have shown that more than three quarters of the housing stock have some kind of environmental barrier that make them difficult for disabled residents to access. The main problems are faced in bathrooms and kitchens and on staircases.

Housing environment

The housing environment is a major element in healthy housing. Although not a part of the dwelling itself, it provides the social and physical context for the dwelling – which can be good or bad. The most important aspects of residential quality appearing in the literature are social ties in the neighbourhood, safety (e.g. from crime and in traffic), environmental hygiene (e.g. noise and air pollution) and the presence of facilities (e.g. shops and green spaces).

Green and public places

The provision of places for leisure, recreation and social activity in the city is as important as the provision of shops and services. The major benefits of such places have been identified as: (a) social bonding between residents, producing an identity and building up social capital and trust; and (b) increased levels of physical activity, leading to a healthier and less overweight population.

Physical activity reduces the risk of obesity, cardiovascular disease, diabetes and stress, but in most countries more than half of the population fail to achieve the minimum amount of daily physical activity needed to bring about health benefits. A review of the economic benefits of green spaces estimated that their provision – thus persuading at least 1% of the sedentary population to become active – could have enormous economic value by reduced health care expenses. Nevertheless, contemporary urban environments often lack public places and thereby encourage sedentary lifestyles.

A variety of urban and neighbourhood planning aspects can be considered in order to counteract the current spread of obesity, such as improved facilities for walking and cycling, better public transport, increased levels of safety, provision of adequate and attractive green and public spaces, and a reduction of environmental burdens such as noise and air pollution.

Perception of safety

There are two relevant issues in public safety, which strongly overlap: (a) the more general perception of safety; and (b) the more specific fear of crime. Looking at the subjective perception of safety, it is especially the occurrence of physical or environmental cues in the residential environment that leads to insecurity and feelings of not being safe. Such cues can be, for example, physical incivilities such as deterioration of neighbourhoods, litter or graffiti (indicating a low community spirit and, in effect, a low social control) or social incivilities such

as conspicuous groups of young people or individuals behaving strangely (questioning the degree to which social norms and customs are respected).

The issue of safety is also relevant for the use of public spaces, but is more often related to crime or fear of crime. Overall, people are more likely to make better use of outdoor space if the area is perceived as safe. Street lighting and adequate environmental and building design improvements lead to a reduction in crime and increase the confidence of residents at night.

Perceptions of insecurity may lead to a reduced quality of life, isolation and mental problems as a result of feeling intimidated within the residential environment and thus lacking control. Lifestyles become increasingly concerned with perceived safety and activities are largely restricted during the hours of darkness, especially for women and children. Studies have stressed how such unsafe environments can affect mental and physical health by reducing physical activity and increasing anxiety and social disorder.

Environmental and architectural issues

The visual and environmental attractiveness of the immediate housing environment can affect health. For example, aesthetically pleasing views from the window – especially looking out on natural and green spaces – have been linked to positive health. Attractive streets and buildings increase the motivation to take a walk around the block. Parks and green streets increase the restorative effects of recreational trips in the neighbourhood and help to reduce daily stress. On the other hand, noise and air pollution have the opposite effect and reduce both the motivation to spend time in the neighbourhood and the health benefits of doing so. In particular, traffic emissions and other types of outdoor air pollution are a public health challenge; long-term exposure to high levels of air pollution can reduce life expectancy by a year or more. The most severe exposures are often found in disadvantaged neighbourhoods.

In this context, an adequate and well-maintained built environment can provide many advantages. Green spaces can positively influence health through their contribution to improved air quality, and may also have a positive impact on the urban climate by preventing the accumulation of heat. The traffic infrastructure can be designed in a way that reduces noise. People are more likely to exercise if pavements are provided and are attractive, unobstructed and well-maintained, and if the scenery is enjoyable.

Suggested reading

Bonnefoy XR et al. *Review of evidence on housing and health*. Background document, Fourth Ministerial Conference on Environment and Health, Budapest, Hungary, 23–25 June 2004. Copenhagen, WHO Regional Office for Europe, 2004 (<http://www.euro.who.int/Document/HOH/ebackdoc01.pdf>, accessed 19 November 2007)

Chance of a lifetime. The impact of bad housing on children's lives. Shelter, 2006 (<http://england.shelter.org.uk/files/seealsodocs/23199/Lifchancereport.pdf>, accessed 19 November 2007).

- Communication from the Commission to the Council and the European Parliament on thematic strategy on the urban environment.* Brussels, European Commission, 2006 (http://ec.europa.eu/environment/urban/pdf/com_2005_0718_en.pdf, accessed 19 November 2007).
- Dürkop J, Moriske H-J, Englert N, eds. *A healthier home – but how? Practical everyday tips.* Berlin, Federal Office for Radiation Protection, Federal Environment Agency and Federal Institute for Risk Assessment, 2005 (http://www.apug.de/archiv/pdf/Healthier_Home.pdf, accessed 19 November 2007).
- Evans GW. The built environment and mental health. *Journal of Urban Health*, 2003, 80:536–555.
- Franchi M et al. *Towards healthy air in dwellings in Europe. The THADE report.* Brussels, European Federation of Allergy and Airways Diseases Patients Associations (EFA), 2004 (<http://www.efanet.org/activities/documents/THADEReport.pdf>, accessed 19 November 2007).
- Frumkin H, Frank L, Jackson R. *Urban sprawl and public health: designing, planning, and building for healthy communities.* Washington, DC, Island Press, 2004.
- Fuller-Thomson E et al. The housing/health relationship: what do we know? *Reviews on Environmental Health*, 2000, 15:109–133.
- Gilbertson J, Green G, Ormandy D. *Decent homes – better health. Sheffield decent homes: health impact assessment.* Sheffield Hallam University, 2006 (http://www2.warwick.ac.uk/fac/soc/law/research/centres/shhru/sdh_hia_report.pdf, accessed 19 November 2007).
- Green Paper on the Urban Environment: communication from the Commission to the Council and Parliament.* Brussels, European Commission, 1990 (COM90 218) (http://ec.europa.eu/environment/urban/pdf/com90218final_en.pdf, accessed 19 November 2007).
- Health impacts of the built environment: a review.* Dublin, Institute of Public Health in Ireland, 2006 (<http://www.publichealth.ie/index.asp?docID=649>, accessed 19 November 2007).
- Housing and public health: a review of reviews of interventions for improving health – evidence briefing summary.* London, National Institute for Health and Clinical Excellence, 2005 (<http://www.nice.org.uk/page.aspx?o=526664>, accessed 19 November 2007).
- Klitzman S et al. Prevalence and predictors of residential health hazards: a pilot study. *Journal of Occupational and Environmental Hygiene*, 2005, 2:293–301.
- LARES: Large Analysis and Review of European housing and health Status. Preliminary overview.* Copenhagen. WHO Regional Office for Europe, 2007 (http://www.euro.who.int/Document/HOH/lares_result.pdf, accessed 19 November 2007).
- Lawrence RJ. Urban health: a new agenda? *Reviews on Environmental Health*, 2000, 15:1–11.
- Loftness V et al. Elements that contribute to healthy building design. *Environmental Health Perspectives*, 2007, 115:965–970.
- Mitchell CS et al. Current state of the science: health effects and indoor environmental quality. *Environmental Health Perspectives*, 2007, 115:958–964.
- Shaw M. Housing and public health. *Annual Reviews of Public Health*, 2004, 25:397–418.
- Walking and cycling in the city.* Copenhagen, WHO Regional Office for Europe, 1998 (Local Authorities, Health and Environment Briefing Pamphlet Series No. 35).

Section 3. – Project preparation (Step 1)

General background and coordination

While the LHHAP project design is simple and straightforward, a project coordinator must be appointed to prepare for the survey and drive the project through to policy-making and action. Two levels of coordination and management are involved; the project coordinator should delegate responsibilities accordingly.

The first level of coordination is administrative and political. Because it is necessary to obtain the municipal approval and overall support, the coordinator needs to have access to high-level officials. The mayor and other municipal heads should be involved and co-opted as supporters of the project. Official approval for the project, negotiating political willingness for the project, obtaining phone numbers and addresses of potential participants for the study and the release of team members from their normal duties are a few examples of the project coordinator's responsibilities. The coordinator should act as the spokesperson and leader of the LHHAP working group.

The project also involves management at the logistical and technical levels prior to and during actual data collection. For example, before data collection, information letters must be mailed to the selected households, the press informed, the list of contacts formatted and distributed to team members, a meeting room reserved and computer programs installed. During the data collection phase, data should be collected and saved daily, group meetings organized, field visits planned and any unforeseen matters resolved.

In an ideal case, the coordinator would have some or all of the following characteristics:

- ✓ experience in project management and staff management;
- ✓ experience with data collection and handling;
- ✓ several years of experience with the local authority; and
- ✓ a position within the local authority that allows the results of the project to be applied and utilized.

Identifying project goals

Establishing what the municipality intends to achieve with a LHHAP project is a largely political decision that must be carefully considered by municipality leadership. The structure of the survey can be tailored to the needs of the municipality. To obtain a first idea, the questionnaire can be quickly perused to become familiar with the type of data it collects and to begin brainstorming about how the data can be used and what objectives they should serve.

There are various opportunities to apply LHHAP data for planning procedures within a municipality. Therefore, the local authorities need to discuss and decide

on the best way to apply LHHAP data and results to benefit urban development and the quality of the housing stock. In the main, political decision-makers need to explore the following questions.

- ✓ It must be determined whether the goal of the LHHAP is to obtain a snapshot of housing conditions throughout the entire municipality or to focus on housing conditions in only one or a limited number of neighbourhoods.
- ✓ The types of follow-up action that are feasible must be explored, including how many resources can be made available, whether there should be a focus on buildings or neighbourhoods, and whether action should focus on information campaigns or building interventions.
- ✓ Departments that will lead or support working with survey results or implementing improvement strategies should be engaged. These may be housing, environment or social departments that deal with housing and can affect housing conditions. It is recommended finding out at an early stage to what extent the results of an LHHAP project may be useful for these stakeholders.
- ✓ Local or national actions and campaigns to which the LHHAP project could relate should be identified. These may be urban developments at local level, the creation of new master plans, or campaigns on specific housing-related issues (home safety, energy efficiency, etc.) at local, regional or national levels.

All of these types of question may affect how the survey is used and on what spatial level data are collected. For example, if the objective is to prepare information campaigns, it may be relevant to involve the whole municipality. If the objective is to inform and initiate housing renovation campaigns, specific city quarters and neighbourhoods could be selected unless the campaigns should address buildings in the entire municipality.

Timeline development

The coordinator should develop a timeline for the project. The timeline should allow for planning of all preparations (political and administrative), for executing the study and for writing a detailed final report. After the survey, the timeline should also include subsequent months of follow-up action and policy-making. See Appendix 1 for an example timeline.

- ✓ Allow three months to six weeks to prepare for data collection (see Appendix 1).
- ✓ For data collection/phone survey, one-week (full-day work) or two-week (half-day work) designs are available (see Appendix 2).
- ✓ For data analysis of the survey, two weeks should be set aside for basic analysis with additional weeks for detailed analyses if desired (see Appendix 1).
- ✓ Follow-up action plans, the timeline can vary greatly depending on the projects and actions based on LHHAP data.

Selection of neighbourhood(s)/survey area(s)

Different strategies exist for selecting survey areas, but the underlying reason for the selection of particular area should be to support municipal goals and intentions for action. For example, a municipality planning a neighbourhood restoration project may choose to focus exclusively on that neighbourhood. If the municipality has a general interest in improving housing and urban quality, or in developing an urban master plan, the LHHAP project can be implemented across the entire municipality. Because the data collected will be used to develop the follow-up action plans, it is crucial that the neighbourhood/survey area selection is based on municipal goals.

- ✓ For the decision on neighbourhood selection, high-level discussions within the municipality may be necessary. The neighbourhood selection process should start in good time before the LHHAP data collection is to be carried out.
- ✓ The municipality's urban and housing-related actions and plans should be considered, as should future needs for data and planning.
- ✓ The final decision on neighbourhood selection should include recommendations from health, environment and social departments as well as from the departments concerned with housing and urban planning.
- ✓ The selection of neighbourhoods should consider official spatial units within the municipality so that the collected data – broken down by these spatial units – can be compared with existing data within the municipality (i.e. the same spatial units used for census and other surveys must be used for the LHHAP project).

Selection of households (sampling)

The households selected for interview during the data collection phase are defined as the sample. The selection of these households (the “sampling process”) is a crucial step in project preparation. For the realization of a LHHAP project, it is recommended that 500 households be selected.

The main requirement is that the sample, to the degree possible, reflects the demographic and housing conditions of the municipality. In other words, the percentage of households living in rented accommodation should be about the same in the sample and in the municipality (or the respective neighbourhood chosen for the LHHAP project). The same is true for all other characteristics, such as age of residents, level of income, age of housing, and so on. To achieve such a representative sample, a “random sampling” procedure is recommended. A random selection of 500 households would provide a final sample that – with limited variations – largely reflects the conditions of households and buildings within the respective municipality or neighbourhood.

As the LHHAP includes a data collection period using a phone survey, each of the selected households must have a phone number. Thus, some households will inevitably be ineligible for selection as they do not have a phone connection, or because their phone number is not available in some records. Emphasis must therefore be placed on identifying the database of local households that contains

the largest number of phone numbers, in order to have the largest possible number of households available when selecting the sample.

The sample can be produced from any type of register that contains the name of the household, street address and phone number. Appendix 3 shows the sample list (Contact Sheet) as it will be given to the interviewers, identifying the kind of information that is necessary to obtain when selecting the 500 households. A very important feature is the information on the spatial unit (neighbourhood, precinct, district, etc.), which needs to be compatible with the spatial categories of the municipal databases so that the LHHAP data can be linked with other municipal data sources.

Experience from previous surveys has shown that the following registers and data sources can be used for the production of the sample, although other useful sources may also exist:

- ✓ municipal registry/inhabitant database;
- ✓ health insurance;
- ✓ water registry (or any other registry that identifies the recipients of basic services such as electricity, waste disposal services, etc.); and
- ✓ cadastre/house owners.

The latter option is not recommended, however. It will lead to problems in rented accommodation, as the name of the householder is not known and therefore it is not possible to send out an information letter before the survey. Also, it may not be possible to find the phone number of the rented property.

It is clear that the need to select households with phone numbers may have an effect on the degree to which the final sample of 500 households is representative of the whole municipality. Nevertheless, collecting data by phone is the only adequate and affordable option, as any other survey method would mean visiting homes, which would make the process much more time-consuming). As the LHHAP is intended to provide local policy-makers with indications of the main problems, the data collected during the phone survey are sufficient to identify and assess the major challenges to be tackled.

When drawing up the sample of 500 households, it is important to keep in mind the following.

- ✓ Mobile phone numbers should be included, if available. This will increase the likelihood that the selected sample is representative of the households in the municipality.
- ✓ The final list of 500 households should be checked to ensure that each household is represented only once. This problem can occur when a list of persons/residents is used in selecting the sample.
- ✓ The sample list is merely a means of contacting the household, and it does not matter what name is on the list. The LHHAP project refers to the property where the householder lives, so the final sample does not represent a list of people to interview but rather a list of households to be contacted. During the survey, any adult resident of the household can answer the questions.

When the sample is drawn up, it is most useful to request from the municipal statistic department a summary of the housing stock and population data for the municipality or the selected neighbourhoods, and add to this the key data for the sample (see Appendix 4 for an example of the relevant data). These data will enable the LHHAP coordinator to determine, during the data collection period, whether a specific neighbourhood or age group is not well represented. In such a case, additional efforts must be made to secure interviews from this neighbourhood or age group).

Finally, the use of the local telephone book for drawing up the sample may appear to be an attractive and easy solution. However, it is not recommended as many households are not listed. It is better to start from a complete register of inhabitants or households and then try to identify phone numbers.

Selection of survey team members

At least 200 surveys should be completed for the LHHAP project. A rough estimate is that, on average, one survey is completed for every hour of work. Five staff members, administering surveys full-time for four days, should be able to meet the 200-survey target. It is recommended that the working group comprise up to five members recruited from all relevant municipal departments.

In theory, anybody should be able to administer the survey. However, the benefit of LHHAP is that it provides a snapshot of the reality of housing and health conditions in the municipality. Therefore, a multidisciplinary team is ideal because it will generate fruitful discussions, increase the range of insight and expertise, and engage more municipal departments. Departments of housing, health, transport, environment, urban planning, sanitation, statistics, etc. can find LHHAP relevant to their work. Architects, sociologists, engineers, historians, etc. may also have interest in participating in the LHHAP. It should be borne in mind that coordinating schedules across the entire municipality will require additional approval from respective supervisors and will probably increase the planning time.

