



WHO second technical meeting on quantifying disease from inadequate housing

Meeting report

Bonn, Germany, 15-17 November 2006



ABSTRACT

The WHO European Centre for Environment and Health is addressing the question "how much human health is negatively affected by inadequate housing?" to support European policy-makers. With the support of the German Ministry of Environment, experts were invited to a meeting in Bonn on November 15-17, 2006 to review and assess the evidence base for quantifying environmental burden of diseases (EBD) for housing-health linkages selected by the first meeting in 2005. The experts presented the available evidence of the association between housing factors and health effects, and identified six housing-health linkages for which a burden of disease assessment will be undertaken (damp / mould and asthma; crowding and tuberculosis; house dust mites and asthma; carbon monoxide and poisoning; home safety and fall injuries; and lack of ventilation). In addition, the experts agreed on a list of relevant housing and health issues for which short evidence summaries will be prepared.

The experts agreed to continue with a first assessment of the environmental burden of disease of inadequate housing and formed six working groups to develop draft assessments. WHO will act as the secretariat to the expert working groups and coordinate the overall process.

Keywords

AIR POLLUTION INDOOR -ANALYSIS - ADVERSE EFFECTS
HOUSING - STANDARDS
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CONTENTS

Page

Introduction and objectives	1
Linkages for discussion	1
Discussion and selection of linkages	2
Summary of expert group agreements	5
Planning the work.....	6
Summary of discussion on the way forward	8
Conclusions and recommendations	10
Annex 1	
LIST OF PARTICIPANTS	11
Annex 2	
LIST OF TOPICS AND EXPERTS	15
Annex 3	
COUNTRY GROUPINGS FOR GLOBAL ASSESSMENT ACCORDING TO WHO SUBREGIONS.....	16
Annex 4	
PROPOSED TABLE OF CONTENT	17
Annex 5	
BACKGROUND DOCUMENTS OF ALL PARTICIPANTS	20

Introduction and objectives

The meeting was opened by Michal Krzyzanowski as the head of the WHO Bonn office, and Gudrun Lücke-Brunk as the representative of the German Ministry of Environment which had funded the meeting.

The WHO secretariat then provided the objectives of the meeting and presented the approach of the Environmental Burden of Disease (EBD) and its application to policy-making. This was followed by a review of the progress on the development of an EBD for inadequate housing conditions achieved since 2005.

The objectives for the meeting were defined to be

- review of evidence base for housing-health linkages as proposed by the expert meeting in 2005
- selection of a key set of linkages with most solid evidence, to be used for the calculation of the EBD of inadequate housing - for selected housing risk factors - as a part of a publication on housing EBD
- agreement on working schedule and working groups

The deliverable of the work was expected to be a WHO brochure on the EBD of inadequate housing, possibly as a part of the WHO EBD series published by WHO Headquarters.

Linkages for discussion

Based on the background documents provided by the experts on individual housing-health linkages, a short introduction on the strength of evidence was presented for each linkage, focusing on the exposure-outcome relationship and the exposure data for national populations. The housing risk factors to be discussed at the meeting were:

- | | |
|-------------------------------|---------------------------------|
| - Rodents and pests | - Ventilation in the dwelling |
| - House Dust Mite allergens | - Neighbourhood noise |
| - Dampness | - Particulate Matter 10 and 2.5 |
| - Environmental Tobacco Smoke | - Low indoor temperatures |
| - Crowding | - Home safety issues/ design |
| - Radon | - Lead |
| - Benzene | - Mould |
| - Formaldehyde | - Carbon monoxide |
| - Nitrogen oxide | |

A full list of the contributions can be found in annex 2.

