Social inequalities and their influence on housing risk factors and health

A data report based on the WHO LARES database

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By Matthias Braubach and Jonas Savelsberg

Abstract

Housing conditions have an influence on residents' health. As different financial capacities - or social determinants in general - may lead to different housing conditions, they can be a potential source of inequalities.

For the presented analysis the WHO LARES data set was used, providing data on housing and health for 8519 individuals in 3373 households compiled from 8 European cities. The study used an exploratory design and identified the magnitude of inequality for a selected number of social determinants, housing factors, and health outcomes.

Within the LARES survey, less affluent residents are more exposed to and affected by inadequate housing conditions. It is shown that inadequate housing conditions have a significant impact on several health outcomes, and that there is a social gradient for both the housing quality and the housing-related exposure, and for housing-associated health outcomes. Within the social category groups, increased exposure to environmental risks was often but not always associated with an increased health outcome. Multiple exposure scores showed the strongest associations.

Housing conditions must be considered as one of the mechanisms through which social inequality translates into health inequality. For the LARES cities, these results indicate a strong need for policymakers and local stakeholders to intervene and develop programmes to overcome such inequalities and provide adequate housing conditions for everyone.

Contents

For interested researchers, the WHO LARES data set is available free of charge. WHO supports further investigations into this topic of inequality and environmental justice in the field of housing and health. For further information, please visit the WHO LARES site at
http://www.euro.who.int/Housing/lares/20080403_1

or the WHO environmental inequality site at
http://www.euro.who.int/envhealth/topics/20090706_1

Introduction

The subject of environmental inequalities or environmental justice first appeared in the US in the 1980's. In Europe the subject first found attention in the recent years starting in the UK and increasingly spreading to other countries, e.g. The Netherlands, Germany, France and others.

In some countries, e.g. Germany, the environmental inequality field is mostly dealt with by Public Health researchers. In other European countries like Scotland or Sweden it is mostly defined through a (socio-)political and juridical perspective.

Analysis on the topic has been and is being done in form of both qualitative and quantitative empirical analyses investigating the effects of socioeconomic, racial or ethnic status on the exposure to environmental contaminants and other potential sources of health effects such as psycho-social stress.

One main dimension of environmental inequalities is considered to be the quality and environmental context of housing. Several research papers have identified that unequal distributions of housing quality and related environmental risks are a prevailing problem in many countries, and may have effects on health status and existing health inequalities. Publications describing inequalities related to housing and residential location are e.g. Bolte and Kohlhuber (2008), Kruize and Bouwman (2004), Briggs et al. (2008), Fairburn et al. (2005) and Power et al. (2009).

This data report aims at showing the distribution of housing risk factors by social determinants on the basis of the LARES data set.

Methods / data sources

The WHO housing and health programme undertook housing and health surveys in eight cities between 2002 and 2003 as a part of the LARES project (Large Analysis and Review of European housing and health Status). The eight participating cities are: Forli in Italy, Vilnius in Lithuania, Ferreira do Alentejo in Portugal, Bonn in Germany, Geneva in Switzerland, Angers in France, Bratislava in Slovakia and Budapest in Hungary.

As the city surveys were based on consistently applied methods and survey tools, the city datasets were merged into an international database (LARES database). Further information on LARES and the questionnaires used can be found at the WHO web site with a more detailed description on the methodology published by Bonnefoy et al. (2007)[1].

For this data report on housing-related inequalities and their potential impact on health, the housing and the health data base were applied which were created from the results of the LARES survey. The health data base has 8519 entries containing health and housing data for each participant of the survey. The housing data base has 3373 entries containing housing data for each household/dwelling that has been surveyed, and the health information for the person providing the housing information on behalf of the household.

This study uses an exploratory approach to identify the existence of housing-related inequalities regarding a variety of risk factors such as e.g. bad indoor air, noise, damp and mould, indoor cold, safety threats, lack of sanitation, crowding, and others. Data analysis was performed with SPSS15© using cross-tabulations of social determinants, housing factors and health outcomes.

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[1] http://www.euro.who.int/Housing/lares/20080403_1

Although the results can neither be representative on city nor on European scale, the data can provide useful indications of the housing conditions within Europe and – due to the large number of participants – provide insights into the specific housing challenges and possibly associated health disadvantages of vulnerable population groups.

This report presents and discusses a selection of results of this exploration in more detail. In Annex 1, tables can be found that show all combinations of factors that were tested as part of the exploratory design, indicating where inequalities were found within the LARES database.