The LHHAP data collection phase is an intensive exercise. To meet survey goals, supervisors must be willing to release staff for the time required. For a one-week data collection exercise, the survey team will need to focus full-time on meeting the survey goal. For a two-week exercise, the team can be available part-time (see Appendix 2).

The data collection team must be willing to work outside traditional office hours. It is suggested that each day, at least two surveyors (if not all) stay until 20:30 to conduct phone interviews. In addition to these extended hours, it may also be necessary to conduct phone interviews on Saturdays to meet survey goals. If possible, staff overtime should be officially recognized and compensated.

The LHHAP also requires data analysis and database research. The purpose of the latter is to identify existing census and municipal databases that will increase the usefulness of the LHHAP. Those designated to carry out the data analysis and database research should have appropriate experience. As part of the survey team, the data analyst should also participate in conducting phone interviews for one day and in at least one field visit. Knowing the type of information the survey

collects is important in identifying links to existing databases and for conducting a thorough analysis.

For the selection of the project team, the following recommendations may be relevant.

- ✓ Determine how many surveys are to be completed and designate an appropriate number of staff to make the phone calls.
- ✓ Keep in mind that the survey is as much about collecting empirical data as it is about getting a snapshot of the reality of housing conditions in the municipality.
- ✓ Select a multidisciplinary team, engaging different municipal departments.
- ✓ Prepare staff to work outside normal office hours, since phone calls will have to be made during evenings and perhaps on Saturdays (see Appendix 2).
- ✓ Get scheduling approval from the supervisors and department heads of each of the team members. It is essential that the LHHAP staff is fully released from their normal duties for the period of the LHHAP.

Media campaigns

A media campaign is important to the success of the LHHAP data collection, as prior knowledge of the survey directly influences residents' participation rates. It is crucial to inform residents of the LHHAP in order to increase willingness to participate and encourage community interest. As an absolute minimum, the municipality must send an official letter notifying the selected residents of the phone survey (see Appendix 5). This letter, which should be mailed one week in advance of the survey, should include the dates of the survey and a general description of what to expect from the interview.

Local media outlets should also be informed of the survey through press releases (see Appendix 6), as they are in a position to help spread awareness. The more the community is aware of the survey, the more supportive and cooperative residents will be.

A press conference on the Thursday or Friday before the survey, with the aim of being reported in the weekend news, is an effective way to promote awareness. The press conference is an opportunity to present the key topics of the LHHAP project (see Appendix 7) and is a forum for the media to ask questions about the survey. The media may even ask to join the field visit. The municipality should prepare a strategy for how to respond to such questions.

If the municipality has a web site, posting the dates and general information about the LHHAP survey will be useful for curious residents.

- ✓ Mail an official letter one week prior to the survey to notify all of the selected residents about the forthcoming LHHAP (see Appendix 5).
- ✓ Press releases to local media outlets (see Appendix 6). The distribution should consider all types of media to provide maximum coverage.

- ✓ Hold a press conference on the Thursday or Friday prior to the survey (see Appendix 7).
- ✓ Post general information about the LHHAP to the municipal web site.

Training and working group meetings

The LHHAP working group will have several meetings planned during the LHHAP project. The team should have at least one meeting prior to data collection to learn about the overall objectives of the project. This meeting is necessary to ensure that the team members are acquainted with each other and with the survey itself. The initial meeting is also the time to offer the survey team brief training on how to use the computer program (see “How to collect local housing and health data” in Section 4 for a general description and Appendix 8 for training information).

Team meetings during the data collection period should be planned in advance. The meetings are an opportunity for the group to discuss ad hoc issues and problems that arise during the implementation of the survey.

After the data collection period is finished, the team should meet for a follow-up and evaluation meeting to assess the overall experience, both from a methodological and technical perspective and to consider the priorities for action as a group.

The last stage of the project is data analysis, which is carried out by only one member of the LHHAP. Nevertheless, it is recommended that at least two LHHAP team meetings are organized during the first two weeks of data analysis (one per week) (Appendix 1) to discuss the first results, to inform the analysis process and to address key priorities.

The following are the key elements in planning working group meetings.

- ✓ Meetings must be scheduled in advance so that each team member has them entered in his/her diary. Meeting times should be blocked prior to the survey as a fixed element of the work schedule.
- ✓ The entire team should be present, in order to benefit from the diversity of knowledge and experience in the municipality.
- ✓ Inviting municipal leaders to the team meetings, especially during the analysis period, can be a useful way of involving local decision-makers in the utilization of LHHAP data and in linking the LHHAP process to municipal actions and policies at an early stage.

Expected participation and response rates

Experience from recent survey and testing periods with the LHHAP tool have shown that, in general, a participation rate up to 50% is possible. With the suggested sample of 500 households, it is entirely possible to achieve up to 250 interviews. The expected number of interviews is 200.

The critical factor affecting participation rates is the official letter of notification of the LHHAP project to the selected households. Other factors that increase participation rates are media announcements and a friendly and professional approach by the interviewers (see the section above on media campaigns.)

It is very important that the residents interviewed reflect the sample. If phone calls are made only during the day, the interviewers will reach mostly elderly and unemployed people; very little information will be obtained from those aged 18–65 years, as most of them will not be at home during the day. If the data collected by the LHHAP project do not provide a balanced sample, the analysis and interpretation will be similarly disproportionate and somewhat limited.

To ensure that all households have the same likelihood of being contacted and interviewed, the survey coordinator can consider the following suggestions.

- ✓ LHHAP staff needs to arrange working times so that each day at least two interviewers make phone calls until 20:30 or 21:00.
- ✓ Saturday may be considered a full working day for making phone calls.
- ✓ Field visits should take place at times when making phone calls is less successful. Since mornings tend to be less productive than afternoons and early evenings for completing interviews, field visits are more suitable during these periods.
- ✓ Residents who do not participate because of work or time constraints should not be pushed to complete an interview, but rather asked for a more suitable time to call.
- ✓ After two days of phone surveys, the coordinator can take a look at the collected data to assess whether the sample has a suitable distribution by age, district, etc. If the data clearly show that a specific age group or district is not as represented as expected, steps can be taken to compensate for this problem during the remaining days of the survey.

Confidentiality requirements

One of the main challenges for the coordinator and the LHHAP staff is to keep the collected data and the names and addresses of those sampled confidential. The LHHAP team should only know which households have been selected, and it should not be possible later on for anyone to link the LHHAP data to a specific household or person. This is a key requirement for the data collection, as some of the data are of a very personal and sensitive nature. An interviewer needs to be able to guarantee full confidentiality of the data to any person interviewed.

To meet this requirement, each household in the sample will be numbered (from 1 to 500) and during the interview only this number will be entered into the database. Only with the sample list will it be possible to link the household number to a specific address. As soon as the interview period is finished, there should be no more mention of addresses but only household numbers.

To make completely sure that the data remains confidential, some basic rules should be followed.

- ✓ LHHAP staff should be advised to not disseminate the sample list or data collected during the project to anyone else. For interviewers recruited from municipal staff, this may already be part of the standard contract with the municipality. For others, this statement should be part of any contract made with the staff.
- ✓ Each interviewer should receive only part of the sample rather than the full list (i.e. with five interviewers, each should receive 100 addresses).
- ✓ When paying neighbourhood and home visits, the LHHAP coordinator should take along only the addresses of the households that may be visited. No other addresses or personal data should be taken along.
- ✓ During the phone interview, no detailed address information (street, house number, etc.) should be recorded and entered into the database. The lowest level of spatial information is the city quarter or neighbourhood, so that it will not be possible to identify specific households from the dataset.
- ✓ After the survey, all sample lists that were given to the surveyors must be collected by the LHHAP coordinator. No addresses from the LHHAP sample should remain with anyone else but the coordinator.
- ✓ During data analysis, the LHHAP coordinator may keep the address list so that households can be re-contacted should specific questions arise during the analysis. However, it is recommended that all LHHAP samples and address lists be destroyed six weeks after the survey at the latest.
- ✓ The neighbourhood and home visit sheets that are filled in during field visits are only to be used for data analysis. They should be stored in a safe place until the information has been used for the LHHAP analysis, and should be destroyed six weeks after the survey at the latest.

In some surveys, specific cases of inadequate housing have led people to ask how they should handle obvious emergency situations. The LHHAP coordinator should therefore discuss options for action with the municipality prior to the survey. Since such action would conflict with the basic requirement of confidentiality, it can only be considered in severe cases. The full responsibility for such a decision remains with the municipality.

Preparing for the survey

Approximately three months to six weeks are needed to prepare for the data collection phase of the LHHAP (see Appendix 1). Depending on the political climate, holiday periods, the number of departments involved, etc., preparation may take significantly longer. The pace of the local bureaucracy should be taken into account when preparing for the survey. In addition to the duties outlined above, the preparation also includes the following tasks.

- ✓ Approval should be obtained from the appropriate municipal authorities (permission for survey, access to register with household names, addresses and phone numbers, release of municipal staff, agreement regarding potential compensation of overtime, etc.).
- ✓ An official informative letter should be prepared and mailed to the selected households.

- ✓ A media strategy should be developed, information and press releases disseminated to the media, and replies sent to requests by the media to join the field visit.
- ✓ The local police should be informed of the forthcoming survey.
- ✓ A list should be prepared of the official spatial units to be used during data collection. Official spatial units should be compatible with existing data sources to facilitate cross-analysis.
- ✓ An interviewer code should be assigned to each team member.
- ✓ Identification cards should be prepared for each surveyor for use during the field visit.
- ✓ Survey documents should be prepared for the working group (Contact Sheet printed on A3 paper, field visit worksheets).
- ✓ Meeting rooms should be booked.
- ✓ Transportation for field visits should be arranged.
- ✓ Office space and equipment (computers, computer passwords telephones, headphones) should be secured.
- ✓ The Excel program should be installed on each computer.
- ✓ Follow-up meetings should be arranged with the city council and municipal departments to share preliminary results.
- ✓ A public event should be arranged at which the results are presented.
- ✓ Training for LHHAP interviewers should be scheduled.
- ✓ An overview sheet should be created to provide key information on the housing stock and population of the surveyed area (municipality or selected neighbourhoods) and key information on the sample. This information will help to determine during the survey whether a specific neighbourhood, housing type or age group is not well represented (see Appendix 4).

Follow-up after the survey

When the LHHAP data collection is completed, the data analyst will prepare the overall dataset for the project. Before the sample papers with all addresses are destroyed, the coordinator should check the LHHAP dataset and check that all data entered on the neighbourhood (or whatever spatial unit has been used) is compatible with the system used by the municipality. If some spatial unit names have been entered that do not match the municipal system, the corresponding address can be checked and the data corrected.

After the two weeks of basic data analysis, the dataset should be forwarded to the Directorate-General of Health for the construction of a national LHHAP database (LHHAP focal point: Claudia Weigert, Environmental Health Division. Email: dsa@dgs.pt). This dataset will contain the data of all municipalities that have undertaken LHHAP projects and will provide a resource for comparing the data of one municipality with that of others. Also, the national database will enable useful evidence on housing and health conditions to be developed on a

national scale, and could potentially develop into a standard tool for national policy-making on housing and urban planning.

In addition to the local dataset, any kind of feedback on the survey and the methodology should be forwarded to the Directorate-General of Health (LHHAP focal point: Claudia Weigert, Environmental Health Division. Email: dsa@dgs.pt). This information will help in further developing the tool and making it more relevant for the municipalities.

Section 4. – Data collection (Step 2)

The LHHAP project is a data collection tool. It considers the collection and integration of data from various sources, such as direct information on housing conditions through phone interviews, data collected through site visits in selected city areas, and existing data identified in the municipality. This section introduces the main types of data and how they are collected.

Data collection is the core aspect of the LHHAP project, and forms the basis for any further technical action or policy-making.

How to collect local housing and health data

The survey is administered using the Excel program. Below is an explanation of how to install and start the program. This is followed by a brief description of how to administer the survey and how to use the Contact Sheet with the addresses of all the selected households.

Excel is easy to install and use. Note that the security settings on the computer must be set to low for the installation. When asked, be sure to enable macros. Install the Excel file like any other program file. After the file is installed, open the program and the “Control panel” page should appear. If not, select the “Control panel” tab at the bottom of the sheet. Click on “Start interview” to begin an interview. The first entry mask for the input of data will then open.

The first entry mask of the interview has blanks for three different types of identification: Interviewer code, dwelling code and district (see Fig. 1). Each interviewer will have an “Interviewer code” assigned by the coordinator, which will be entered into the first blank. The “Dwelling code” and the “District, precinct, quarter, ward, zone” correspond to fields on the Contact Sheet and are used to identify the dwelling. Fig. 1 gives an example in which an interview is conducted for dwelling 2 and conducted by Interviewer P7.

After entering the correct identification information, click on “1st question” to begin the interview. Each question of the interview must be answered before moving on the next question. The program will not continue unless the question is answered. If the respondent does not know the answer to the question or does not respond at all, select “Missing data”. After an answer is selected, click on “Next” to open the next entry mask.

Administering the survey is relatively easy. The first few surveys may take more than 30 minutes each but, as the interviewer gains experience, the completion time shortens to less than 30 minutes. The most difficult part of the telephone survey is breaking the ice and getting the respondent to agree to participate. For ideas on how to approach the initial phone conversation, see Appendix 9.

Fig. 1. Example of the first entry mask with three identification elements

1	2	3	4	5	6
#	District, precinct, quarter, ward, zone	Complete Name	Telephone number	Interview completed	Interview Refused (why)
1	Amora	Francisco Puo Alves	210 754 885	X	
2	Amora	Graciano Aguiar	212 658 985	X	
3	Amora	Cláudia Sofia Batalha	212 364 984		X No time

The interviewer must remember the following when conducting a survey.

- ✓ It is essential to ask each question exactly the way it is written in the entry mask. Do not skip any questions or change or rephrase a question.
- ✓ Be aware of what the interviewed person says. If the answer is not clear, ask for a clarification. Do not assume an answer for any question, no matter how simple.
- ✓ Every question must be answered. If the respondent does not know the answer or does not respond, code as "Missing data" and click "Next".
- ✓ Interviewers must be persistent and continue to make phone calls even when people are unavailable or decline to participate. It is normal for some households to be difficult to contact. Several attempts should be made to contact each household.

For more information on how to administer the survey, see the PowerPoint presentation (Appendix 8). The presentation contains note pages and can be used by the LHHAP coordinator during staff training.

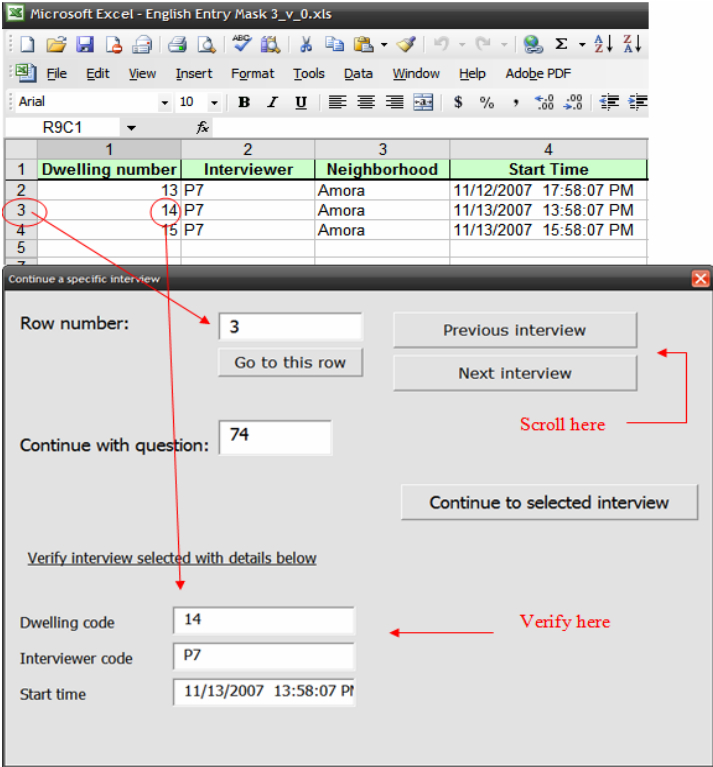
Depending on the answer to a particular question, some other questions may be skipped. If the respondent answers "No" to the question "Do you perceive the temperature in the dwelling during the summer season as a problem?" then the follow-up question "Is it because it is too warm or too cold?" will be skipped and not shown on the screen at all.