Discussion and selection of linkages

The experts were divided into four working groups based on the health outcome of the presented housing-health linkages. The task for each working group was to provide a ranking of the linkages based on evidence and expert assessment, identifying the strongest linkages within the group. The four working groups related to the following health outcomes:

- 1) Asthma and tuberculosis
(Formaldehyde, Nitrogen oxide, Ventilation, Crowding, Rodents, House Dust Mites, Dampness)
- 2) Cardiorespiratory and cancer
(ETS, Radon, Benzene, Neighbourhood noise, Low temperatures, PM_{2.5} and PM₁₀)
- 3) Injuries
(Home safety and home design)
- 4) Mental and neurological
(Lead, Mould, Carbon monoxide)

The plenary discussion on the selection of the linkages was initiated by the reports of the four working groups, which provided the results of their first selection process to the participants. Within the working groups, the following linkages were selected as those with sufficiently strong and reliable evidence:

Working group 1: Asthma and tuberculosis

- Dampness and asthma
- Ventilation (NB – this is rather considered a modifier and “problem solution”. Thus, its contribution will have to be arranged differently)
- Crowding and tuberculosis
- House Dust Mites and allergy / asthma symptoms

Working group 2: Cardiorespiratory and cancer

- Radon and lung cancer
- ETS and lower respiratory infections

Working group 3: Injuries

- Home safety / design and accidents

Working group 4: Mental and neurological

- Carbon monoxide and poisonings / neurologic sequelae

The meeting participants then reviewed all suggested linkages in plenary and provided a number of comments to each of them. The discussion and the decisions made by the expert group are summarized below:

Dampness => asthma and asthma symptoms

Damp was seen as an extremely relevant housing factor involved in respiratory and allergic effects. It shows a strong association between exposure and outcome, which can be quantified rather easily. It has specific significance for children and has a high policy relevance as a

traditional housing risk factor. Also, it has a high prevalence in housing, is not exclusively associated with old or substandard housing, and therefore affects wide parts of the population.

The expert group recommended to possibly adding mould to the exposure if sufficient evidence on the exposure-response relationship is available. Cold may be considered as an additional risk factor as it does increase the likelihood of condensation.

The expert group selected the linkage for EBD calculation.

Ventilation

Ventilation – or lack of it – was considered a key housing parameter affecting all indoor air exposure problems. Due to its cross-cutting nature and its central position in controlling exposure, potential problems of double-counting when related to health outcomes were expected. The expert group therefore decided to present ventilation as modifier and potential solution to housing problems. Although no direct EBD calculation was to be done for ventilation, available data that links lack of ventilation to direct health outcomes could also be discussed in the chapter.

The expert group selected the linkage as special section in the report, providing information on its health relevance.

Crowding => Tuberculosis

The relevance of crowding for the spread of infectious diseases represents a traditional element of housing and environmental health and was considered an important aspect of housing and health. Associated with socio-economic status, the issue of crowding also has an inequity dimension that makes it a policy-relevant housing factor. Data on crowding can be taken from routine surveys, while for the risk estimate the evidence seemed restricted to some countries only.

The expert group suggested looking into other infectious diseases if evidence on an association with crowding would be available.

The expert group selected the linkage for EBD calculation, requesting additional evidence review as a part of the first chapter draft.

House dust mites => asthma symptoms

The exposure to house dust mites was considered a major housing issue as its exposure is exclusively housing-related. It shows a strong association between exposure and outcome that has been quantified already, and has high policy relevance because the associated outcome of asthma is one of the emerging avoidable health outcomes largely caused by environmental factors

Due to the currently available evidence derived from two major international studies, the EBD assessment may be restricted to a limited age group of the population. The expert group requested from the responsible expert to provide an assessment for an extended age group if such an extension can be accepted from scientific point of view.

The expert group selected the linkage for EBD calculation.

Radon => lung cancer

The experts agreed that there was sufficient evidence and that radon was one of the best-known housing and health risks. However, problems were considered to be the difficult exposure estimates and the large variations between / within countries. Specifically, it was noted that the synergistic effect with smoking and ETS was to be considered.