The exploratory analysis of the data can be divided into four major steps:

Step 1: Relevant social determinants in the housing and health context were identified based on recent publications on housing -related inequalities, and the already available LARES results. All potential social determinants were then checked for their association with several housing risk factors and health outcomes.
The social determinants selected for further analysis were: "SES index" (combination of nine social and economic variables, for details see Ormandy (2009)), "income groups", "employment status", "problem to pay housing expenditure" and household status as "single parent" households with one or more children. All social determinant variables were regrouped to reduce the number of values. A list of the selected social determinants and their distribution is attached in Annex 1.

Step 2: The selected social determinants were compared to various risk factors and outcomes using cross tables to assess the degree of inequalities in risk exposure (results for the list of risk factors and outcomes considered are shown in Annex 2). Some of the results are presented in this data report in more detail, using cross table charts .

Step 3: Stratified cross tables were used to analyse health inequalities by social determinants and risk exposure mechanisms. Some of the results are presented in this data report in more detail, using the form of flow charts (social determinant => housing risk factor => health outcome) to show how health outcomes may vary within the different social strata and exposure groups.

Step 4: Two specific analyses have been performed to assess the synergetic effects of multiple exposures. These analyses used two differently constructed housing exposure scores, one based on objective exposure factors identified by a housing inspector (not waterproof roof, problems with water supply and single glazed windows) and one based on subjective assessments reported by the residents (mould growth, bad air quality and cold in winter).

Interesting findings and indications of associations between social determinants, distribution of housing risks and health outcomes result from these descriptive and exploratory analyses. However, multivariate analysis needs to be applied to further explore and validate the dimension of housing-related inequalities associated with social gradients.

Main results – a selection

The following section provides an overview of selected results on inequalities identified in the LARES data set. A full overview of all analyses (all social determinants in relation to all selected housing conditions) is provided in Annex 2.

a) Bivariate analysis: cross-tabulations

Chart 1 shows the frequency of problems with damp and with mould growth in households within the different income groups.

Damp is much more common in dwellings of the lower income groups, in fact it occurs almost four times as often in dwellings of the lowest income group as in dwellings of the highest income group.

Since mould growth is largely determined by damp, there is a similar distribution of homes with mould problems, although on a reduced level. Still, mould growth occurs three times more often in dwellings of the lowest than of the highest income group.
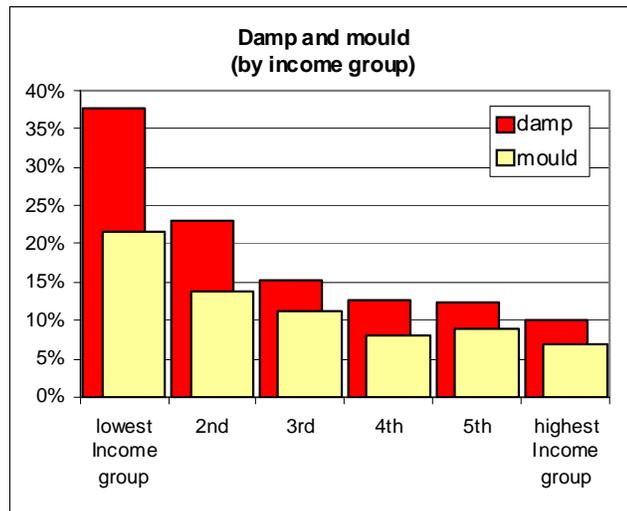
Chart 1: Damp and mouldy dwellings

Crowding – defined as less than one inhabitable room per person - is much more common in households that have problems to pay their housing expenditure. It can be found almost two and a half times more often in households reporting financial problems than in those where housing costs are not perceived as a burden.[2]

Crowding is undesirable because it may lead to a worse health status, including physical and mental health, as well as to a higher frequency of accidents within the household.
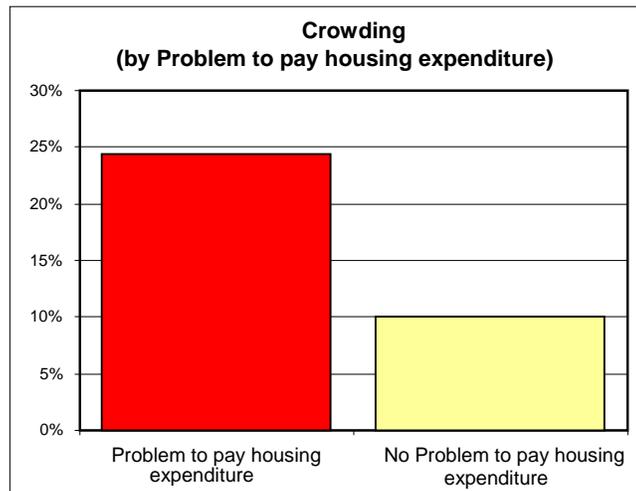
Chart 2: Crowded dwellings

The association between risk for home accidents and the occurrence of crowding was then checked for the most frequent home accident type, which is the fall.