At the end of the interview, a text box will appear for additional comments. Adding comments to the box is optional and at the discretion of the interviewer. When comments are added, be sure to put comments from the Respondent and those from the Interviewer in their respective text box.

Once started, it is best to complete an interview. In the unfortunate event that an interview has to be stopped before completion, be sure to manually save the data by going to "File" and selecting "Save". Then make an appointment to complete the interview at a later time. Indicate on the Contact Sheet the number of the question where the interview will resume and the time of the appointment.

To continue an interview, go to "Control panel" and click "Continue with an interview". An entry mask will appear that contains information from the Excel sheet where all of the data collected is being stored. The entry mask will allow the user to scroll through the rows of interviews by clicking "Previous interview" or "Next interview". (See Fig. 2 for an example of the "Continue with an interview" entry mask.) By scrolling through the rows, the user will be able to see the dwelling number, interviewer code and start time of a particular interview. Scroll through the rows until the desired dwelling number appears. Verify that this is the dwelling number for the interview that will be continued. Enter the question number where the interview will resume in the box labelled "Continue with question" then click on "Continue to selected interview". The program will then allow you to resume the interview. In the example below, the interview will continue for dwelling 14 and will resume at question 74.

Fig. 2. Example of the "Continue with an interview" entry mask



If it is known that the interview is to be resumed at or around a specific row, enter the row number in the "Row number" blank and click "Go to this row". Verify that the Dwelling code belongs to the interview that should be continued.

If the Dwelling code does not match, scroll to the correct Dwelling code. Continue with an interview only after the Dwelling code has been verified.

Because it is easy to make a mistake during this process, interrupting and resuming an interview should be avoided if at all possible. Note also that the skip function will be disabled from this point; the interviewer will need to remain alert to any inapplicable questions that should be coded as "Missing data".

Each member of the team will have a Contact Sheet with a list of names and addresses of those to be interviewed. The Contact Sheet is an Excel document prepared by the coordinator that will help each interviewer stay organized (see Appendix 3). The Contact Sheet is formatted for and should be printed on A3 paper. The data listed in the Contact Sheet contain the name of the householder, the telephone number, the complete address and check boxes to mark whether an interview has been completed, refused or postponed to a later time. The Contact Sheet also has fields to enter the date and time of unsuccessful contacts so that the interviewer can track phone calls made earlier to a household and record comments.

The following is a summary of the important points in preparing for and implementing data collection.

- ✓ All LHHAP staff should meet before the phone survey for a short training session. The coordinator should use the training to explain the entry mask and the overall work to be done by the interviewers (see Appendix 8).
- ✓ During training, each interviewer should be given a unique code that will be entered into the computer when starting an interview. This enables each interview to be credited to the respective interviewer.
- ✓ Each interviewer should be given a Contact Sheet with his/her section of the selected phone numbers. For a staff of five and a sample of 500 households, each person should have 100 phone numbers.
- ✓ Each interviewer should receive a random geographical mix of residents to contact. This will help avoid different neighbourhoods being covered differently should interviewers perform with varying efficiency.
- ✓ For reasons of confidentiality, it is important that only the spatial area (district, quarter, etc.) is entered at the very start of the interview. Entering street names and house numbers conflicts with confidentiality requirements.
- ✓ The coordinator should fix times during the data collection period for the group to meet and discuss the work and emerging issues.

How to arrange neighbourhood and home visits

The field visit consists of both neighbourhood and home visits. The coordinator should have a preliminary idea of which neighbourhoods the team will visit during the field study. Nevertheless, the field visit plan should be flexible so that the team can respond to and investigate any unexpected findings that the phone survey uncovers.

Either four half-day or two full-day visits should be planned. As an absolute minimum, one day should be devoted to a field visit and all survey team members should be involved. The field visit is an exceedingly important dimension of the LHHAP and must not be dismissed. Even when the survey team is already familiar with the study area, the field exercise is indispensable because it allows each participant to see the neighbourhood and housing stock in terms of housing and health conditions. The exercise is also about the study team interacting, sharing perspectives, exchanging ideas, developing solutions and building partnerships. The opportunity to witness, engage in and explore first-hand the living conditions in the municipality will foster a better understanding of the study area and place the empirical data in context.

Neighbourhood visits should be based on the smallest spatial unit. For each visit, the discussion can be guided by the SWOT worksheets (see Appendix 10), which ask the group to identify the strengths, weaknesses, opportunities and threats for the neighbourhood or area visited. One SWOT worksheet per individual should be used for each neighbourhood or area visited. Visiting a neighbourhood is an informal activity: team members should walk around the neighbourhood and talk casually with residents about their perceptions of the housing conditions.

Home visits are also part of the field visit and are an opportunity for the team to make a first-hand assessment the housing conditions in a given area and widen their understanding of the local situation. There are two main ways of gaining access to dwellings. First, a home visit may naturally evolve out of a discussion with the residents during a SWOT exercise. Second, the data input program has a flagging mechanism that will select households that may be interesting to follow-up: when a household meets specific critical conditions, the program will automatically prompt the interviewer to ask for permission to visit the dwelling. When an adult resident grants general permission to visit the home and the dwelling is selected by the team members for a visit, the household should be contacted again to arrange an appointment.

Even when not flagged by the computer program, a dwelling may be identified as warranting a home visit. In this case, the interviewer should ask for permission to visit the dwelling and, after agreeing with the team, schedule an appointment. For every dwelling visited, the interviewer should complete a home visit worksheet (see Appendix 11) that covers key aspects of housing and health.

To make field visits effective, the following should be considered.

- ✓ All team members should be involved in the field visit to create an interdisciplinary discussion.
- ✓ At least one day of field visits should be arranged; two days are better.
- ✓ The homes to be visited should be discussed and selected by the team as a whole. The decision should be made prior to the field visit and based on those households that are most relevant to project goals. The households that have agreed to a home visit can be identified using the Excel data sheet or by the interviewers themselves.
- ✓ Permission should be obtained from an adult before entering any home, and an adult should be present during the visit.
- ✓ The size of the group should be considered when arranging home visits. Many households will only accept two or three team members, not more.

How to collect municipal data

One member of the LHHAP team (the “data analyst”) should be responsible for data analysis. This also includes the collection of existing data contained in municipal registries and databases.

To better understand the concept and objectives of the LHHAP, the data analyst will spend one day conducting phone interviews and participate in at least one field visit. It is important for the data analyst to conduct phone interviews to get a feeling for the type of information the survey collects, which will make it easier to identify links with existing data sources. Ideally, the data analyst will have prior experience of municipal and other government databases and will know where to look.

Apart from one day for phone interviews and half a day for a neighbourhood visit, the data analyst should spend his/her time going through municipal data that may be relevant to the LHHAP data. It is necessary to consider the spatial level of the municipal data, as this will be decisive in linking them to the LHHAP data. The LHHAP data collection should therefore adopt the official spatial categories that are used by the municipality.

Potentially interesting data sources could be, for example:

- ✓ local census data (information on residents, housing, housing quality, sanitation, rent levels, age of buildings, etc.);
- ✓ inhabitant, housing and social registries (demographic structures, social housing and poverty levels, income, etc.);
- ✓ specific municipal data sources and surveys on selected topics (if available); and
- ✓ traffic and urban development plans and social housing schemes.

To relate these data to the LHHAP data, it is recommended that the data analyst prepares a data profile for the city, city quarters or spatial entities covered by the LHHAP project. The profile may include all types of housing and health information, or information that may relate to housing or extend the overview of housing conditions. It is recommended that the overall objective of the LHHAP is discussed and agreed on before the project begins, so that the data analyst has specific ideas of the type of data to look for.

After data collection has finished, the data analyst will turn to analysing the LHHAP data and, as a part of the analytical process, link it to the municipal data. The basic analysis should take two weeks.

Working group meetings

During the data collection period, it can be difficult to arrange meetings of the entire working group. It is recommended that team meetings to discuss the survey are scheduled in advance (see Appendix 2). Such meetings are important: they give the group a chance to offer feedback on the survey and the coordinator an opportunity to adjust the survey and/or calling schedules if any problems are encountered, such as a skewed representation of households sampled (see “Selection of households (sampling)” in Section 3). Team meetings

during the data collection period also serve to plan the neighbourhood visits and to decide which homes will be visited.

For an effective team meeting, the following aspects should be considered.

- ✓ Team meetings are important and should be scheduled in advance so that everyone is able to participate. The presence of every team member is necessary to ensure comprehensive discussion and to guarantee that decisions are known and understood by all.
- ✓ The coordinator should obtain an overview of the data collected by the team before the group meeting. He/she should look at the data collected in the Excel worksheets and assess whether there are some neighbourhoods or household (age) groups that are not well represented.
- ✓ Phone interviewers should bring suggestions for home visits to the meeting. After final selection by the team, the respective interviewers should contact the selected households to arrange appointments for home visits.

Section 5. – Data analysis and interpretation (Step 3)

When the data collection period is finished, there are two weeks for data analysis. The data analyst will be responsible for collecting data from the individual computers on which the phone interview data have been entered, and for consolidating the data into one LHHAP database (in Excel). The survey data can then be integrated with the already available census and municipal data. A statistician is not required for this task but would certainly be welcome.

The section below provides basic instructions on the data analysis process. However, as a part of the LHHAP tool, there will also be an automatic analysis sheet with pre-entered formulae that can be downloaded together with the entry mask and data input tool from the LHHAP website at the Directorate-General of Health (www.dgs.pt). The analysis sheet contains the formulae for the frequencies/distributions of each individual question, and will only need to be adapted to the number of interviews carried out.

Overview of tasks and expected outcomes

Before beginning the analysis, the data analyst needs to collect all relevant information and compile the LHHAP dataset. This includes:

- ✓ copying all data from the individual computers of the phone survey into one Excel document;
- ✓ collecting from the LHHAP group all summary sheets on neighbourhood and home visits (these will indicate specific problems and situations that can then be checked in the LHHAP dataset);
- ✓ discussing with the LHHAP group or coordinator the first topics for analysis; and
- ✓ agreeing on the format of the final output after two weeks (e.g. a set of results and tables, a report, a presentation, etc.).

It is important not to set expectations too high, as detailed analysis can take some time. The first two weeks cover a general overview of the entire dataset, plus the exploration of detailed analyses on a few selected neighbourhoods or topics.

In general terms, there are two ways of looking at the LHHAP data. First, data can be analysed in total to obtain an overview of housing conditions in the surveyed area. Second, the analysis can look at individual areas/neighbourhoods (provided the data have been collected with information on spatial entities, see "Selection of neighbourhood(s)/survey area(s)" in Section 3) and identify or compare local situations. In both cases, the data can be looked at individually in so-called frequencies (e.g. age distribution of buildings, or percentage of housing reporting mould growth) or in combination, using so-called cross-tabulations (e.g. housing with mould growth by age of buildings), which will provide more detailed information.

The expected outcomes of the data analysis can be very diverse and mostly depend on the objectives of the survey. The municipality needs to decide, before the LHHAP project is carried out, what it intends to use the data for and the type

of product (report, data tables, etc.) that is to be produced. Some of the many opportunities are:

- ✓ identification of the most prevalent housing problems within the survey area or within individual neighbourhoods;
- ✓ comparison of the housing conditions among neighbourhoods;
- ✓ identification of neighbourhoods or housing types with the poorest housing conditions;
- ✓ priority-setting for housing projects in neighbourhoods that are to be renovated;
- ✓ assessment of the housing conditions of specific population groups;
- ✓ focused analysis of specific housing problems (noise, home safety, thermal comfort, etc.) for the whole survey area or for specific neighbourhoods, building types, etc.; and
- ✓ comparison of LHHAP data with already existing datasets to extend local knowledge in relation to existing data.

LHHAP data analysis

The LHHAP data are stored in an Excel spreadsheet, and the analysis is also carried out in Excel. The basic functions suggested for the analysis are related to the exploring single data variables (frequencies) and two variables in relation to each other (cross-tabulations).

For both analytical functions, detailed guidance on how to carry out the analyses has been developed (see Appendix 12 for frequencies and Appendix 13 for cross-tabulations). For the frequencies, the LHHAP software package contains a section in which the frequencies for some of the questions are automatically provided. For the cross-tabulations, the software package contains two examples that are automatically produced.

The LHHAP data themselves are listed only as values in the spreadsheet. However, each value has its own meaning, e.g. the "1" could mean "No" and the "2" could mean "Yes". The meaning of the value for each question is listed in the map code section of the LHHAP tool.

The basic steps in data analysis are as follows.

- ✓ When all LHHAP data have been compiled in one Excel worksheet, the automatic analysis sheet with pre-entered formulae is added to quickly generate first descriptive analysis (frequencies) of the most relevant questions.
- ✓ For all pre-entered formulae, it is necessary to adapt the formula with the number of cases in the analysis (i.e. the total number of interviews).
- ✓ For new analyses, the format of the pre-entered formulae can be used and adapted. Details can be found in Appendices 12 and 13.

It is of course possible to carry out the data analysis in any other statistical program that the data analyst is able to use.

With regard to the more qualitative and descriptive reports of the neighbourhood and home visits, the analysis is limited to a review of all protocols and the derivation of a list of key priorities as observed during the field visits. The list of priorities should then be used as a guide to the data analysis, to make sure that the problems as perceived by the LHHAP team are substantiated by the data analysis.

How to link data sources

There are various ways in which the LHHAP data can be combined and linked with already existing datasets. For the most part, information from the LHHAP will be compared with that from other data sources in order to widen knowledge of local housing conditions. Some of the existing opportunities for utilizing LHHAP data in this way are the following, although there may be many others.

- ✓ Municipal records and the LHHAP data can be compared to see where they match and where they differ. Depending on the year when the municipal data were collected, the LHHAP data can then show those areas in which changes have occurred, for better or for worse (e.g. more or fewer problems with mould growth).
- ✓ If the general prevalence of specific conditions is fairly similar in both datasets, the LHHAP data may be used to answer more detailed questions that cannot be answered with the other datasets. For example, if the overall number of homes with mould growth is 20% in the municipal records and 22% in the LHHAP data, then the LHHAP can provide more detailed information by neighbourhood if the municipal data do not exist at neighbourhood level. However, it is important to recognize that the greater the difference between the datasets, the less useful are LHHAP data in replacing official statistics based on the entire municipality.
- ✓ Forthcoming municipal urban planning actions can be evaluated by comparing the problems and needs of the residents in given neighbourhoods with plans for future development. If there is a high level of dissatisfaction among residents with noise in a given neighbourhood, it may lead to a review of traffic planning.
- ✓ Different datasets may be linked to create new insights. If, for example, there is a health dataset showing that in one particular neighbourhood there are higher rates of diarrhoea, the LHHAP data can be used to identify any specific housing conditions in this neighbourhood that may be associated with the problem (e.g. a higher number of residents complaining about the drinking-water).

In addition, it is possible to directly import data from the LHHAP dataset into other municipal databases, or to import external data (e.g. from the municipal registry) into the LHHAP dataset.

Working group meetings

Throughout the data collection phase, meetings of the working group will have been carried out to provide a common understanding of the local housing and health challenges. This knowledge is also an essential resource for the analysis process, and the group should therefore meet at least twice to discuss and inform the analysis process (see “Training and working group meetings” in Section 3).

At these meetings, the data analyst should give a short overview of the status of the work and further plans. The overview should also identify questions regarding the analysis process and the priorities to address. The working group can then – based on the members’ professional backgrounds and the needs and interests of their respective departments – use its collective knowledge and its expectations of the LHHAP data to inform the data analyst on the next steps.

The bringing together of all LHHAP staff will also give individual members an opportunity to stay involved in the project in the long term.

- ✓ The presence at meetings of all team members will allow the data to be transferred to all municipal departments involved in the project and thus increase the use and implementation of LHHAP data.
- ✓ To make the team meetings efficient for the data analyst, the whole team should be present so that the diversity of backgrounds and knowledge within the municipality can be utilized.
- ✓ Invitation of some municipal leaders to the analysis meetings is useful for linking the LHHAP process to municipal actions and policies at an early stage and involving local decision-makers in the use of LHHAP data.

Drawing conclusions

The conclusions drawn from data analysis mainly depend on the objective of the LHHAP exercise, as the overall objective will determine how the analysis is carried out and what data are given priority (see “Identifying project goals” in Section 3).

If the objective is to provide an overall assessment of housing conditions in relation to health, than the conclusion could be to identify in which housing areas the surveyed households have the greatest problems or report the lowest levels of satisfaction.