As an international expert group on EBD of radon exists, radon was suggested to be covered only in a two-page summary based on the work of the expert group.

A summary statement with a short overview of data was agreed upon by all experts.

ETS => lower respiratory infections

For ETS, strong evidence has been collected and especially for children, the policy relevance is high. However, there was discussion whether it is a housing issue, and it was concluded that ETS is a public health issue that needs to be addressed and that housing is the setting of exposure. Nevertheless, housing (and ventilation) are not the main strategies to address the problem and the public health message should focus on “no smoking” in first place.

As an WHO expert group on EBD of ETS for children exists, it was suggested to be covered by a two-page summary based on the work of the WHO expert group. Potentially, additional calculations on adults may be made based on the WHO methodology.

A summary statement with a short overview of data was agreed upon by all experts.

Housing conditions and design => falls

Home injuries were considered by all experts to be a major health issue of inadequate housing conditions, with high policy relevance for both children and elderly. The review of evidence provided sufficient data for few countries, which needs to be extended but may be sufficient for a generalized risk estimate. However, it seemed difficult to identify the attributable fraction of housing for accident cases, as there was always some degree of behavioural influence in each accident.

The experts requested that an acceptable way is found to compile the data required by EBD method. However, it may be an alternative solution to cover missing data with expert judgment (eg direct estimations using an agreed-upon risk ratio based on selected countries), which has to be adequately documented and justified.

The expert group selected the linkage for EBD calculation, expecting the first chapter draft to contain a scientifically sound and convincing way of providing data and risk assessments.

CO => mortality and neurologic sequelae

All experts agreed that carbon monoxide was a typical housing issue and represented a threat that was directly related to indoor conditions and – most often – inadequate housing conditions. The health outcome of CO poisoning is most severe and has high policy relevance, especially as there

are clear prevention steps that can be taken. Sufficient risk estimates can be combined with European data from several sources.

The expert group recommended cooperation with the accident group and the Injury Database (IDB). As well, some methodological issues regarding severity weights of neurologic sequelae were to be solved (otherwise, the outcome should restrict to mortality).

The expert group selected the linkage for EBD calculation, requesting from the author a solution on the severity weights in the first chapter draft.

Summary of expert group agreements

In summary, the final list of linkages for which a first calculation of the EBD of inadequate housing is to be done was agreed to contain:

- Dampness (and possibly mould) => asthma and asthma symptoms
- Lack of ventilation
- Crowding => Tuberculosis
- House dust mites => asthma symptoms
- Housing conditions => falls
- CO => mortality and neurologic sequelae

The selection of the linkages also brought consensus amongst the experts that the final document should not exclusively focus on the selected linkages, which may lead to wrong interpretations that other housing risk factors would have no health relevance. To present housing and its health impact holistically, it was agreed that not only for ETS and radon, but for all other housing-health linkages a two-page statement summarizing the current state of knowledge should be included. The list of candidates for which such summary statements are considered is

- ETS and lower respiratory infections (based on ongoing EBD work by WHO Rome office)
- Radon and lung cancer (based on ongoing EBD work by a scientific expert group)
- Rodents, pests and cockroaches and asthma
- Formaldehyde and lower respiratory symptoms
- Nitrogen oxide and lower respiratory symptoms
- Neighbourhood noise and hypertension
- Indoor cold and mortality¹
- PM_{2.5} and PM₁₀ and mortality
- Lead in homes and lead poisoning
- Mould and depression

A suggested structure for the two-page summary statement can be found in annex 4.

¹ A comment was made by the expert contributing on the issue of indoor cold, stating that if the UK evidence on the housing-attributable fraction of excess winter deaths was an acceptable solution, the linkage could provide adequate data for a large number of European countries. It was agreed that an updated draft, providing arguments for extrapolating the UK evidence and using direct estimation or expert judgment, should be provided to the WHO secretariat as soon as possible for a final decision.