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[2] For this analysis, which is based on the housing data base, one person households were excluded because they obviously won't have any crowding and would affect the output.

More residents within the lower income households than in the higher income households have reported a fall accident in the last year, but the difference is marginal (12.1% versus 9.8%). However, looking only at the households that live in crowded conditions (less than one room per person), the increase of fall accidents in low-income households is much stronger and the rate of reporting households goes up to 16% (Chart 3). The reduced rate for high-income households is possibly related to the fact that falls often occur in elderly, which tend to not live in crowded conditions.

Falls reported by crowded and not crowded households (by income group)
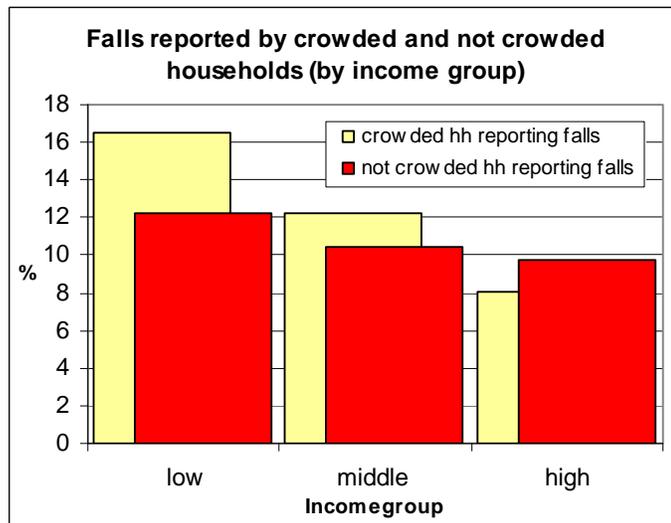
Chart 3: Fall accidents by crowding and income group

Chart 4 shows the proportion of households which permanently or often experience problems with noise disturbance in their dwelling by problems to pay housing expenditure. In dwellings of households reporting problems to pay their housing expenditure, the frequency of noise disturbance is at 33% and therefore much higher than in dwellings of households that have no financial problems. The exposure rate of 21% for the "well-off" households does, however, show that noise exposure is a general environmental problem for all population groups.

Permanently or often noise disturbance in the dwelling (by Problem to pay housing expenditure)
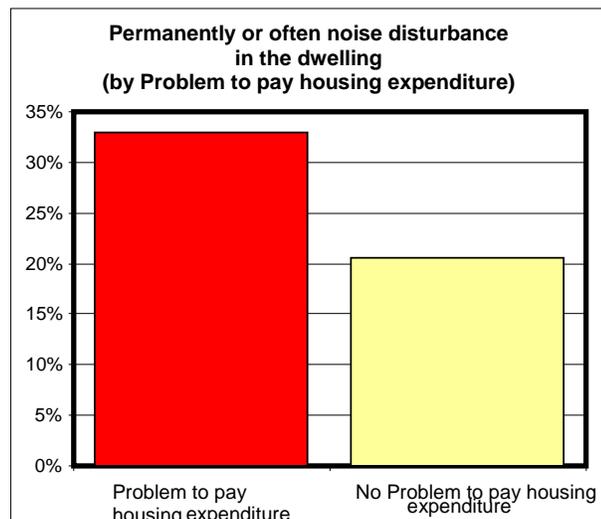
Chart 4: Frequent noise exposure in the dwelling

Chart 5 shows the proportion of residents who report sleep disturbances by noise, again split up by problems to pay housing expenditure. Reflecting the unequal distribution of noise exposure shown above, there is an increased reporting of sleep disturbance in the group of residents living in households with problems to pay housing costs. As not all noise exposure necessarily leads to sleep problems, the overall expression is lower but looking into the well-off households specifically the data indicates that there are still 21% reporting noise-related sleep disturbance.

Sleep has been disturbed by noise (by Problem to pay housing expenditure)
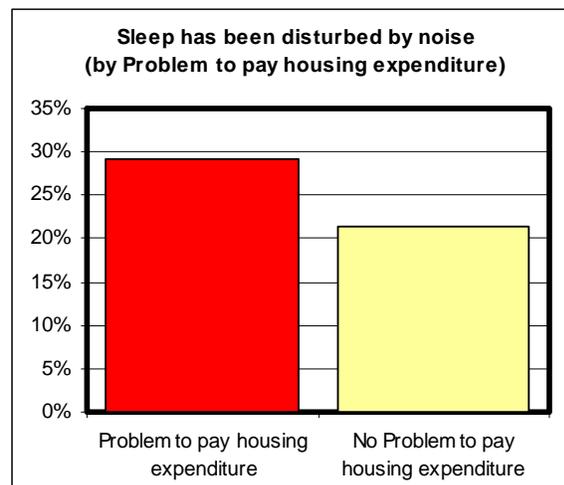
Chart 5: Sleep disturbance by noise

Chart 6 shows another dimension of environmental disadvantage that is obviously faced most by the residents of less affluent neighbourhoods.