If the objective is to report on the problem of mould growth, than the conclusion could address statements on which types of housing are most affected (building age, building type?), which types of household are most exposed (rich or poor households, households with children, more elderly households?) and which types of housing condition are related to mould growth (problems with damp, quality of heating or ventilation system?).

If the objective is to compare neighbourhoods and their housing and health conditions, then the conclusions could cover variations in housing problems by neighbourhood (what is the lowest and the highest percentage of homes with

mould in the neighbourhoods?), an assessment of which neighbourhoods are most disadvantaged in general housing terms (which neighbourhoods are often negatively rated compared to others?) and to what extent this may affect the health of the residents (are there increased health problems in neighbourhoods with specific housing problems?).

These examples show that, depending on the objective, the data can be analysed in different ways. In any case, however, the conclusions of the analysis should:

- ✓ be based on the LHHAP data and, if possible, be in line with other municipal datasets;
- ✓ refer to problems with housing conditions and identify those areas where there is a need for priority action (e.g. protection from noise, prevention of mould);
- ✓ be discussed with the relevant municipal departments (health, housing, environment, social) before publication to avoid wrong interpretations; and
- ✓ suggest types of campaigns and actions that can be taken (e.g. which houses or neighbourhoods should be targeted, which housing elements should be replaced or improved, and whether any specific risk group should be considered).

Section 6. – Action and policy-making (Step 4)

Evidence on housing conditions and data reports are not the final products of the LHHAP. As long as the data remain in a report and do not initiate action to improve the key issues, the LHHAP remains a survey rather than an action plan. Therefore, the decisive element of any LHHAP is the application of the data to inform, initiate or improve local action on housing conditions, with the aim of improving the health and quality of life of the inhabitants of the municipality.

Mechanisms and strategies for action

A variety of actions, interventions and campaigns can result from the LHHAP project and the final set of recommendations and priorities. Any action that is finally taken will be based on a political decision of the municipal leadership.

Based on the LHHAP data, three main strategies for addressing identified priorities can be distinguished: direct technical action; policy-making and regulation; and information and awareness campaigns.

Direct technical action

The first strategy is concerned with direct technical interventions that will lead to physical changes to homes and other buildings, such that existing properties are improved or repaired and health risks and exposure factors within the home are reduced or removed. Examples of such action could be:

- ✓ the initiation of and political support for campaigns to repair and renovate specific housing types or neighbourhoods that have particular problems with the housing stock (e.g. lack of thermal insulation, inside toilets and sanitation, or the presence of unvented gas appliances);
- ✓ the introduction of housing rehabilitation schemes into the public housing sector;
- ✓ the introduction of grants and incentives to make investment in housing attractive for owners and residents as well as housing agencies (this would require the development of minimum standards for the housing factors considered by the incentive and grant programme); and
- ✓ interventions within the urban environment to reduce health risks to residents, such as the introducing traffic calming schemes and low-speed zones, constructing recreational facilities, improving public utilities such as water supply and sanitation systems, or extending public transport

Policy-making and regulation

The second strategy concerns actions affecting the regulatory and policy aspects of housing construction and maintenance, leading to a change of the legal framework affecting housing conditions. This is easier to implement for regulations and building codes that apply to new housing, but may also affect existing housing through regulations on renovation work. Examples of such action could be:

- ✓ the adaptation and improvement of building codes, standards and regulations for new housing development and construction (e.g. regarding thermal insulation, layout, sanitation, ventilation, heating, accessibility standards, etc.);
- ✓ the provision of standards and regulations for the renovation and extension of existing buildings (e.g. heating systems, kitchen and hygiene facilities, thermal insulation, etc.);
- ✓ the review and improvement of standards and regulations for housing maintenance, especially in respect of housing agencies and owners of rented property (e.g. the provision of minimum standards of housing adequacy that have to be fulfilled by rented dwellings); and
- ✓ the introduction of financial incentives to provide adequate rented housing (e.g. through legislation allowing tenants to withhold some of the rent if the basic requirements of housing adequacy are not met).

In most cases, codes and regulations will be laid down by the national government, municipalities having a mandate only to execute local action within the legal framework provided. The national framework can nevertheless be developed through local planning processes, such as urban planning, master plans and restrictions on buildings in selected urban land-use plans, and local grant and incentive programmes.

Information and awareness

The third strategy relates to the information and empowerment of residents, and will raise the level of awareness and capacity of the public to address housing and health issues. The objective is to sensitize people to their housing conditions, and to provide them with information for making correct and healthy decisions concerning their own dwellings. Examples of such action could be:

- ✓ information campaigns in the media regarding the most relevant or most topical housing problems and the appropriate actions to be taken by the residents;
- ✓ dissemination of brochures and information materials to households in the municipality, focusing on the priorities identified by the LHHAP (also in foreign languages if necessary);
- ✓ preparation of a guidance document on housing problems, giving the respective contact persons in the municipality or other responsible institutions;
- ✓ integration of housing and health topics within other municipal or health-related areas by training and educating relevant staff and developing information materials for specific professions (school curricula, social work, municipal services such as energy and water provision, mobile care teams for home care provision, midwives, etc.); and
- ✓ Establishment, within the housing or health department, of advisory services on healthy do-it-yourself renovation and rehabilitation work (offering advice on, for example, selecting building materials and equipment and personal protection mechanisms such as the use of face masks, gloves, etc. during renovation work).

There are many opportunities to bring together several of the approaches suggested, and many of them will naturally overlap. The decision on the best way forward will require a thorough analysis of the main problems within the municipality or specific neighbourhoods, and a thoughtful discussion within the departments involved. For the development of information material, the help of experts or institutions working in this field may be required. For the development of such partnerships, the Directorate-General of Health as well as the Public Health Departments of the Regional Health Administrations can provide additional support and networking.

Since policy or technical action is the outcome of the LHHAP project, the working group will not be in charge of its implementation. Nevertheless, the work of the LHHAP group can provide the best means of identifying the appropriate action. Key requirements for a constructive and useful LHHAP report to the municipal authorities are:

- ✓ a clear and concise description of the main problems and priorities identified, where they are to be found and who is mostly affected;
- ✓ a summary of the report, clearly setting out the main priorities for action;
- ✓ a final chapter on recommended actions, identifying which technical problems should be tackled and what types of action seem suitable; and
- ✓ informal discussion of the draft report with the working group and representatives of all relevant municipal departments before official release of the final version.

National campaigns/projects to link to

For many of the housing and health problems that may be considered a priority at the municipal level, there may already be campaigns or projects on the regional or national scale. For example, if there is a national campaign on home safety, and in one municipality reducing home accidents is seen as a priority, the municipality may not need to develop its own action plan and information materials as the national campaign materials can often be used. The LHHAP therefore helps the municipality identify its needs and make use of existing, professionally developed resources, thus reducing the burden of developing a local action campaign.

After the municipality has identified areas of improvement, an attempt should be made to connect to projects carried out by the Directorate-General of Health or other national/regional health agencies, or to build on projects already developed by other municipalities. By tapping into existing efforts, the municipality can maximize effectiveness while keeping costs down.

- ✓ Contact the Directorate-General of Health to determine if there are national campaigns on the particular topic to support the municipality's efforts.
- ✓ Contact the Directorate-General of Health and other municipalities to determine if there are local campaigns that can be used or adapted.
- ✓ Conduct general research, using the Internet to find information on existing campaigns.

Appendix 1: Timelines for the LHHAP project

Below is an example timeline for the LHHAP. The schedule must be adapted to fit the unique political situation of each municipality.

Time frame	Activity
3 months to 6 weeks prior to data collection	Obtain political approval for LHHAP, determine project goals, set dates for data collection
2 months to 6 weeks prior to data collection	Decide on 1- or 2-week data collection exercise Select team members and obtain supervisor approval for time away from the office for the LHHAP project Secure the list of participant addresses (sample)
4 weeks prior to data collection	Reserve meeting rooms Reserve transportation for field visits
10 days to 1 week prior to data collection	Mail information letter to selected households Prepare Contact Sheet for each team member Assign Interviewer Code to each team member
Wednesday prior to data collection	Fax/e-mail press releases
Thursday prior to data collection	Press event Fax/e-mail press releases Prepare for training, install computer programs
Friday prior to data collection	Press event LHHAP software training, project overview and team member introduction
Data collection	Data collection (one- or two-week design)
Monday after data collection	Group meeting, debriefing, group reflection, follow-up
2–6 weeks after data collection	Data analysis Weekly group meeting for discussion and feedback in the first two weeks immediately following data collection
3–8 weeks after data collection	Draft report for discussion within municipality
1–3 months after data collection	Final report Media/public event for dissemination of results
2–6 months after publication of final report	Policy development, create and implement action plans
6+ months	Continue to follow up

Appendix 2: Example schedules for data collection exercise

Table 1. Example schedule (one-week data collection exercise)

Day	Activity	Participants
Friday prior to data collection	Group training and introductions	All group members*
Monday morning	Phone calls	All group members*
Monday afternoon	Phone calls	All group members*
Monday evening	Phone calls	At least 2 group members
Tuesday morning	Phone calls Database research	All group members 1 group member
Tuesday afternoon	Group meeting Phone calls Database research	All group members* All group members 1 group member
Tuesday evening	Phone calls	At least 2 group members
Wednesday morning	Field visit, including 2 home visits	All group members*
Wednesday afternoon	Phone calls Database research	All group members 1 group member
Wednesday evening	Phone calls	At least 2 group members
Thursday morning	Phone calls Database research	All group members 1 group member
Thursday afternoon	Group meeting Phone calls Database research	All group members* All group members 1 group member
Thursday evening	Phone calls	At least 2 group members
Friday morning	Field visit, including 2 home visits Database research	All group members 1 group member
Friday afternoon	Phone calls Database research	All group members 1 group member
Friday evening	Phone calls	At least 2 group members
Saturday afternoon (optional)	Phone calls Database research	All group members

* The asterisk indicates the minimum number of activities in which the data analyst should participate with the group. However, the data analyst is encouraged to participate in additional activities during the entire week of data collection.

Table 2. Example schedule (two-week data collection exercise)

	Day	Activity	Participants
Week 1	Friday prior to data collection	Group training and introductions	All group members*
	Monday afternoon	Phone calls	All group members*
	Monday evening	Phone calls	At least 2 group members
	Tuesday afternoon	Phone calls	All group members
		Database research	1 group member
	Tuesday evening	Phone calls	At least 2 group members
	Wednesday afternoon	Phone calls	All group members
		Database research	1 group member
	Wednesday evening	Group meeting	All group members*
		Phone calls	At least 2 group members
	Thursday afternoon	Field visit, including 2 home visits	All group members*
	Thursday evening	Phone calls	At least 2 group members
	Friday afternoon	Phone calls	All group members
		Database research	1 group member
Friday evening	Phone calls	At least 2 group members	
Saturday afternoon (optional)	Phone calls	All group members	
	Database research	1 group member	
Week 2	Monday afternoon	Phone calls	All group members
		Database research	1 group member
	Monday evening	Phone calls	At least 2 group members
	Tuesday afternoon	Phone calls	All group members
		Database research	1 group member
	Tuesday evening	Phone calls	At least 2 group members
	Wednesday afternoon	Phone calls	All group members
		Database research	1 group member
	Wednesday evening	Group meeting	All group members*
		Phone calls	At least 2 group members
	Thursday afternoon	Field visit, including 2 home visits	All group members
		Database research	1 group member
	Thursday evening	Phone calls	At least 2 group members
	Friday afternoon	Phone calls	All group members
Database research		1 group member	
Friday evening	Phone calls	At least 2 group members	

* The asterisk indicates the minimum number of activities in which the data analyst should participate with the group. However, the data analyst is encouraged to participate in additional activities during the entire week of data collection.

Appendix 3: Contact Sheet

No.	District, precinct, quarter, ward, zone	Full name	Telephone number	Interview completed	Interview refused (why)	1st contact (date & time)	2nd contact (date & time)	3rd contact (date & time)	Time of telephone interview appointment	Complete address	Postcode/city
1	Amora	Ernestina Rodríguez Muro Rodríguez	36.3256.6518	X		13/7 10:15	13/7 14:15			R Mário Sacramento LT 3110 2º D	7871-212 Seixal
2											
3											
4											
5											
6											
7											
8											
9											

Appendix 4: Data summary table for LHHAP

The table below suggests key indicators for identifying whether the sample reflects well the composition of the municipality (or selected neighbourhoods). The difference between the data from the municipality (or selected neighbourhoods) and the LHHAP sample should not be more than a few percent. During data collection, the LHHAP coordinator can use these data to quickly check whether the LHHAP data are in line with the expected distribution, or whether there is a need to focus on a specific age group or survey area.

Note: Population distribution by neighbourhood is only possible for the whole municipality. If more than one neighbourhood is selected, then the tables need to be constructed individually for each neighbourhood.

Population	Municipality	LHHAP sample (500 addresses)	Survey data (interviews)
District/quarter A	XX%	XX%	
District/quarter B	XX%	XX%	
District/quarter C	XX%	XX%	
District/quarter D	XX%	XX%	
District/quarter E	XX%	XX%	
	100%	100%	
Age groups	Municipality/selected LHHAP neighbourhoods	LHHAP sample (500 addresses)	Survey data (interviews)
0–18 years	XX%	XX%	
19–40 years	XX%	XX%	
41–65 years	XX%	XX%	
66 years and older	XX%	XX%	
	100%	100%	
Housing type	Municipality/selected LHHAP neighbourhoods	LHHAP sample (500 addresses)	Survey data (interviews)
One-family house	XX%	XX% (if possible)	
Dwelling/apartment	XX%	XX% (if possible)	
	100%	100%	
Housing age	Municipality/selected LHHAP neighbourhoods	LHHAP sample (500 addresses)	Survey data (interviews)
Up to 19 years	XX%	XX% (if possible)	
20–49 years	XX%	XX% (if possible)	
50 years and more	XX%	XX% (if possible)	
	100%	100%	
Tenure	Municipality/selected LHHAP neighbourhoods	LHHAP sample (500 addresses)	Survey data (interviews)
Owned	XX%	XX% (if possible)	
Rented	XX%	XX% (if possible)	
	100%	100%	
Household size	Municipality/selected LHHAP neighbourhoods	LHHAP sample (500 addresses)	Survey data (interviews)
1 person	XX%	XX% (if possible)	
2 persons	XX%	XX% (if possible)	
3 persons	XX%	XX% (if possible)	
4 persons	XX%	XX% (if possible)	
5 and more persons	XX%	XX% (if possible)	
	100%	100%	

Appendix 5: Sample text for letter to selected households

Dear Mr/Mrs/Ms

This letter serves to inform you of the forthcoming Survey on Housing and Health in (*enter name of municipality*), which has been developed by the World Health Organization (WHO) European Centre for Environment and Health, Bonn Office, in collaboration with the Directorate-General of Health. The survey will be carried out by the city of (*enter name of municipality*) from (*enter date*) to (*enter date*) and will be undertaken as part of the (*add name of relevant programmes / plans etc.*).

A random sample of households has been selected by the municipality, and yours is one of the 500 dwellings selected. We kindly ask that you agree to participate in this survey.

The telephone survey has been developed at European level, its key objective being to collect information on aspects of housing that can affect the health and well-being of the residents. According to WHO, the living environment and neighbourhood play an important role – positive or negative – in the physical and psychosocial well-being of the inhabitants.

A similar housing and health survey has already been completed in four Portuguese cities, and further surveys will to be conducted in other Portuguese cities. The collected data will allow the identification of health problems that may be related to housing conditions, and will provide data for the development of Local Housing and Health Action Plans for (*add municipality name*). It will provide recommendations to local housing and social policies, aiming to improve housing and health conditions.

The survey mainly analyses personal experiences and general satisfaction with housing. It offers the opportunity for residents to express their opinion on their housing situation. Only one resident will need to respond to the questions asked by the interviewer. The phone interview will take less than 30 minutes.

Participation in the survey is voluntary. It is carried out by phone interview and all data remain confidential. No other organization or individual is authorized to access or use the data. You will not be asked to purchase anything or to leave your dwelling.

The participation of you and your household is one of the factors essential for the success of this project. We urge you to participate by cooperating with our interviewers and responding to all the questions you are asked. If you have any questions regarding your participation in the survey, please contact the municipality (*add contact or phone number*).

Thank you for your attention.