The WHO secretariat may add other linkages to this list, depending on the potential contribution of other relevant housing-health linkages with adequate evidence. Those additional topics could e.g. be provided by expert contributions to the previous meeting in 2005, at which a number of linkages was assessed as having insufficient evidence for the calculation of the EBD of inadequate housing (e.g. heat, housing quality aspects, fear of crime, physical activity etc.). However, in many cases there may be sufficient data to provide a two-page summary of the impact on health.

In addition, the work of WHO HQ on the EBD of solid fuel burning in homes can be added as a two-page summary statement, as well as the work on the EBD of noise which looked into the impact of street noise exposure on cardiovascular outcomes and myocardial infarctions. Similarly, a summary statement may be considered for the cardiovascular effects of traffic noise exposure in the home, taken from a WHO project on the EBD of noise.

Planning the work

After the selection of the key linkages for the EBD assessment, working groups were formed to discuss the work process for each of these linkages and identify the experts willing to commit to the development of this work. All evolving working groups were asked by the WHO secretariat to discuss the roles of the working group members, the contributions they would provide, and whether the provision of a first draft by June 2007 would be feasible.

The working groups reported back to the plenary and provided their first working plans:

Group 1: Damp (and mould) and asthma

Main contributors: Aino Nevalainen, Maritta Jaakkola

Working group members: Bernhard Link, Ian Matthews, Janet Rudge, Nicolas Gilbert

Draft by June 2007 latest: Yes

Group 2: Crowding and tuberculosis

Main contributors: Philippa Howden-Chapman, David Jacobs

Working group members:

Draft by June 2007 latest: Yes (including review of evidence)

Group 3: House dust mites and asthma / asthma symptoms

Main contributor: Ian Matthews

Working group members: David Crowther

Draft by June 2007 latest: Yes (including definition of population base for the assessment)

Group 4: Carbon monoxide and poisoning / mortality

Main contributors: Stefanos Kales

Working group members: Robert Bauer

Draft by June 2007 latest: Yes (addressing method issues)

Group 5: Home safety / design and falls in homes

Main contributors: to be identified

Working group members: Maggie Davidson, David Ormandy, Robert Bauer

Draft by June 2007 latest: first draft in March as discussion paper, proposing method for EBD assessment

Group 6: Lack of ventilation

Main contributors: Jan Sundell, Lidia Morawska

Working group members:

Draft by June 2007 latest: Yes (addressing the relevance of ventilation as a solution to indoor air quality problems)

For the other linkages, the following experts made a commitment to provide a two-page summary statement by June 2007.

- ETS and lower respiratory infections: Maritta Jaakkola (taking EBD for children from Rome office, possibly adding EBD adults estimate based on same method)
- Radon and lung cancer: Olivier Catelinois (taking results from the EBD expert group on radon)
- Rodents, pests and cockroaches and asthma: Stephen Battersby
- Formaldehyde and lower respiratory symptoms: Nicolas Gilbert
- Nitrogen oxide and lower respiratory symptoms: Nicolas Gilbert
- Neighbourhood noise and hypertension: Hildegard Niemann
- Indoor cold and mortality: Janet Rudge / Jonathan Healy
- PM_{2.5} and PM₁₀ and mortality: Lidia Morawska (focus on gas consumption in homes, possibly infiltration in hot spot areas)
- Lead and lead poisoning: David Jacobs
- Mould and depression: Edmond Shenassa

Additional topics to be explored could be:

- Solid fuel combustion and selected health outcomes: WHO HQ
- Housing quality and mental health: Gary Evans (tentative)
- Light and mental health: Mary Jean Brown (tentative)
- Heat and mortality: Oliver Thommen (tentative)
- Traffic noise exposure and cardiovascular symptoms: Wolfgang Babisch
- Fear of crime and depression / isolation (to be identified)
- Lack of recreational areas and physical activity (to be identified)
- Etc.