Based on the inspection report, data on the greenery at the residential place (e.g. public and/or private gardens, street trees, vegetation on balconies etc.)) was summarized into a greenery index. Almost half of all residents with low income are living in a residential place with no greenery reported at all. This lack of greenery quickly declines with rising income, and is already under 10% for residents with middle income levels.
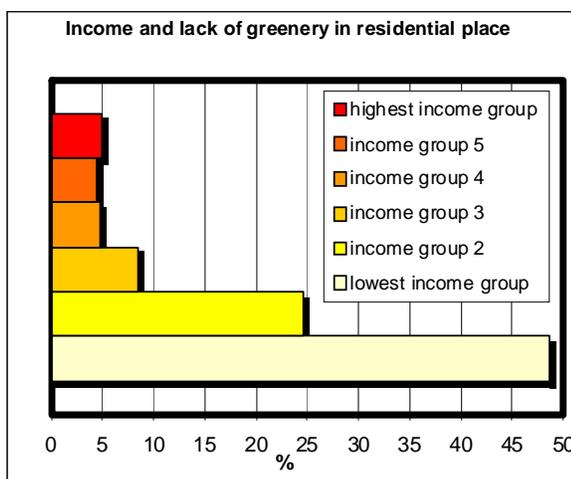
Chart 6: Greenery by income groups

b) Stratified cross tabulation

The following flow charts show how two selected social determinants ("Problem to pay housing expenditure" and "SES score") affect the distribution of housing risk factors and the expression of health outcomes. The flow charts enable a direct identification of how both the selected housing risk factor, and the associated health outcome varies in relation to the social determinant.

In all examples, social inequalities are associated with varying exposure levels to the housing risk factor, and with varying health outcomes. This indicates that residents from the lower social or economic status groups may be more strongly affected by inadequate housing conditions through (a) increased exposure to inadequate housing and (b) more severe health outcomes.

Almost half of the residents (46.0%) that report having problems to pay their housing expenditure live in dwellings with an increased level of deprivation (compared to 18.0% for well-off residents) (Chart 7). Within this group, 29.7% report a poor health status in comparison to 15.5% of households with financial constraints that are living in a dwelling with low deprivation level.

Of further interest is the finding that poor health is only reported by 7.1% of those residents who have no problems to pay their housing expenditure but nevertheless are exposed to low quality housing conditions.

The results indicate that the financial capacities have a strong effect on health, but may be modified by housing quality to a considerable extent. However, it may even be more relevant to look at this association in a reverse way, as the data confirms that the most vulnerable population groups are those that are most exposed to inadequate housing conditions.
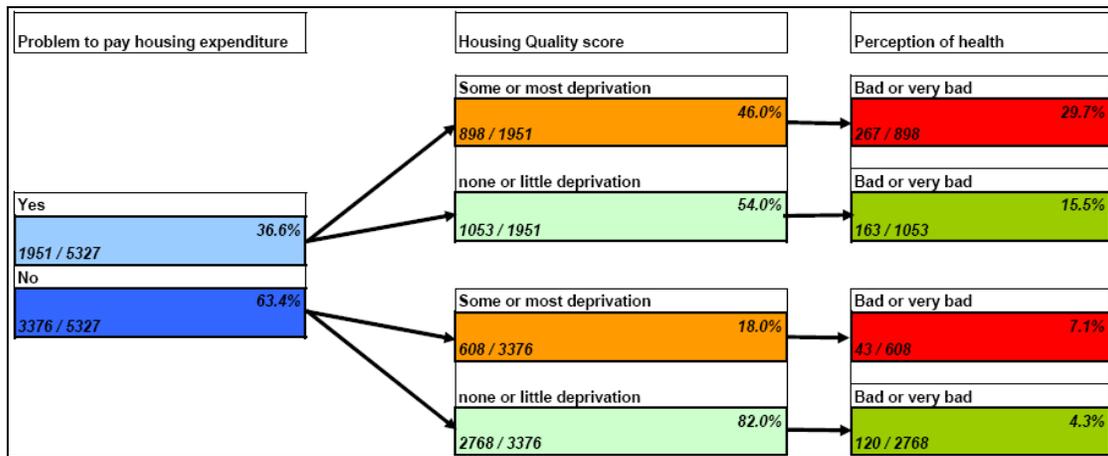
Chart 7: Housing quality and self-reported health by problems to pay housing expenditure

Within the households that report having problems to pay their housing expenditure (Chart 8), 20.9% of the residents are dissatisfied with the indoor air quality in their dwelling (compared to 8.4% for well-off residents).Within this group 16.1% have respiratory symptoms in comparison to 9.8% of those who have no problems to pay the housing expenditure but are similarly exposed to low indoor air quality. In both groups, the perception of inadequate indoor air quality is therefore associated with an increased reporting of (doctor-diagnosed) respiratory health outcomes when compared to the households not complaining about indoor air problems.