Yours truly,

Mayor of Municipality

Appendix 6: Sample text for press release

Local Housing and Health Action Plans (LHHAP)

Following the Local Housing and Health Action Plan (LHHAP) projects conducted in Ferreira do Alentejo, Amarante, Mira and Seixal, the Directorate-General of Health has determined that it is important to better understand the housing conditions existing in other municipalities throughout the country. The Directorate-General of Health will therefore continue to collect data on housing conditions by conducting a LHHAP study in *(insert city)* in partnership with the Municipality of *(insert city)* and the Public Health Departments of the Regional Health Administrations. The LHHAP survey in *(insert city)* will take place on *(insert date)*. Results of the study will be released by *(insert date, ca. 2–3 months after the survey time)*. The local survey data will also contribute to a national plan of action.

The intention is to investigate a broad variety of housing types, in order better to understand the health impact of housing conditions and develop local and national health and housing priorities. The principal objective of the LHHAP is to develop recommendations regarding the quality and improvement of housing conditions that will promote residents' health. The survey identifies classic housing conditions related to health, such as overcrowding, indoor air quality, humidity and mould growth, heating and ventilation, mental health, affordability of energy, extreme indoor temperatures, home accidents, accessibility, social exclusion, residential quality, noise exposure, allergies, and privacy. Based on the analysis of the study, the authorities involved will be able to establish priorities for action. Utilizing the results of the survey, the municipality will work to improve housing conditions with the goal of improving the overall health of inhabitants.

Appendix 7: Sample list of LHHAP topics for Press Conference

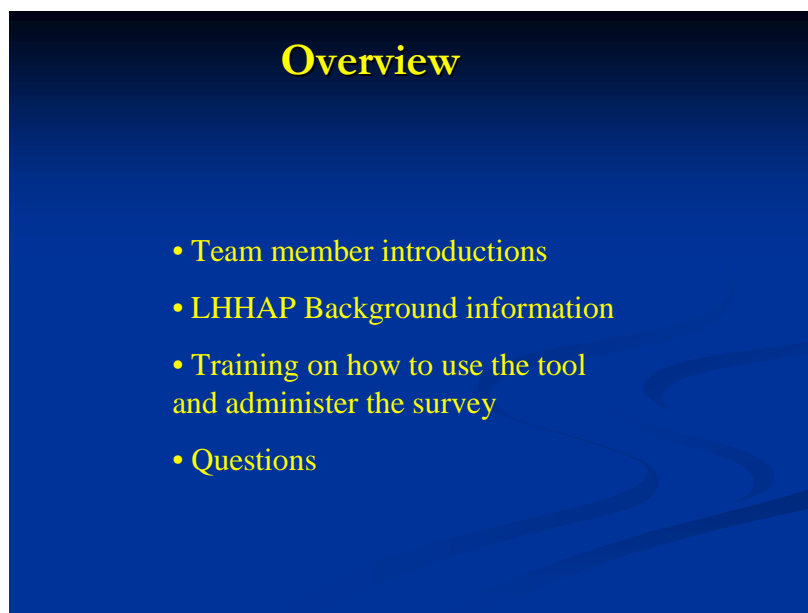
Local Housing and Health Action Plan

The LHHAP project will address the following housing problems and identify local priorities for action on:

- faults, disrepair or deterioration
- security/accessibility
- neighbourhood and residential environment
- electrical and sanitary installations
- home accidents
- health and illness
- building structure
- temperature
- energy consumption
- humidity and mould
- ventilation/indoor air exchange
- lighting
- tobacco smoke
- insect and pest infestation
- floor plan and structure
- noise
- building quality and maintenance
- level of satisfaction with the dwelling
- household socioeconomic information, rent levels, expenses, etc.

Appendix 8: Interviewer training document

The training of the LHHAP staff is facilitated by a PowerPoint presentation which presents the relevant features of the survey and the entry mask used for the phone survey. Each slide comes with a short explanation, pointing out the messages to be forwarded to the survey staff. The presentation can be downloaded together with the survey files at www.dgs.pt.



LHHAP: Scales of significance

Local level:

- Health benefits as a result of housing improvements
 - based on surveys and follow-up action

National level:

- National action to improve housing standards
 - based on local contributions to a national evidence base

LHHAP: Scales of significance

LHHAP objectives in (*ADD MUNICIPALITY NAME*)

- (*ADD GOAL # 1*)
- (*ADD GOAL # 2*)
- (*ADD GOAL # 3*)
- And so on...

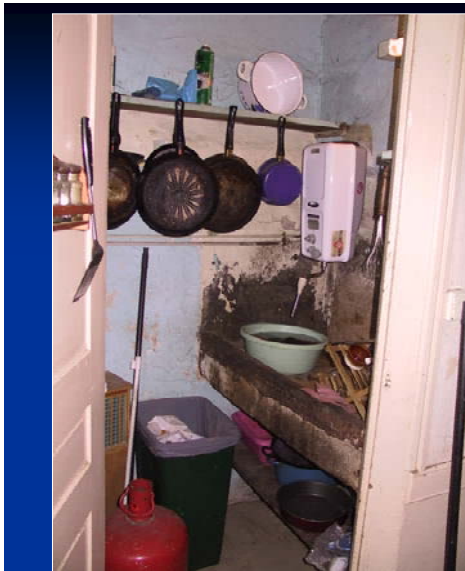
Portuguese LHHAP: Manual (1)

The **context** of urban and housing conditions:

- Humans spend a large part of their life at home
- Children, the sick and elderly—the most vulnerable populations spend the greatest amount of time at home
- A house will see three to four generations living in it
- Trend toward urbanization



Sanitary conditions



Hygiene conditions



Injuries



Mould



LHHAP: Overall objective

Improvements in key housing conditions serve as:

- a preventative strategy against housing-related health effects and injuries
- a means to mitigate social and health inequities within a population

Housing stock needs to match the social and life-expectancy changes of recent decades!!

LHHAP: Priorities

Top priorities:

- ***Eradicate substandard housing
- ***Reduce health threats and exposures
- ***Reduce injuries
- ***Improve health

LHHAP: Main topics

Housing Issues Covered by the Survey

- Faults, disrepair or deterioration
- Security / accessibility
- Neighbourhood and residential environment
- Electrical and sanitary installations
- Home accidents
- Health and illnesses
- Building structure
- Temperature
- Energy consumption
- Humidity and mould
- Ventilation/ indoor air exchange
- Lighting
- Tobacco smoke
- Insects and pest infestation
- Floor plan and structure
- Noise
- Quality and maintenance of the building
- Level of satisfaction with the dwelling
- Household socio-economic information, rent levels, expenses etc.

LHHAP: Survey work

Data collection

- 1) **Survey tool** - collection of new data through telephone survey
- 2) **Field visit** - evaluation of housing and neighbourhood conditions/structure by a local multidisciplinary team (from e.g. housing, urban planning, social, health, environment departments etc.)
- 3) **Existing data** - review data from municipality and other sources

LHHAP: Survey schedule

One-week data collection exercise

- Phone calls to administer questionnaire
- Field visits
- Group meetings
- Research into existing data sets by designated person

Rough schedule:

Day 1	Phone calls to administer the questionnaire
Day 2:	Group meeting / database research / phone calls
Day 3:	Field visit / database research / phone calls
Day 4:	Group meeting / database research / phone calls
Day 5:	Field visit / database research / phone calls
Day 6 (optional):	Database research / phone calls

LHHAP: Survey schedule

Two-week data collection exercise

- Phone calls to administer questionnaire
- Field visit
- Group meetings
- Research into existing data sets by designated person

Day 1	Phone calls to administer the questionnaire
Day 2:	Database research / phone calls
Day 3:	Group meeting / database research / phone calls
Day 4:	Field visit / phone calls
Day 5:	Database research / phone calls
Day 6 (optional):	Database research / phone calls
Day 7	Database research / phone calls
Day 8:	Phone calls / database research
Day 9:	Group meeting / database research / phone calls
Day 10:	Field visit / database research / phone calls
Day 11:	Database research / phone calls

LHHAP: Materials

Materials for each team member

- Contact Sheet
- Interviewer Code
- Participant letter
- Interview introduction sheet
- Computer software (Excel file with macros ENABLED)
- Identification card for field visits

LHHAP: Phone interviews

Remember

- Ask every question exactly how it is written
- Try not to give information beyond what is available on the Entry Mask
- SAVE interviews often!!

Types of questions

- Single-code
- Multi-code
- Fill in the blank

LHHAP: Survey questions

Types of questions / how to code

Every question must be answered before the program will continue.

- I don't know = Missing Data
- No response/ no answer = Missing Data
- Probe for number / Probe for answer

LHHAP: Contact Sheet

Staying organized

1. Track time of phone calls
2. Make appointments to return calls
3. Record completed interviews

#	District, precinct, quarter, zone	Complete Name	Telephone number	Interview completed	Interview Refused (why)	1st contact (date & time)	2nd contact (date & time)	3rd contact (date & time)	Time of telephone interview appointment	Complete address	Postal code / city
1	Amora	Ernestina Rodriguez Muro Rodriguez	36 3296 6518	X		13/7 10:15	13/7 14:15			R. Maro Sacramento LT 3110 2ª D	7871-212 Seixal
2	Amora	Eugenio Aguiar	210 696 686	X					13/7 16:30	R 28 Abril Lt 28	7871-212 Seixal
3	Amora	Cláudia Sofia Bataha	212 354 6854		X No time					R Alemdeda 2821	7871-212 Seixal
4											
5											
6											
7											
8											
9											
10											
11											

Dwelling code

Interview complete

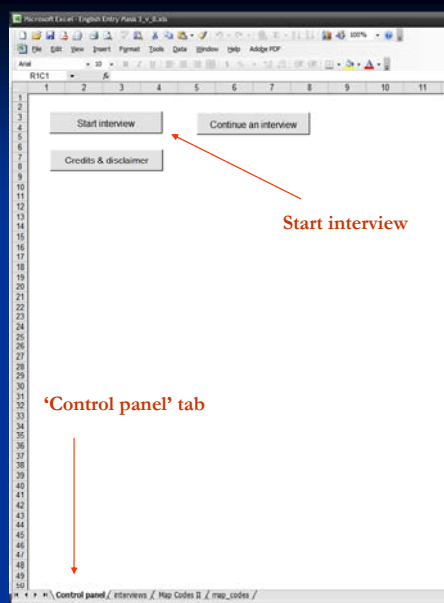
Interview declined (ask for reason)

Appointment time

LHHAP: Control Panel

Within the Excel document for the interview, go to the Control panel.

From Control Panel, click on 'Start interview' to start survey tool.



LHHAP: Entry mask

Start a new interview

Introduction:

Ask to speak to the head of the household or someone responsible for the family. Give your name and explain that you are calling on behalf of the Municipality. Ask the person if they will participate in the survey.
(If they agree, click 'New interview'.)

Credits & disclaimer

New interview

Introduction page

- Ask to speak to an adult
- Introduce yourself
- Tell them the survey will take about 25 minutes

Then click 'New interview'

LHHAP: Dwelling and interviewer codes

Interview Code:

Add information from Contact Sheet, then click '1st question'

Interview CODE - START and FINISH

ID-code:

Interviewer code: P7

Dwelling code: 2

Assigned by coordinator

Amora

District, precinct, quarter, ward, zone

1st question

Automatically save all entries

1	2	3	4	5	6
#	District, precinct, quarter, ward, zone	Complete Name	Telephone number	Interview completed	Interview Refused (why)
1	Amora	Francisco Alves	210 489 651	X	
2	Amora	Eugenio Aguiar	210 656 686	X	
4	Amora	Claudia Sofia Bataha	212 354 651		X No time

LHHAP: Entry mask

1st question of survey

Answer question...
Then click 'Next'

Question_01_Sex

Inhabitant Information

1. Are you male or female?

Male Female

Missing data

Previous Next

LHHAP: Question types

Types of questions / how to code

Single-code

- Ask for one answer

Multi-code

- Ask for an answer for each individual option—even Other
- If no answers match = No such problems

Fill in the blank

- Write answer in blank. 'No,' 'Nothing' ARE valid answers. Write this in the blank.
- If the person answers 'I dont know' = Missing Data

LHHAP: Question types

Yes/No

(Single Code)

Question_K_7_water in kitchen

Hygiene & sanitation

49. Is piped water available in the kitchen?

No

Yes

Missing Data

Previous Next

LHHAP: Question types

Single code

Question_BT_8_indoor toilet

Hygiene & sanitation

58. Is there a toilet inside the dwelling?
(If yes, read 'yes' options. Verify.)

No toilet inside the dwelling

Yes, a toilet is inside the dwelling AND it is in separate room or a bathroom

Yes, a toilet is inside the dwelling BUT it is NOT in a separate room or a bathroom

Missing data

Previous Next

LHHAP: Question types

Multi-code

Question_P_1_pests in house

Pests and insects

41. Currently, which of the following pests are present in your house?
(Read all options and ask for a response between options. Multicode.)

Ants

Flies

Fleas

Bedbugs

Rats or mice

Cockroaches

Other
(Ask then specify.)

None of the above
(After reading options, if no pests are identified, mark here.)

Missing data

LHHAP: Question types

Fill in the blank

Question_SA_2_harmful installations

Safety and accidents

69. Are there any installations or locations in the dwelling that you see as potentially harmful?
(If yes, fill-in keywords! If no, write 'no' in blank.)

Missing data

LHHAP: Question types

Probe question

Get a number as a response

Question_E_1_rate area

Housing environment

96. On a scale from 1 to 5, how do you rate your neighborhood overall as a place to live? 1 being very bad to 5 being very good? (Probe for NUMBER.)

Very bad Very good

1 2 3 4 5

Missing data

LHHAP: Question types

Important 'must ask' question

Ask this question exactly as it is written. Do not assume the answer is '2,' even if only 2 people live in the dwelling

Question_L_8_adults per room

Layout and structure

15. What is the maximum number of adults, 18 and older, sleeping in the same room?

adults

Missing data

Previous Next

LHHAP: Question types

Important 'must ask' question

Ask this question exactly as it is written. Do not assume that if the respondent does not smoke that the answer is 'no.' Other inhabitants or guests may smoke in the room.

Question_ET9_2

Environmental Tobacco Smoke

16. Do any adults sleep in the same room where people smoke? (Verify. If yes, read 'yes' options.)

No, never

Yes, sometimes

Yes, often

Missing data

Previous Next

LHHAP: Question types

Special follow up question

Follow up comes automatically if:

- Mould + leaky roof + unsealed doors/windows

--OR--

- No indoor toilet
- No running water in kitchen
- No electricity

Follow-up In-person visit

Conclusion

102. Your dwelling has been identified for follow-up investigation. Is it possible for a team of experts to visit your dwelling in person?

No

Yes

Missing data

Previous Next

LHHAP: Question types

Final question

Inhabitant comments

Interviewer comments

LHHAP: Control Panel

Resuming an interrupted interview

From Control Panel, click on 'Continue with an interview.'

LHHAP: Interview continuation

1. Scroll to row number
2. VERIFY dwelling code
3. Click 'Continue selected interview'

Excel sheet

Contact Sheet

	A	B	E
1	Dwelling number	Interv	
2	6	P7	
3	6	P7	
4	2	P7	

	A	B			
	#	District, precinct, quarter, ward, zone			
2	1	Amora			
3	2	Amora	Eugenio Aquiar	210 656 686	X
4	3	Amora	Cláudia Sofia Batalha	212 354 651	X No time

Appendix 9: Interview introduction sheet

The most difficult part of the survey is to establish first contact with the selected households. Those selected have to be convinced to participate in the survey. Each person who does not agree to participate makes the sample smaller. There is no sure way of persuading a person to agree to an interview; the interviewer always has to adapt to the person answering the phone call. If a child answers the phone, the interviewer should ask the child to call the parents. If the person is elderly, has problems understanding what is required, is frightened, or is apprehensive about telephone surveys, the interviewer has to improvise. Remember always to remain cordial, polite and patient.

The following points will help during the phone call. It may not always be necessary to mention all the listed points if the person already knows about the survey.

- ✓ Introduce yourself with your first and family name and tell the person on the phone that you are calling on behalf of the municipality.
- ✓ Refer to the LHHAP campaign and ask whether the information letter has been received.
- ✓ Explain the objective of the survey.
- ✓ Explain how the survey is conducted, being careful not to frighten the person.
- ✓ Inform the person that all data provided are confidential.
- ✓ If the person refuses to participate, ask for the reason (and mark in the Contact Sheet).

The total length of the opening of the phone call should not be more than three or four sentences. When asking questions (such as whether people want to participate), try to avoid "Yes-No" questions as it is difficult to get people to participate once they have said "No". Rather, ask whether they have time to do the interview now or whether a later appointment should be made. This avoids a straight rejection by the respondent and gives the interviewer the opportunity to adapt to the answer by suitable arguments and suggestions.