Summary of discussion on the way forward

Selection of evidence data

- For each data element that is not taken from peer-reviewed literature, the contribution needs to provide the respective evidence directly.
- It is suggested that as a part of the preparation of this work, the review could be submitted as an independent publication to a relevant peer-reviewed journal.

Calculation of EBD

- The calculation should as much as possible provide to levels of information:
 - health consequences attributable to inadequate housing characteristics
 - health consequences that could be prevented through housing improvements (preventable fraction)
- For the selected linkages, it is possible to work on more than one health outcome provided that adequate evidence from peer-reviewed journals is available.
- The process of identifying and deciding for the data to be used needs to be transparent. Any decision taken needs to be documented, as well as there needs to be clear information what statement is based on evidence and what statement is based on expert assessment (this should as much as possible remain the exception).
- When relating known risk estimates to independently collected exposure data, it is necessary to make sure that the definition of the risk factor is consistent.
- In the absence of data on the WHO European region level, it is recommended to calculate the EBD for specific housing factors by country and then aggregate this data.
- European countries can also be grouped in to three regions (Euro A, Euro B and Euro C – see information in Annex 3). If no data is available for few countries within one region, potentially the mean of the other countries can be used (unless such an approach is not justified). The priority for making such decisions is sound scientific judgment.
- If possible, the EBD should rather be related to the whole population within a country. However, depending on the evidence available, age groups may need to be excluded.
- At the end of the report, the individual EBD assessments of the selected linkages will be aggregated to provide a conservative estimation of the EBD of inadequate housing based on selected examples. Due to this aggregation, the WHO secretariat will work with the expert groups to avoid any risk of double-counting.

Preparing the publication

- It needs to be stated in the introduction and conclusion chapters that the EBD assessment for inadequate housing is based on selected examples and therefore is an underestimation.
- This relates both to the risk factors – we may have not covered significant ones as we lack necessary data – as well as the outcomes, as we focus on selected outcomes only.

- One conclusion should be that the EBD work suffered from availability of exposure data, which shows that housing monitoring systems are lacking or not sufficient.
- It is suggested to add a statement that not everything that happens in the home is also caused by the home.
- All not selected linkages will be represented in the final report with a two-page summary on the current status of evidence (no application of EBD method).
- Chapters on the EBD assessment of the selected linkages should focus on the evidence and follow a standard structure (annex 4), with a length of around 15 pages. WHO would provide the introduction and general method chapter, as well as the final chapter on conclusion and policy formulation.
- WHO was requested to include into the policy chapter some statements regarding the multiple benefits of housing interventions (eg mould mitigation has more benefits than just the reduction of specific health outcomes addressed in the respective chapter). It is necessary to make clear that the EBD assessment is by any means an understatement of the real burden.

Time schedule

- A first draft is expected to be sent to the WHO secretariat in **June 2007** latest. This is valid for both full chapters and summary statements.
- WHO would then provide an in-house review of the drafts and return comments to the authors in **July**.
- An updated second draft should be provided to the WHO secretariat by the end of **August 2007** and will be sent for external review. Comments will be forwarded to the authors by **October**.
- By the end of **December 2007**, the final scientific draft should be sent to WHO and will be edited / reviewed by WHO HQ before final acceptance.

Authorship and publishing

- The report would be edited by WHO, recognizing the experts involved in the working groups in an annex. The chapters on the individual linkages would be authored by the respective expert(s), and their contributions will be acknowledged.
- It is encouraged that expert teams use their work (especially the overview of exposure-response and the exposure assessment) for peer-reviewed journal publications in parallel to the EBD work (such publications should provide the scientific basis that is used for the calculation of the EBD, but the publications should not directly quote the final EBD assessment – this part should be kept exclusive for the WHO report). Before submitting the manuscript, the authors should inform WHO secretariat for a peer-review among the expert teams.