The results thus suggest that indoor air quality conditions affect respiratory health outcomes and that this potential effect is found in well-off as well as less well-off residents and households.
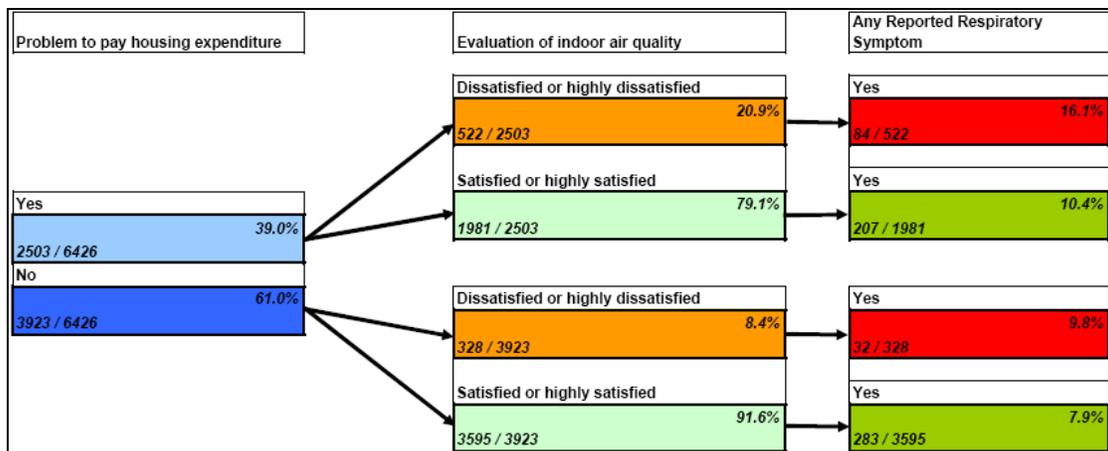
Chart 8: Perception of indoor air and respiratory symptoms by problems to pay housing expenses

Within the group of residents reporting problems to pay their housing expenditure (Chart 9), 37.1% experienced problems with indoor cold in winter in the last year. For those who have no problems to pay their housing expenditure, it is only 15.3%.

45.4% of those residents that have problems to pay their housing expenditure and that experienced problems with cold temperature in winter had a diagnosed cold or throat illness in the last year. In the group reporting no problems to pay the housing expenditure but similarly exposed to indoor cold in winter, only 36.4% had a diagnosed cold or throat illness in the last year.

This is a significant difference especially when considering that for residents not exposed to indoor cold – and irrespective of financial capacities -, the prevalence of cold or throat

illness is almost the same (33% and 33.7%). Notably, the prevalence level for non-exposed residents is only slightly below the level of exposed residents from the well-off group. This could possibly indicate that the actual temperature – separate to the reported perception – may be lower in dwellings of poorer households than in well-off households, thus leading to an increased occurrence of health outcomes. This would be in line with studies showing that fuel poverty and heating costs are most severe in less affluent households.
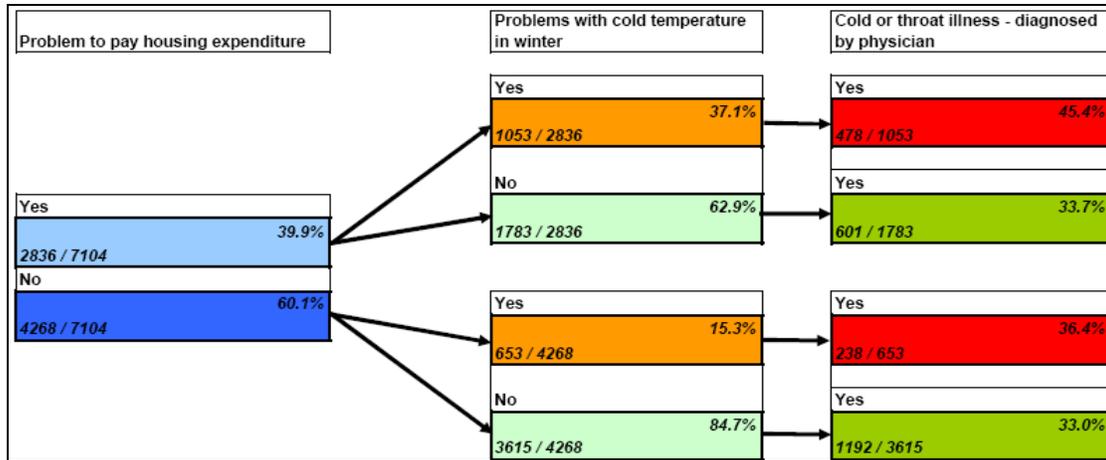
Chart 9: Problems with indoor cold and cold / throat illnesses by problems to pay housing expenditure