Appendix 10: SWOT protocol for neighbourhood visits

Interviewer ID: _____ Date: _____

Neighbourhood: _____

Start time: _____ End time: _____

LHHAP SWOT Neighbourhood Visit

S – Strengths of the neighbourhood

What environmental and structural characteristics are present that can promote and/or protect the health of neighbourhood residents and facilitate a healthy lifestyle?

W – Weaknesses of the neighbourhood

What neighbourhood characteristics are potential obstacles to residents' health, safety, well-being or attempts to lead a healthy lifestyle?

O – Opportunities of the neighbourhood

What factors or developments could positively influence the environmental and structural characteristics of the neighbourhood in the near future?

T – Threats to the neighbourhood

What trends, developments or urban planning projects could harm the ability of residents to live in a health-promoting environment and lead a healthy lifestyle?

Please give a general assessment of the housing stock and describe any visible problems.

Additional comments

Appendix 11: Home visit worksheet

Interviewer ID: _____ Date: _____

Dwelling Code: _____

Neighbourhood: _____

First name of adult resident hosting the home visit: _____

Start time: _____ End time: _____

LHHAP Home Visit

<u>Question</u>	<u>Answer</u>	<u>Comments</u>
Is there: (Please allow the resident help you answer the following questions)		
noticeable mould growth anywhere in the dwelling?	N Y _____	
a smell of dampness anywhere in the dwelling?	N Y _____	
a sink in the bathroom?	N Y _____	
anything unsatisfactory about the bathroom conditions?	N Y _____	
a functioning refrigerator?	N Y _____	
a separate solid waste bin?	N Y _____	
anything unsatisfactory about the condition of the kitchen?	N Y _____	
an installed heating system in all inhabitable rooms, including the bathroom?	N Y _____	
a vent for all gas fires	N Y N/A _____	
any issue that needs urgent attention?	N Y _____	

What things in the dwelling or immediate housing environment are dangerous, hazardous or abnormal?

What faults, defects and damage to the housing structure are visible?

Is the dwelling crowded? Does the dwelling layout provide adequate living space and privacy?

Does the dwelling feel like a safe place for refuge and rest?

What is the overall assessment of the dwelling and housing environment?

Additional issues identified and comments

Appendix 12: Analysis I – frequencies

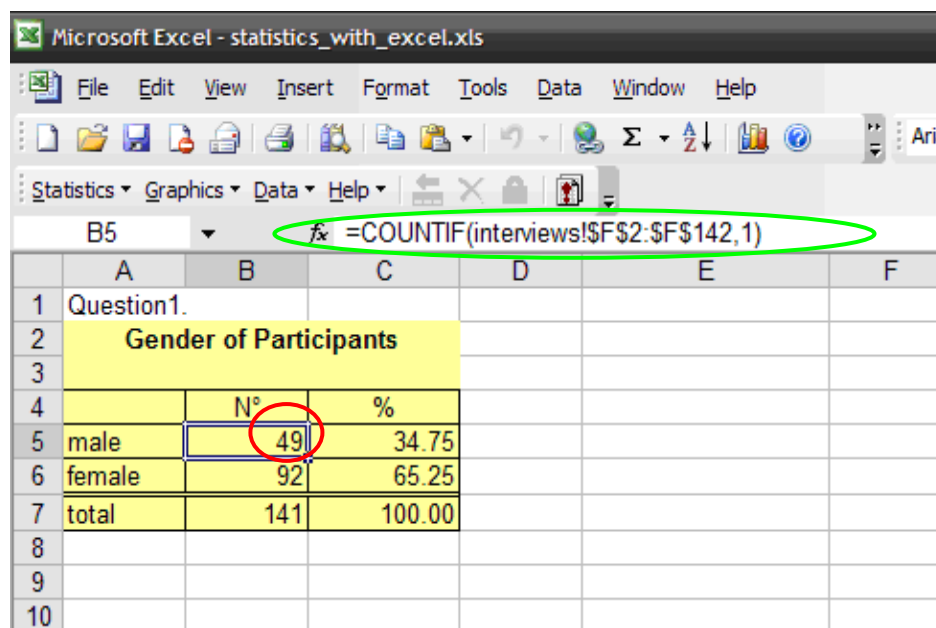
What is a frequency?

In statistical terms, the frequency of an event is the number of times the event has occurred in the experiment or the study. For the LHHAP survey, this means that a frequency represents the number of times a particular answer has been given. Two types of frequency are useful for the LHHAP analysis:

- absolute frequency, being the number of times a particular answer is given; and
- relative frequency, being the percentage gained by a particular answer compared to the total.

An example of both frequency types is given in Fig. A12.1. In the example, the answer “1=male” has been given 49 times and “2=female” 92 times. Thus, 34.75% of the respondents are male and 65.25% are female. The row “total” indicates the number of all respondents and of course must add up to 100%.

Fig. A12.1. Screenshot of the frequency table for Question 1 (gender)



	A	B	C	D	E	F
1	Question1.					
2	Gender of Participants					
3						
4		N°	%			
5	male	49	34.75			
6	female	92	65.25			
7	total	141	100.00			
8						
9						
10						

For most purposes, relative frequencies are more useful than absolute frequencies as they allow comparisons to be made.

The method that Excel uses for analysis is the definition of formulae. Formulae are always specific to the cells in which they are entered. For the example in Fig. A12.1, all six data elements (the number of male and female respondents, their respective percentages, and the number and percentage of the total) are computed through an individual formula. For example, the number 49 in cell B5 (marked with the red circle) is the result of the formula that has been entered into the cell (marked with the green circle). Fig. A12.1 shows how the Excel screen will look when adding the formula into cell B5.

Note that this example refers to the cell B5. Each cell has its own formula that computes the resulting data. It is important to note that the formula is slightly different for each cell.

Before starting the analysis, it is important to know the difference between the answer value (the survey data stored in the “interviews” worksheet shown on the next page) and the actual meaning of the answer. The “map codes” worksheet, which is part of the Excel tool (see green circle in Fig. A12.2), tells you how many possible answers there are to a question. Unless you are interested in only one answer, you should calculate the frequency for each possible answer to the question you are analysing.

The map code gives you the information on the meaning of each answer value. For example, the answer value “1” of question 8 below represents the answer “Close to a busy street”, while the answer value “2” represents “Close to a less busy street”. As the analysis program can only handle the values for the answers, it will work with the “1” and the “2” and the person carrying out the analysis needs to know that these values stand for “Close to a busy street” and “Close to a less busy street”. Fig. A12.2 shows the structure of the map code for questions 8, 9, 10 and 11.

Fig. A12.2. Screenshot of the “map codes” worksheet

	A	R	S	T	U
1	Legend	8	9	10	11
2	Condensed question	Which describes the housing circumstance?	How big is the dwelling?	What is the age of your building or house?	How many rooms can function as a living room or bedroom?
3	Multi-code option				
4	Type of answer	Integer	Integer	Integer	Integer
5	Number of existing values	2	8	9	1
6	Meaning	Close to a busy street	Under 30 sqm	Under 10 years	Number of rooms
7	Value	1	1	1	Unspecified
8	Meaning	Close to a less busy street	30-39 sqm	10-19 years	
9	Value	2	2	2	
10	Meaning		40-49 sqm	20-29 years	
11	Value		3	3	
12	Meaning		50-59 sqm	30-39 years	
13	Value		4	4	
14	Meaning		60-79 sqm	40-49 years	
15	Value		5	5	
16	Meaning		80-99 sqm	50-59 years	
17	Value		6	6	
18	Meaning		100-119 sqm	60-74 years	
19	Value		7	7	
20	Meaning		120 or more sqm	75-99 years	
21	Value		8	8	
22	Meaning			100 or more years	
23	Value			9	
24	Meaning				
25	Value				
26	Meaning				
27	Value				
28	Meaning				

How to calculate frequencies in Excel

Absolute frequencies for single-code questions

Single-code questions are those for which only one answer can be chosen. The collected data of those questions is stored in a single column.

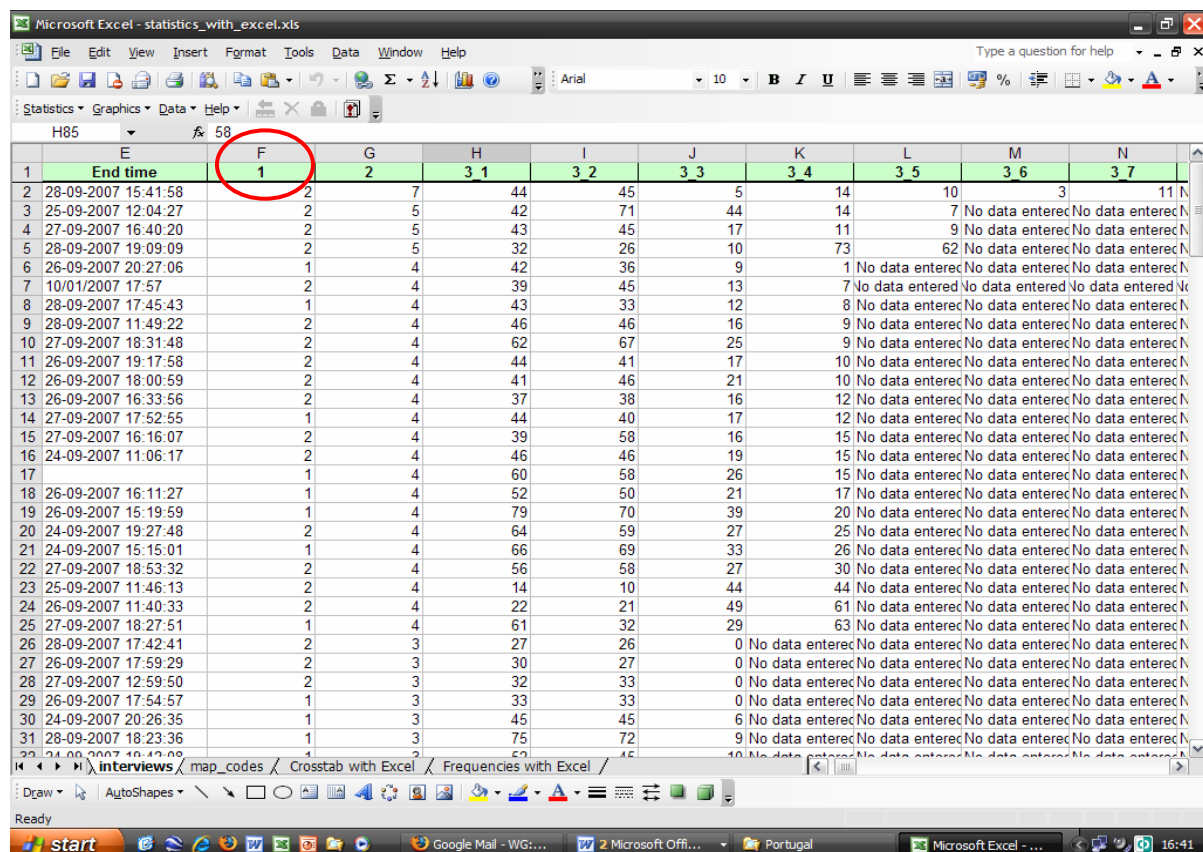
The number of people giving a specific answer is calculated by the formula:

=COUNTIF(interviews!\$F\$2:\$F\$142,1)

The components of the formula are as follows.

- All Excel formulae start with “=”.
- “COUNTIF” instructs Excel to count only those cells that contain a specific criterion (which is specified in parentheses after COUNTIF).
- “interviews!” is the name of the worksheet where, in the example, the data from the survey have been stored. The exclamation mark behind the name of the worksheet is required by Excel to be able to establish a relationship.
- “\$F\$2:\$F\$142” is the range of cells in which Excel will conduct the command given by the formula. In the example, these are the cells in rows 2–142 of column F in the “interviews” worksheet (note that the first row is reserved for the name of the variable – the so-called header row). The appearance of the “interviews” worksheet on screen is presented in Fig. A12.3, where column F (representing question 1) is marked with a red circle.

Fig. A12.3. Screenshot of the “interviews” worksheet containing the survey data



	E	F	G	H	I	J	K	L	M	N	
1	End time	1	2	3	1	2	3	4	5	6	7
2	28-09-2007 15:41:58	2	7	44	45	5	14	10	3	11	
3	25-09-2007 12:04:27	2	5	42	71	44	14	7	No data entered	No data entered	
4	27-09-2007 16:40:20	2	5	43	45	17	11	9	No data entered	No data entered	
5	28-09-2007 19:09:09	2	5	32	26	10	73	62	No data entered	No data entered	
6	26-09-2007 20:27:06	1	4	42	36	9	1	No data entered	No data entered	No data entered	
7	10/01/2007 17:57	2	4	39	45	13	7	No data entered	No data entered	No data entered	
8	28-09-2007 17:45:43	1	4	43	33	12	8	No data entered	No data entered	No data entered	
9	28-09-2007 11:49:22	2	4	46	46	16	9	No data entered	No data entered	No data entered	
10	27-09-2007 18:31:48	2	4	62	67	25	9	No data entered	No data entered	No data entered	
11	26-09-2007 19:17:58	2	4	44	41	17	10	No data entered	No data entered	No data entered	
12	26-09-2007 18:00:59	2	4	41	46	21	10	No data entered	No data entered	No data entered	
13	26-09-2007 16:33:56	2	4	37	38	16	12	No data entered	No data entered	No data entered	
14	27-09-2007 17:52:55	1	4	44	40	17	12	No data entered	No data entered	No data entered	
15	27-09-2007 16:16:07	2	4	39	58	16	15	No data entered	No data entered	No data entered	
16	24-09-2007 11:06:17	2	4	46	46	19	15	No data entered	No data entered	No data entered	
17		1	4	60	58	26	15	No data entered	No data entered	No data entered	
18	26-09-2007 16:11:27	1	4	52	50	21	17	No data entered	No data entered	No data entered	
19	26-09-2007 15:19:59	1	4	79	70	39	20	No data entered	No data entered	No data entered	
20	24-09-2007 19:27:48	2	4	64	59	27	25	No data entered	No data entered	No data entered	
21	24-09-2007 15:15:01	1	4	66	69	33	26	No data entered	No data entered	No data entered	
22	27-09-2007 18:53:32	2	4	56	58	27	30	No data entered	No data entered	No data entered	
23	25-09-2007 11:46:13	2	4	14	10	44	44	No data entered	No data entered	No data entered	
24	26-09-2007 11:40:33	2	4	22	21	49	61	No data entered	No data entered	No data entered	
25	27-09-2007 18:27:51	1	4	61	32	29	63	No data entered	No data entered	No data entered	
26	28-09-2007 17:42:41	2	3	27	26	0	No data entered	No data entered	No data entered	No data entered	
27	26-09-2007 17:59:29	2	3	30	27	0	No data entered	No data entered	No data entered	No data entered	
28	27-09-2007 12:59:50	2	3	32	33	0	No data entered	No data entered	No data entered	No data entered	
29	26-09-2007 17:54:57	1	3	33	33	0	No data entered	No data entered	No data entered	No data entered	
30	24-09-2007 20:26:35	1	3	45	45	6	No data entered	No data entered	No data entered	No data entered	
31	28-09-2007 18:23:36	1	3	75	72	9	No data entered	No data entered	No data entered	No data entered	
32	24-09-2007 10:49:09	1	2	50	45	10	No data entered	No data entered	No data entered	No data entered	

Together, "interviews!\$F\$2:\$F\$142" represents the data range, i.e. the information needed for Excel to know that the data in cells F2–F142 of the worksheet "interviews" should be analysed.

The \$ signs in front of the column name and the row numbers create an absolute reference, so that wherever this formula is used it will always come up with the same result. To calculate the frequencies of answers to another question (for which the collected data is, for example, stored in column Z rather than F), the F is replaced by the name of the relevant column:

=COUNTIF(interviews!\$Z\$2:\$Z\$142,1)

To separate the data range from the criterion, a comma is placed after the description of the range and this is followed by the criterion. In our example, the criterion is 1. Thus, the first formula instructs Excel to count all those cells in rows 2–142 within column F that contain a 1. The number of times answer 1 has been given will then come up as the frequency and the result of this formula.

To calculate the frequency of the second possible answer to question 1, the criterion has to be changed to count all those cells that contain a 2 in column F and rows 2–142. In the formula, criterion "1" is therefore exchanged to "2":

=COUNTIF(interviews!\$F\$2:\$F\$142,2)

The formula can therefore be used to calculate all frequencies for the same question simply by changing the criterion.