The role of the WHO secretariat

The WHO secretariat will provide the following functions:

- support in the identification of studies and data, especially from countries in which the experts have no own network
- support to the quantification process and the EBD assessment
- coordination of review and editing process
- Production of a printed report (possibly in WHO HQ EBD series)
- Attempt to identify funding for hosting an editorial meeting in late 2007

Conclusions and recommendations

The expert group provided a set of conclusions and recommendations to WHO.

Feasible – The experts concluded that with the collected evidence, a calculation of the EBD of inadequate housing for selected examples is feasible. The selection of linkages was considered as a good reflection of housing and health issues based on the available quantitative evidence. However, it was strongly recommended that other housing issues are reflected in the report to avoid misinterpretation that housing factors not covered are not associated with health outcomes.

Conservative - The experts concluded that the EBD of inadequate housing report would provide a very conservative assessment of the health impact of inadequate housing. A variety of risk factors will not be covered at all, or only insufficiently. Similarly, a variety of health outcomes which may be associated with selected housing risk factors may not be addressed as well. Therefore, there need to be clear statements that the report would provide examples for the EBD of inadequate housing, but not an exhaustive measure of the EBD of inadequate housing.

Coordination – The meeting requested the WHO secretariat to provide the overall coordination of the working process and specific support to the experts. Main support needs are (a) quantification and calculation of the EBD; (b) selection of severity weights for selected health outcomes; (c) coordination of the review and quality control of the chapter drafts; and (d) production of the publication.

Policy relevance – the meeting experts agreed to request from the WHO secretariat to provide the more general chapters of the report, and especially to develop a chapter on the policy relevance of the individual findings and the opportunity to use housing interventions as a prevention strategy.

Cooperation with HQ – The WHO secretariat was requested to cooperate with HQ on the development of the EBD of inadequate housing report and negotiate a potential publication as a part of the WHO EBD series. Part of the discussion could also be whether the work could be extended out of the European Region to cover non-European countries with modern and developed housing stocks (such an application would make publication in the EBD series of WHO HQ more likely.)

Annex 1

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ORGANISATION MONDIALE DE LA SANTÉ
BUREAU RÉGIONAL DE L'EUROPE

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ЕВРОПЕЙСКОЕ РЕГИОНАЛЬНОЕ БЮРО

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Annex 2

LIST OF TOPICS AND EXPERTS

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ORGANISATION MONDIALE DE LA SANTÉ
BUREAU RÉGIONAL DE L'EUROPE

WELTGESUNDHEITSORGANISATION
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List of topics and experts

Housing factor	Health effect	Contributor
Rodents and pests	Asthma and mental health	Battersby, UK
House Dust Mite allergens	Asthma symptoms / allergic reactions	Matthews / Crowther, UK
Dampness	Asthma in children	Nevalainen, Finland
Environmental tobacco smoke	Lower respiratory infections, lung cancer	Jaakkola, Finland
Crowding	Infectious diseases with focus on tuberculosis	Howden-Chapman, NZ
Radon	Lung cancer mortality	Catelinois, France
Benzene	Leukemia	Link, Germany
Formaldehyde	Lower respiratory symptoms	Gilbert, Canada
NOx	Lower respiratory symptoms	Gilbert, Canada
Ventilation in the dwelling	Respiratory and/or allergic effects	Sundell, Denmark
Neighbourhood noise	Hypertension	Niemann, Germany
Particulate Matter 10 and 2.5	Mortality, cardiovascular, respiratory	Morawska, Australia
Cold (indoor) temperatures	Mortality	Rudge, UK / Healy, Ireland
Home safety issues / design	Falls & general home injuries based on - IDB - Literature review - UK evidence	- Bauer, Austria / - Sehti, WHO / - Ormandy, UK
Lead	Childhood Lead Poisoning; Neurobehavioral Effects; Reduced IQ	Jacobs, USA
Mould	Depression	Shenassa, USA
CO	Unintentional Poisoning Death, Delayed / Persistent Neurologic Sequelae	Kales, USA