Chart 10 shows the frequencies of diagnosed bronchitis or pneumonia for three levels of socio-economic status (SES) and in relation to reported problems with indoor cold in winter. Problems with cold in winter are most frequent in low SES-households (43.5% versus 39.3% and 31.1%), showing that households with a high SES score are clearly advantaged. Looking at the health outcome, the data shows that within each SES group, the prevalence is increased by around 30% for residents of cold dwellings compared to dwellings not considered cold. However, the frequency of people with diagnosed acute bronchitis or pneumonia also shows a gradient for SES within both the exposed and the not exposed households. This implies that both factors – social status and housing conditions – may have an influence on health, with the highest exposure rate found for low SES-households living in inadequate housing.
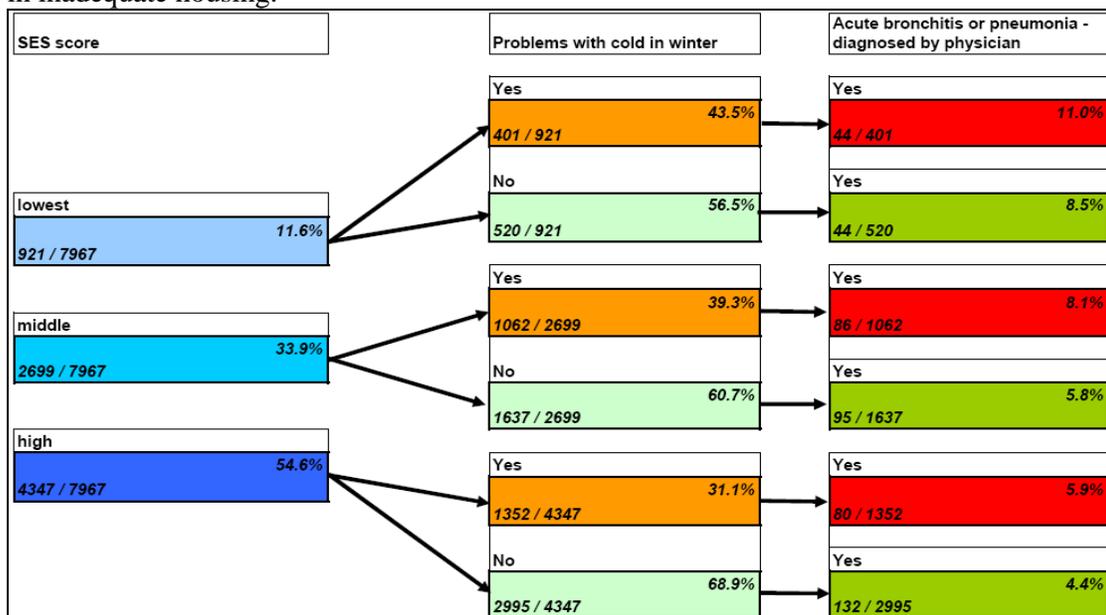
Chart 10: Problems with indoor cold and bronchitis / pneumonia by socio-economic status

Specific key messages on children

Children are a very important group as they are still in their period of growth and therefore more sensitive for health risks. Chart 11 shows that in general, smoking in the dwelling is more common for low income households; with the risk of exposure being twice as high (41%) for the lowest income group as for the highest income group (21%). For children living in households within the lowest income groups,

Smoking in the dwelling (by income group)

Chart 11: Smoking exposure in the dwelling – for whole population and for children only

the risk is almost 3.5 times higher (52%) as for children in the highest income group (15%). This result needs to be considered in the context that the increased exposure of children in the lowest income groups is not related to an increased presence of children in low income households, and therefore seems to be a result of smoking behaviour.

The population exposure to (perceived) mould growth is more than three times higher in the lowest income group (27%) than in the highest income group (8%). For children, this difference in exposure to mould is even higher, and ranges from as high as 45% for the lowest income group to 11% for the highest income group. The reported child-related exposure is therefore more severe in all income groups, but the highest level of perceived child exposure is within the low income groups.