After calculating the frequencies for all possible answers (male and female in the example given in Fig. A12.1), the next row is used to calculate the total by using the formula:

=SUM(B5:B6)

This example formula instructs Excel to add up all numbers in the cells B5–B6 (in our example, this means adding the numbers for males and females).

You can customize the formula according to the cells in which you have calculated the frequencies. If, for example, you have calculated the frequencies in the cells G25–G34 (which means there are 10 answer options) and you want the sum of these frequencies, the formula would be:

=SUM(G25:G34)

Absolute frequencies for multi-code questions

While the data for single-code questions are stored in a single column (as there is always only one answer), the data for multi-code questions are stored in several columns, as there can be two or more answers to the question. For each possible answer, the LHHAP tool has an own column in the "interviews" worksheet where the data are stored. Therefore, the column name in the formula needs to be changed for each answer.

Table A12.1 shows absolute and relative frequencies for question 35 ("Do you have any of the following problems with the quality of air in your house?"). Answers to this

question are to be found in columns BK–BT in the example database. Thus, for each row of the table the column name in the formula needs to be changed.

Table A12.1. Question 35: “Do you have any of the following problems with the quality of air in your house?”

Problems with air quality			
	No.	%	
Dampness	53	16.06	<i>This relates to data from column BK in the “interviews” worksheet</i>
Dryness	11	3.33	<i>This relates to data from column BL in the “interviews” worksheet</i>
Dust and particles	53	16.06	<i>This relates to data from column BM in the “interviews” worksheet</i>
Smell	55	16.67	<i>This relates to data from column BN in the “interviews” worksheet</i>
Smoke	27	8.18	<i>This relates to data from column BO in the “interviews” worksheet</i>
not enough air exchange, stale air	10	3.03	<i>This relates to data from column BP in the “interviews” worksheet</i>
Too much air exchange, draught	25	7.58	<i>This relates to data from column BQ in the “interviews” worksheet</i>
Outside air pollution	73	22.12	<i>This relates to data from column BR in the “interviews” worksheet</i>
Other	0	0.00	<i>This relates to data from column BS in the “interviews” worksheet</i>
No such problem	23	6.97	<i>This relates to data from column BT in the “interviews” worksheet</i>
Total	330	100.00	

The data for the answer “Dampness” are stored in column BK in the “interviews” worksheet. Thus, the formula for the first row of Table A12.1 is:

=COUNTIF(interviews!BK\$2:BK\$142,1)

This assumes that 141 interviews were carried out and that the answer category “1” represents households that have a problem with dampness. If the criterion were “2”, then the result would be the number of households reporting no problem with dampness.

As the data for the next answer, “Dryness”, are stored in column BL, the formula is:

=COUNTIF(interviews!BL\$2:BL\$142,1)

This system can be followed for all answer categories of the same multiple code question, the formula remaining the same except for the column names.

To categorize answers to a question, the formula for calculating the absolute frequencies needs to be extended. A categorization is, for example, reasonable when calculating the frequencies of age distribution.

Table A12.2. Question 3: “Age of people living in dwelling”

Age of people living in dwelling (categorized)		
	No.	%
0–4	6	1.72
5–12	23	6.59
13–18	16	4.58
19–25	17	4.87
26–50	92	26.36
51–65	107	30.66
66–75	63	18.05
>75	25	7.16
Total	349	100.00

The formula for the first row (age 0–4 years) of Table A12.2 is:

=COUNTIF(interviews!\$H\$2:\$Q\$142,"<5")

This formula instructs Excel to count all those cells in rows 2–142 in columns H–Q that contain a value less than 5. The criterion here contains not only numbers but also the symbol for “less than” (<). Therefore, the criterion has to be written in double quotation marks.

The formula for the next row (5–12 years) requires the following extension:

**=COUNTIF(interviews!\$H\$2:\$Q\$142,"<13")
-COUNTIF(interviews!\$H\$2:\$Q\$142,"<5")**

This formula instructs Excel to count all those cells in rows 2–142 in columns H–Q containing a value less than 13, to count all of those cells in rows 2–142 in columns H–Q containing a value less than 5, and to subtract the second value from the first. Thus the result will be the number of people aged 5–12 years.

The section of the formula containing the criterion with the greater value must be placed first in order to obtain a result with a positive value.

With the changes in the above formula, two new options are inserted:

1. The formula draws data from columns H–Q, which means it considers all questions that ask for the age of a resident (up to 10 people) in parallel. This avoids the need to analyse all 10 columns individually. The possibility of analysing several columns together is available only for the age question (question 3) and the question on expenses (question 100).
2. The formula groups the age of the residents. By using this option, the analyst can adapt the analysis directly to specific age groups. This option can be applied to all answer options with continuous numbers (for example groupings can be made for age (making specific age groups as shown above), for percentages (making groups such as “from 25% to 50%”) or for number scales from 1 to 5 (grouping answers 1–3 and answers 4–5).

Relative frequencies for single- and multi-code questions

The way of calculating relative frequencies is the same for both types of question.

To calculate the relative frequency as a percentage, for the example given in Fig. A12.1, the following formula is used in cell C5:

=B5/\$B\$7%

B5 is the cell where, in the example, the absolute frequency (49 males) has been calculated. The value of this cell is divided by the value of the cell where the total number of answers has been calculated (B7 in our example). Again, the \$ signs in front of the column name (B) and the row number (7) establish an absolute reference.

The percentage sign ensures that the relative frequency is displayed as percentage.

To calculate the relative frequency for the next row in Table A12.1 (92 females) the formula is:

=B6/\$B\$7%

How to use the prepared analysis elements

The LHHAP tool comes with an Excel workbook comprising various worksheets. Next to the data entry masks for the phone interviews, the tool will contain worksheets entitled "interviews", "map codes" and "frequency examples".

- The "interviews" worksheet is where all the data from the survey are stored (this is the data source for all formulae used during the analysis).
- The "map codes" worksheet provides information on the meaning of the numbers for each variable. For example, the map code will tell you that a specific variable may have two answer options ("1" and "2") and that, for example, "1" stands for "No" and "2" stands for "Yes".
- The "frequency examples" worksheet contains pre-entered formulae for frequencies of some selected variables. As soon as data are entered into the "interviews" sheet during the phone survey, the frequencies will automatically be computed. From the various examples given in this sheet (clicking into each of the cells containing data will show the formula used for that cell), the analyst can easily develop further frequencies by simply copying the formulae and changing them slightly.

Appendix 13: Analysis II – cross-tabulations

What is a cross-tabulation?

A cross-tabulation displays the joint distribution of two or more variables. Whereas a frequency distribution provides the distribution of one variable, a cross-tabulation can describe the distribution of two or more variables simultaneously.

Table A.13.1 shows the basic idea of a cross-tabulation.

Table A13.1. Cross-tabulation of the variables “Do you have problems with dampness or condensation?” and “Do you have a ventilation system?”

Do you have a ventilation system?	Do you have problems with dampness or condensation?			Total
	No	Sometimes	Often	
No	50	20	15	85
Yes, a forced ventilation system	26	8	4	38
Yes, a free ventilation system	8	7	3	18
Total	84	35	22	141

The cross-tabulation shows the number of households that answered two questions in a specific combination. For example, 4 households reported having a forced ventilation system and often problems with dampness or condensation. The totals to the bottom and the right reflect the overall number of households that reported a specific condition. For example, the 35 on the bottom row indicates that, in total, 35 households answered “Sometimes” to the question on dampness and condensation problems. These 35 households are the sum of the three groups in the cells above: 20 of those who sometimes have problems with dampness and condensation have no ventilation system, 8 have a forced ventilation system and 7 have a free ventilation system.

The cross-tabulation shown in Table A.13.1 is the simplest type and only shows the number of households for each combination of answers. It is difficult with these data to make comparisons between the answer categories. Cross-tabulations are therefore usually extended to show percentages, making it easier to interpret the results. As there are two variables that have been crossed, there need to be two sets of percentages (one for each variable). In addition, it is normal to calculate the total percentage for each combination of answers. The section below addresses this in more detail.

Cross-tabulations are usually presented as a contingency table in a matrix format. Table A13.2 gives an example of a 3 x 3 contingency table. This displays the joint distribution of the variable “Do you have problems with dampness or condensation?”, which is the column variable in our example, and the variable “Do you have a ventilation system?”, which is the row variable. Both variables have three answer

categories. For the column variable, these are: "No", "Sometimes" and "Often". For the row variable, the categories are: "No", "Yes, a forced ventilation system" and "Yes, a free ventilation system".

For each category of the row variable, a set of numbers is created. The first set of numbers in this example refers to the households that answered "No" when asked: "Do you have a ventilation system?" The other sets of numbers provide the same information for households with a forced or a free ventilation system.

Table A13.2. Contingency table for the cross-tabulation of the variables "Do you have problems with dampness or condensation" and "Do you have a ventilation system?"

		Column variable			Total	
		No	Some-times	Often		
Row variable Do you have a ventilation system?	No	Frequency	50	20	15	85
		Row percent	58.82	23.53	17.65	(=100%)
		Column percent	59.52	57.14	68.18	
		Total percent	35.46	14.18	10.64	
Yes, a forced ventilation system		Frequency	26	8	4	38
		Row percent	68.42	21.05	10.53	
		Column percent	30.95	22.86	18.18	
		Total percent	18.44	5.67	2.84	
Yes, a free ventilation system		Frequency	8	7	3	18
		Row percent	44.44	38.89	16.67	
		Column percent	9.52	20.00	13.64	
		Total percent	5.67	4.96	2.13	
Total			84	35	22	141
				(=100%)		

Each set of numbers consists of four rows; these are explained one-by-one below.

Frequency

The frequency row shows that of the 85 households that answered "No" when asked if they have a ventilation system, 50 answered "No" to the question "Do you have problems with dampness or condensation?", 20 answered "Sometimes" and 15 answered "Often".

The frequency row therefore gives the normal distribution for the column variable, but limits this to those households that have answered "No" for the row variable.

Row percent

The second row of each dataset indicates row percent. The row percent shows the percentage of each answer to the column variable (in this case: No; Sometimes; Often). The row percent row therefore gives the same information as the frequency row, but expresses it as a percentage rather than a number.

In our example, for the first set of numbers, the row percent indicates the distribution of answers to the question "Do you have problems with dampness or condensation?" among the 85 households who said they had no ventilation system. Of these, 58.82% answered "No", 23.53% answered "Sometimes" and 17.65% answered "Often".

The values in the cells of the row percent row, added horizontally, should always add up to 100% ($58.82 + 23.53 + 17.65 = 100$).

Column percent

The third row of each dataset indicates column percent. The column percent shows the percentage of each answer to the row variable (in this case: "No"; "Yes, a forced ventilation system"; "Yes, a free ventilation system") given by all those with a specific answer to the column variable.

In our example, for the column "Sometimes" of the column variable in each set of numbers, the column percent indicates the distribution of the answers to the question "Do you have a ventilation system?" among the 35 households that said they sometimes had problems with dampness or condensation. In the example, 57.14% (20 households) of those that sometimes had problems with dampness or condensation said they had no ventilation system, 22.86% (8 households) said they had a forced ventilation system and 20% (7 households) said they had a free ventilation system.

The values in the cells of the column percent row, added vertically, should always add up to 100% ($57.14 + 22.86 + 20.00 = 100$).

Total percent

The last row of each set of numbers is total percent. This row indicates the percentage for each of the possible nine combinations of this example. For example, 35.46% (50 households) of all 141 households said they had no ventilation system and no problems with dampness or condensation, which is by far the most frequent combination. In all, 5.67% (8 households) reported having a forced ventilation system and sometimes problems with dampness or condensation.

How to create a cross-tabulation with Excel

For any kind of statistical action, Excel uses a formula that is specific to each cell. The following example explains the formula for each of the four rows in a set of numbers.

Formulae for frequencies

In our example, the formula for the frequency in the first set of number is:

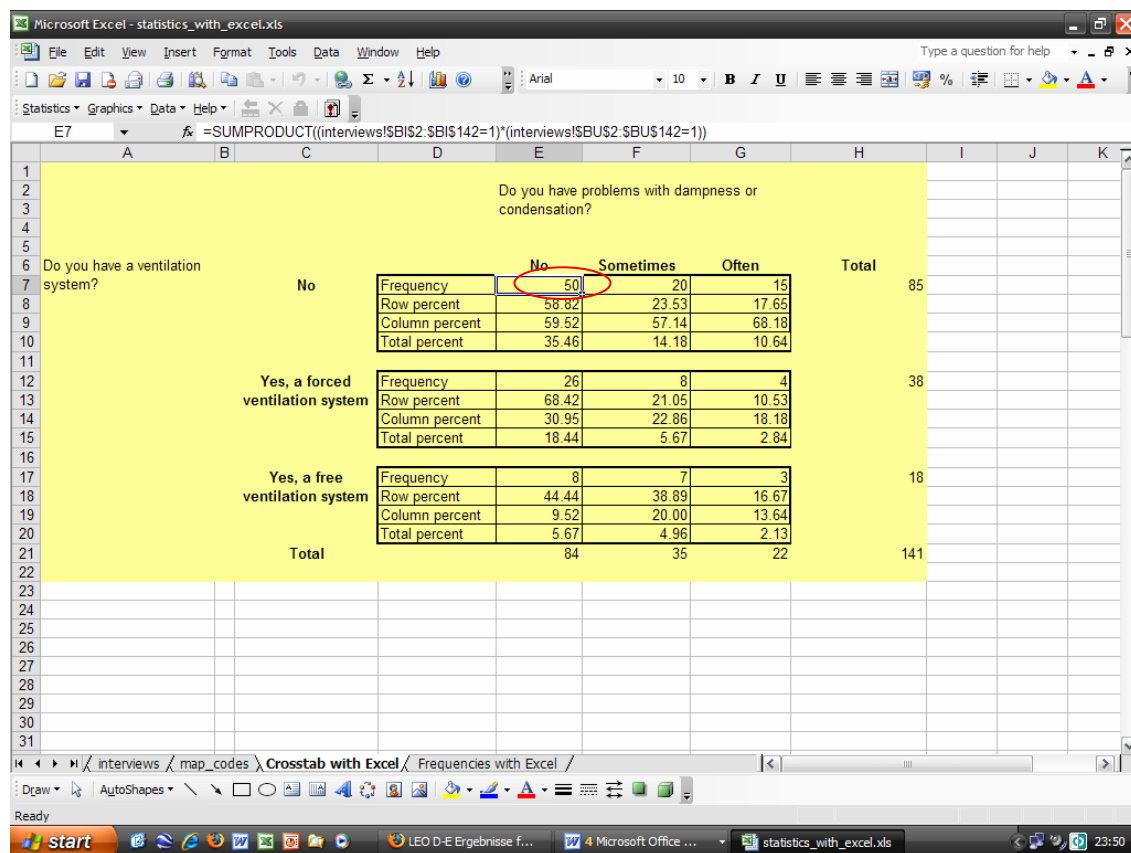
```
=SUMPRODUCT((interviews!$BI$2:$BI$142=1)  
*(interviews!$BU$2:$BU$142=1))
```

This formula needs to be entered in cell E7, as displayed in Fig. A13.1.

To calculate frequencies for the LHHAP database, you need to adapt the formula to your database. The components of the formula are as follows.

- All Excel formulae start with “=”.
- “SUMPRODUCT” is the function used for cross-tabulations.
- “interviews!” is the name of the worksheet where, in the example, the data from the survey have been stored. The exclamation mark behind the name of the worksheet is required by Excel to be able to establish a relationship.