Annex 3

COUNTRY GROUPINGS FOR GLOBAL ASSESSMENT ACCORDING
TO WHO SUBREGIONS

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

Annex 4

PROPOSED TABLE OF CONTENT

*“Assessing the burden of disease of inadequate housing in developed countries.
An application for Europe” (proposed working title)*

1. Introduction (WHO) (ca. 5-6 pages)

- Introduction to housing and health and the relevant risk factors
- Definition of housing as used in the report
- Relevance of inadequate housing

2. Approach and method (WHO) (ca. 5 pages)

- Causal web and selection of linkages
- General methodology
- Data needs
- Summary of sections 3 to 5 below, preferably in bullet points, and no longer than 1 page (drawing from all linkages)

3 Linkage sections (max. 10-12 pages each) by working groups

3.1 Asthma and asthmatic symptoms

3.1.1. Dampness and mould

3.1.2 House dust mites

3.2 Tuberculosis

3.3 Falls

3.4 CO poisoning

Each linkage chapter should follow the structure given below:

A. Exposure-response relationship (to be done for each linkage)

- What is known about dose-response relationships, relative risk estimates or disease frequency of exposed; overview of available evidence; synthesis of available evidence;
- Choice of outcomes to be assessed

- Information source for health statistics (addressed in general in the introductory volume, but in case there are specific issues for the selected outcomes, it may be addressed here)
- Selected exposure-response relationship, providing full rationale for this choice (i.e. most recent meta-analysis, only large multi-country study etc.); if review of the evidence has not been published before, then the presentation of the review needs to be transparent and at the level of the one required for a peer-reviewed journal.

B. Exposure assessment (to be done for each linkage)

- Choice of exposure variable (what measures of exposures and outcomes are available, and which were chosen for the assessment, and why)
- Data sources for exposure (or how to perform studies or surveys to assess indicators of exposure)
- Examples of exposure values, e.g. regional means

C. Estimating the disease burden (to be done for each linkage)

- Processing of the data into housing-attributable fraction or disease burden
- Potential aggregation of national to sub-regional or regional level

In the case of the housing EBD, application to the WHO European Region if possible. Calculation by country and then grouping into the Regions Eur A, B and C.

If not possible to extrapolate to all of these 3 regions, then restrict the analysis to the evidence-covered area.

D. The benefit potential of housing improvement (to be done for each linkage)

- Preventable fraction of the EBD of inadequate housing

E. Uncertainty (to be done for each linkage)

- What are the principal sources of uncertainty in the assessment, what effect these may have on the conclusion, and how error may be minimized in future assessments

3.5 Special consideration: Lack of ventilation (ca. 8 pages)

- Lack of ventilation as a housing risk factor
- Summary on the existing evidence - how much does improving ventilation help to reduce other housing problems?
- Summary of housing threats mitigated through ventilation
- Conclusion

4. Summary statements of other housing-health linkages (ca. 2 pages each)

- Short introduction
- Summary on the existing evidence on exposure-response relationships

- Summary on the existing evidence on exposure assessment
- Uncertainty
- Conclusion / best available estimate on health impact

- 5. Housing interventions (Hilary Thomson) (4-5 pages)**
- 6. Cost-benefit examples of housing action (Maggie Davidson) (3-4 pages)**
- 7. Policy relevance (WHO) (3-4 pages)**
- 8. Conclusions and policy formulation (WHO) (2-3 pages)**
- 9. References (provided by all chapter authors)**

Annex 5

BACKGROUND DOCUMENTS OF ALL PARTICIPANTS

The original background documents provided by the experts can be requested from WHO by email. Statements and opinions in these documents are those of the respective authors and do not necessarily represent WHO position.

For requesting the background documents, please contact Ms Nuria Aznar at naz@ecehbonn.euro.who.int