Perception of mould growth (by income group)
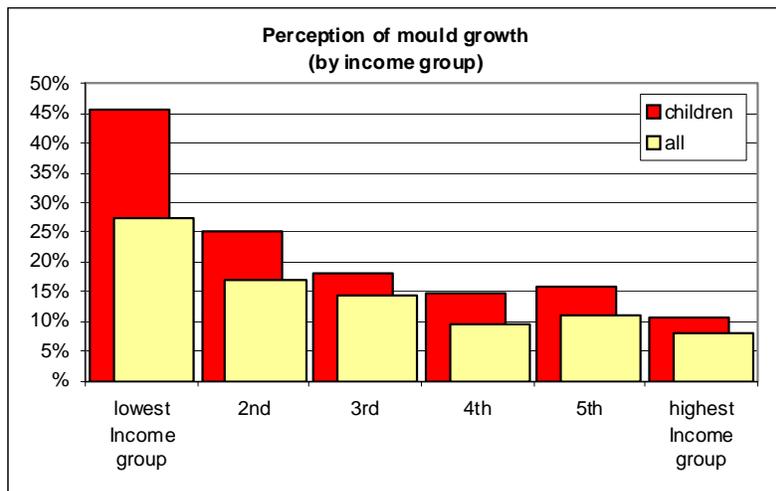
Chart 12: Reported perception of mould growth – for whole population and for children only

As in the previous chart, this is not linked to an increased presence of children in the lower income groups.

Multiple exposures

Since health outcomes are not exclusively caused by single mechanisms, and often result from multiple risk factors affecting and interacting with each other, the influence of multiple exposures is very important. This is especially relevant in the housing setting, where a variety of risk factors can come together. Unfortunately, even a large data set like the LARES quickly reaches its limits when combining multiple exposures. Nevertheless, attempts to assess the effects of selected key risk factor combinations were made and below two examples for such multiple exposure analysis are presented.

First, the existence of an association between income level and combined exposure to perception-based risk factors (here: mould growth, bad air quality and cold in winter) was verified (Chart 13). The frequency of at least two of these occurring in parallel is almost three times higher in households of the low income group than in households of the high income group.
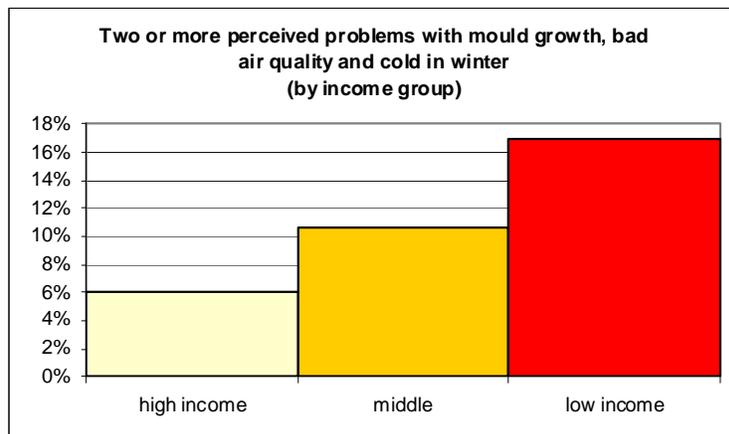
Chart 13: Combined exposure to two or more perceived problems by income group

Chart 14 presents the same data as in chart 13, but in a greater level of detail reflecting the prevalence of poor self-rated health for residents exposed to none, one, or two and more perceived housing problems. The results indicate that there is a strong (and statistically significant) disadvantage for low income households in general terms, but also that the level of disadvantage is strongly increased for multiple exposures and reflected by the highest level of poor health evaluation.
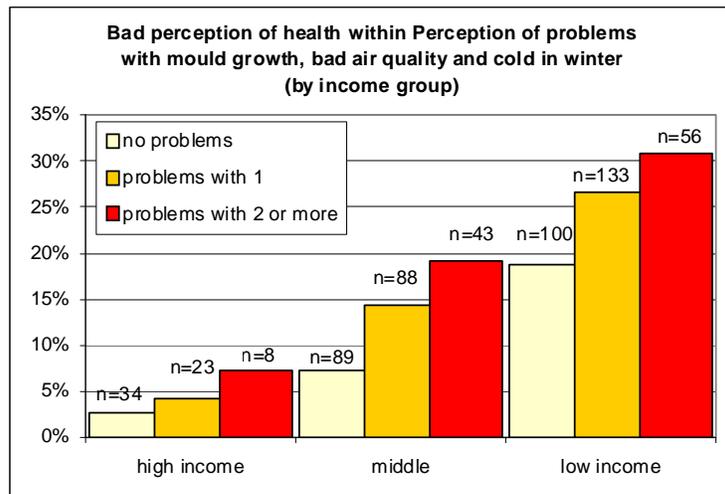
Chart 14: Self-reported health, combined exposure to no, one, or two and more perceived problems by income group

Second, the association between income level and combined exposure to more objective housing problems (here: not waterproof roof, problems with water supply and single glazed windows) was verified (Chart 15). The frequency of at least two of these problems occurring simultaneously is almost three times higher in households of the low income group than in those of the middle and high income groups. Different to charts 13 and 14, which were based on the perceptions of residents,

Chart 15: Combined exposure to two or more structural housing problems by income group

all three variables used here are based on an objective report from a housing inspector. Because of too little cases in the respective income groups (serious material deprivation is rare outside the low income group), middle and high income have been merged.