Fig. A13.1. Screenshot of cross-tabulation in Excel

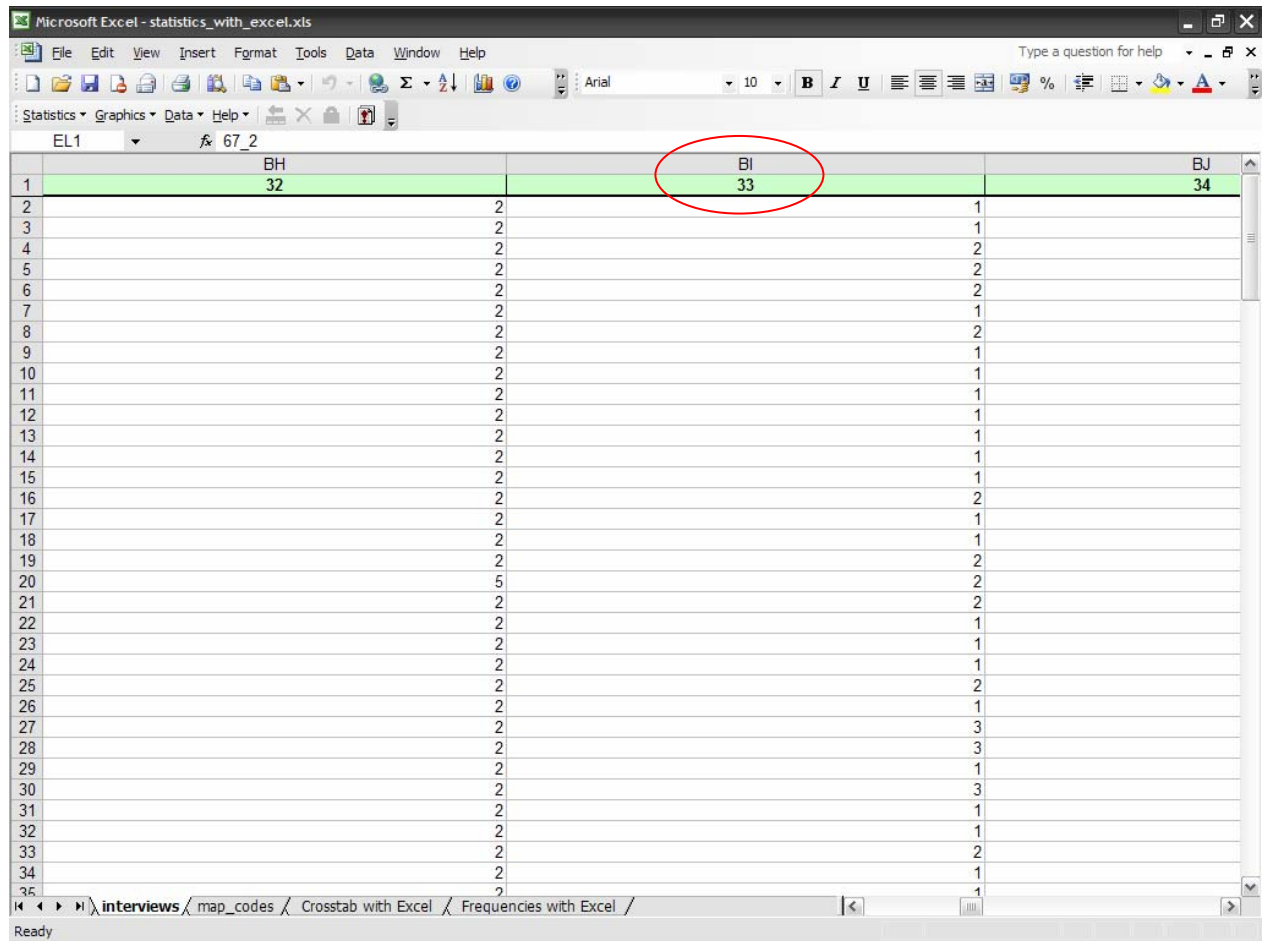


The part of the formula within the first set of parentheses refers to the column variable, whereas that within the second set of parentheses refers to the row variable.

In the example, BI is the column in which the data for the column variable are stored in the “interviews” worksheet (see Fig. A13.2) and BU is the column in which the data for the row variable are stored.

To calculate frequencies for a combination of other variables you will need to change the names of the columns (in the example BI and BU) to the names of the columns containing the variables that you want to use.

Fig. A13.2. Screenshot of the data sheet in Excel



The expression "\$BI\$2:\$BI\$142" means that the first row of the "interviews" worksheet is row 2 and that row 142 is the last row with interview data. The cross-tabulation will then work with the data from cells BJ2 to BJ142, which means it will consider 141 household cases. The first row (BI1) is reserved for the name of the question/variable (the so-called header row, see Fig. A13.2). The last number will change depending on the number of interviews conducted (if you have exactly 200 interviews, the data range would be from row BI2 to BI201).

Using "\$" in front of the column name (BI) and the row number (2–142) establishes an absolute reference. This means that when copying the formula to another cell of the worksheet, the formula will still refer to the same cells as before. This ensures that you are using the same variables for the whole contingency table.

The "=1" at the end of the first part of the formula tells Excel to look only at those cells from BI2 to BI142 that contain the answer "1", which in our example indicates the answer "No" to the question "Do you have problems with dampness or condensation?".

Accordingly, "=1" at the end of the second part of the formula tells Excel to look only at those cells from BU2 to BU142 that contain a "1", which in our example stands for the answer "No" to the question "Do you have a ventilation system?". Thus the final symbol in each set of parentheses is the search criteria that identifies – in our example – one of the nine possible combinations of answers.

Using the formula as explained above, Excel will calculate the frequency for the combination of the answers "No" to the row variable and "No" to the column variable.

To calculate the frequency for a different combination of answers, such as “No” to the row variable and “Sometimes” to the column variable, the formula would look like this:

**=SUMPRODUCT((interviews!\$BI\$2:\$BI\$142=2)
*(interviews!\$BU\$2:\$BU\$142=1))**

The only thing that needs to be changed is the last number in the part of the formula that indicates the search criteria within the column variable (see the red circle around the “2” in the formula above indicating the answer “sometimes”). This principle applies to all possible answers for the column variable. Just copy the formula to the next cell to the right and change the number of the search criterion according to the answer to the column variable.

To calculate the frequency for the next set of numbers of the row variable, the search criterion within the row variable needs to be changed (see the red circle around the “2” in the formula below indicating the answer “Yes, a forced ventilation system”).

**=SUMPRODUCT((interviews!\$BI\$2:\$BI\$142=1)
*(interviews!\$BU\$2:\$BU\$142=2))**

This formula will calculate the frequency for the combination of the answers “No” to the column variable and “Yes, a forced ventilation system” to the row variable.

Formulae for row percent

To be able to calculate row percent it is important to have the total number of cases of the frequency row. For our example, the formula used is (see Fig. A13.1):

=SUM(E7:G7)

for the first set of numbers, which will enter the numbers contained in the cells E7, F7 and G7 and will make a total of 85 households. For the second set, the formula is =SUM(E12:G12), and for the third it is =SUM(E17:G17). It is important to note that for variables with four or five answer options, the data range for the total will include four or five cells to make up the total (for example, =SUM(E7:I7) when there are five answer options from cells E7 to I7).

When the total number (100% of all cases within the set of numbers) is calculated, the individual row percentages for each answer category of the column variable (No, Sometimes, Often) can be created. In our example, the formula for calculating row percent is:

=IF(H7=0,0,E7/H7%)

The “E7/H7%” part of the formula calculates row percent. The number in cell H7 indicates the total number of all households (85) who answered “No” to the row variable. E7, in our example, indicates the cell containing the frequency for the combination of the answers “No” to the column variable and “No” to the row variable (50 households).

It is necessary to add the formula element “IF(H7=0,0,” to ensure that a division by zero is excluded (the detailed statistical reasons for this are not relevant for the analysis and are therefore not given here).

To calculate the row percent for the next column (combination of answers "No" to the row variable and "Sometimes" to the column variable), use the same formula and change only the name of the cell containing the frequency for this combination of answers. The formula will therefore be =IF(H7=0,0,F7/H7%) for the contingency table of our example. The row percent for the third column (No ventilation system and often problems with dampness or condensation) is calculated by the formula =IF(H7=0,0,G7/H7%).

To calculate the row percent for the next set of numbers, the name of the cell containing the frequency and that of the cell containing the row total for this set of numbers need to be changed. In our example, for the combination of "Yes, a forced ventilation system" and "No" for problems with dampness or condensation, the formula would be =IF(H12=0,0,E12/H12%). For the second column of this set of numbers, the formula would be =IF(H12=0,0,F12/H12%) and for the third column =IF(H12=0,0,G12/H12%).

Formulae for column percent

To be able to calculate the column percent it is necessary to have the total of the frequencies for each column variable category (considered in a vertical direction). This total indicates the number of households that answered with the corresponding answer to the column variable.

This total number of households by column variable category is calculated by using the formula:

=SUM(E7,E12,E17)

for the first column in our example ("No" for problems with dampness or condensation). This formula will enter the numbers of the cells E7, E12 and E17 and add up to a total of 84 households. For the second column (sometimes problems with dampness or condensation), the formula is =SUM(F7,F12,F17), resulting in 35 households.

When the total number (100% of all cases within the answer categories of the column variable) is calculated, the individual column percentages for each answer category of the row variable (no ventilation system, forced ventilation system, free ventilation system) can be created. The formula for calculating column percent for the first set of numbers is:

=IF(E21=0,0,E7/E21%)

In our example, this formula calculates the column percent for the combination of answers "No" to the row variable and "No" to the column variable. For "E7/E21%", E21 contains the total of the column frequencies and E7 contains the frequency of the specific combination of answers. Here again, the use of "=IF(E21=0,0," is necessary to prevent a division by zero.

To calculate the column percent for the next column of the same set of numbers (combination of answers "No" to the row variable and "Sometimes" to the column variable), use the same formula and change the name of the cell containing the frequency for this combination of answers (F7) as well as the name of the cell containing the column total (F21).

For the answer "Sometimes", the formula is therefore =IF(F21=0,0,F7/F21%) and for the answer "Often" it is =IF(G21=0,0,G7/G21%)

To calculate the column percentage for the next set of numbers, only the name of the cell containing the frequency for this set of numbers needs to be changed.

The formula for the combination of the answer "Yes, a forced ventilation system" to the row variable and the answer "No" to the column variable is =IF(E21=0,0,E12/E21%). For the combination of the answer "Yes, a free ventilation system" and "Often" problems with dampness or condensation, the formula would be =IF(G21=0,0,G17/G21%).

Formulae for total percent

In the total percent row of each set of numbers, the percentage of each of the possible combinations of answers (nine for this example) is calculated in relation to all households. Thus it is necessary to have the total number of all households in the contingency table. In our example, this is the last cell of the row in the "Total" column and is located in cell H21. Adding the numbers in the row and the "Total" column should in both cases come to the same number, which in our example is 141 households.

The formula for calculating the total percent for the first combination of answers (No ventilation system and No problems with dampness or condensation) is:

=E7/H21%

According to the principles used before, the formula for the next column in the same set of numbers (answer category "Sometimes") is =F7/H21%. The formula for the third answer category of the column variable ("Often" problems with dampness or condensation) and the next set of numbers ("Yes, a free ventilation system") is =G17/H21%.

Adding "Missing data" and "No data entered" categories

The contingency table consists of as many sets of numbers and columns as there are categories for the two variables that have been chosen for the cross-tabulation. A variety of options is possible (2 row variable categories by 5 column variable categories, 3 row variable categories by 4 column variable categories, and so on, depending on the number of the answer options).

However, there might be cases where more sets of numbers and columns are required than the number of available answer categories. This occurs when the interviewed household is not able to answer a question, which will be marked as "Missing data". Also, in some circumstances, specific questions will not be put to a household (e.g. if there is no ventilation system, the question on the evaluation of the system is skipped). Such skipped questions are marked as "No data entered".

If the column totals or row totals do not add up to the total number of households that responded to the survey, some households did not give a valid answer. For example, if 141 households participated in the survey, the total of answers should always be 141. If the total adds up to 138, it means that for three households there is either missing data or no data entered. A threshold of 10% loss is suggested as acceptable. Therefore, if the total number of households covered in the cross-tabulation is equal or greater than 90% of the total number of households in the

dataset, no "Missing data" or "No data entered" columns are required for the analysis. In other words, in our example, the 10% "accepted loss" represents 14 households, so if the total number of households covered by the tabulation is less than 141 minus 14, or 127 households, it is suggested that the cross-tabulation includes the two additional answer options.

Two more columns or sets of numbers need to be created in the cross-tabulation to reflect the households for which "Missing data" or "No data entered" is given. The formulae for these additional columns or sets of numbers are in general the same as described above for the variable categories. The only difference is that, instead of numbers, some text has to be included in the formulae calculating the frequencies. The example below shows how to deal with this additional element.

In Fig. A13.3, the row variable ("Do all the stairs have sufficient and operational light equipment?") has a set of numbers entitled "Missing data" and a set of numbers entitled "No data entered", in addition to the four answer options given. The formula for the first cell (E92 in Fig. A13.3) of the frequency row in the "Missing data" set of numbers (marked with a red circle in Fig. A13.3) is:

**=SUMPRODUCT((interviews!\$E\$2:\$E\$142=1)
*(interviews!\$F\$2:\$F\$142="Missing data"))**

The part of the formula within the second set of parentheses refers to the row variable and, since we want to know the number of cases of "Missing data" within the row variable, "Missing data" has to be entered as the search criterion. To enable Excel to understand that the search criterion is text, it has to be written in double quotation marks.

Fig. A13.3. Screenshot of contingency table for the cross-tabulation of the variable "Items involved in accidents or injury: stair, staircase" and the variable "Do all the stairs have sufficient and operational light equipment?"

		Items involved in accidents or injury: stair, staircase				Total
		Mentioned	Not mentioned	Missing data	No data entered	
Do all the stairs have sufficient and operational light equipment?	None of the stairs have adequate	Frequency	0	0	0	1
		Row percent	0.00	0.00	0.00	100.00
		Column percent	0.00	0.00	0.00	0.00
		Total percent	0.00	0.00	0.00	0.71
	Yes	Frequency	3	12	2	90
		Row percent	2.80	11.21	1.87	84.11
		Column percent	0.00	0.00	0.00	0.00
		Total percent	2.13	8.51	1.42	63.83
	Some stairs inside do not have	Frequency	1	1	0	7
		Row percent	11.11	11.11	0.00	77.78
Column percent		0.00	0.00	0.00	0.00	
Total percent		0.71	0.71	0.00	4.96	
Some stairs outside do not have	Frequency	0	0	0	2	
	Row percent	0.00	0.00	0.00	100.00	
	Column percent	0.00	0.00	0.00	1.69	
	Total percent	0.00	0.00	0.00	1.42	
Missing data	Frequency	0	0	0	2	
	Row percent	0.00	0.00	0.00	100.00	
	Column percent	0.00	0.00	0.00	0.00	
	Total percent	0.00	0.00	0.00	1.42	
No data entered	Frequency	0	3	1	16	
	Row percent	0.00	15.00	5.00	80.00	
	Column percent	0.00	0.00	0.00	0.00	
	Total percent	0.00	2.13	0.71	11.35	
Total		4	16	3	118	141

The same principle applies for the "No data entered" set of numbers. The formula for the first cell (E97) of the frequency row in the "No data entered" set of numbers is therefore:

**=SUMPRODUCT((interviews!\$EL\$2:\$EL\$142=1)
*(interviews!\$FL\$2:\$FL\$142="No data entered"))**

Also, for the column variable (in our example, the variable "Items involved in accidents or injury: stair, staircase"), "Missing data" and "No data entered" need to be entered in the formula. The formula for the frequency cell of the "Missing data" column is:

**=SUMPRODUCT((interviews!\$EL\$2:\$EL\$142="Missing data")
*(interviews!\$FL\$2:\$FL\$142=1))**

This formula considers the existence of the category "Missing data" in the column variable and therefore puts it within the first set of parentheses.

The formula for the frequency cell of the "No data entered" column is computed in the same way, the formula therefore being:

**=SUMPRODUCT((interviews!\$EL\$2:\$EL\$142="No data entered")
*(interviews! \$FL\$2:\$FL\$142=1))**

How to use the prepared analysis elements

The LHHAP tool comes with an Excel workbook comprising various worksheets. Next to the data entry masks for the phone interviews, the tool will contain worksheets entitled "interviews", "map codes", "frequency examples" and "cross-tabulation examples".

- The "interviews" worksheet is where all the data from the survey are stored (this is the data source for all formulae used during the analysis).
- The "map codes" worksheet provides information on the meaning of the numbers for each variable. For example, the map code will tell you that a specific variable may have two answer options ("1" and "2") and that, for example, "1" stands for "No" and "2" stands for "Yes".
- The "frequency examples" worksheet contains pre-entered formulae for frequencies of some selected variables. As soon as data are entered into the "interviews" sheet during the phone survey, the frequencies will automatically be computed. From the various examples given in this sheet (clicking into each of the cells containing data will show the formula used for that cell), the analyst can easily develop further frequencies by simply copying the formulae and changing them slightly.
- The "cross-tabulation examples" worksheet contains pre-entered formulae for selected variable combinations. As for the frequencies, these formulae can be used to easily develop the formulae for additional cross-tabulations.