Chart 16 presents the percentage of bad health perception within the different income groups and the different levels of combined exposure. Again, bad self-reported health status is – for all levels of deprivation - more than three times more frequent for residents within the low income group than for those in the middle and high income group. Although both results for low and for middle/high income groups are statistically significant, the strongest association

Chart 16: Self-reported health, combined exposure to no, one, or two and more perceived problems by income group

with bad health perception is clearly found in the low income residents with highest deprivation levels.

Conclusion

This report shows that less affluent residents and households are more exposed to and affected by inadequate housing conditions and associated risk factors. The result of the data analysis shows that within the LARES data set inadequate housing conditions have a significant impact on health outcomes such as self-rated health, accidents (falls), and respiratory diseases as shown in the report, and also on safety perception, gastro-intestinal diseases, development of depression and the frequency of accidents (not shown).
Housing conditions can therefore be considered as one of the mechanisms through which social inequalities may translate into health inequalities.

Even though some inequalities related to several social determinants are shown in this report and the appendix, it is only a small part of the vast extent of environmental inequalities. Scientific evidence is available for housing inequalities suffered by e.g. migrants and ethnic groups, but such analysis was not possible based on LARES data (see annex 1). Another potential dimension of inequality that is not covered in this report is gender inequalities and age has been only looked at for the specific age group of children.

Several charts have indicated various magnitudes of inequalities in relation to specific social, housing, and health-related variables, showing that the challenge of inequalities is probably universal and covers a variety of risk factors. As well, results indicate that often the effect of inadequate housing conditions is visible all income or socio-economic groups, although their expression tends to be more clear within disadvantaged households and residents. Still, the most relevant example from public health perspective may be that the real health challenge lies within the identification of and provision of support to those households and residents suffering from multiple exposures. As this will be rather the norm than the exception for the households living in inadequate dwellings, the preliminary findings of this data report – indicating that despite low case numbers, severe exposure and health problems can be found when looking at multiple exposed population groups – suggest that there may be large health improvement opportunities when focusing on inadequate housing conditions to remove multiple exposures.

Since the gap between the rich and poor is still growing, the reduction of inequalities is becoming a topic of increasing relevance, especially in countries with insufficient social and health security mechanisms. However, additional effects on specific vulnerable population groups (such as e.g. children, elderly, disabled or single parents) may further enhance the inequalities associated with social determinants.

A note of caution is necessary regarding the interpretation of these results. First, it is to be considered that the LARES data does represent housing conditions for eight European cities, and cannot be extrapolated to national or European level. Second, the survey was of cross-sectional design and therefore only enables the identification of statistical associations, while it cannot make statements on potential causalities. However, separate to the question of causality, the results clearly indicate that bad housing conditions and poor health often are associated. In essence this means that the most vulnerable population groups suffer from the worst housing conditions, which – irrespective of the necessary discussion on causal pathways – is unacceptable.

The results indicate a strong need for policymakers and local stakeholders to intervene and develop programmes to overcome such inequalities and provide adequate housing conditions for everyone. This need is supported by the findings of the final report of the Commission on the Social Determinants of Health (2008) recommending daily living conditions to be improved as a first step towards tackling social disparities.

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Annex 1: Overview of social determinants used for the study

Socio-economic status quintiles (individual level data)

SES score of household - 5 equal bands

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	bottom 20%	946	11.1	11.6	11.6
	20th-40th percentile	1418	16.6	17.3	28.9
	40th to 60th percentile	1357	15.9	16.6	45.5
	60th to 80th percentile	1991	23.4	24.4	69.9
	top 20%	2461	28.9	30.1	100.0
	Total	8173	95.9	100.0	
Missing	System	346	4.1		
Total		8519	100.0		

The SES score is based on a combination of following parameters: number of residents in household; household type; highest education level of household member; number of household members aged 18-59 and in full-time work; number of full-time jobs held by all household members; number of people aged 60 and above; size of dwelling in square meters; number of rooms in the dwelling (for details, see Ormandy (2009)).

Income groups (individual level data)

Income groups in all LARES cities

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	lowest income group	678	8.0	8.9	8.9
	income group 2	1418	16.6	18.7	27.6
	income group 3	1651	19.4	21.7	49.3
	income group 4	1356	15.9	17.8	67.2
	income group 5	802	9.4	10.6	77.7
	highest income group	1692	19.9	22.3	100.0
	Total	7597	89.2	100.0	
Missing	0	2	.0		
	no answer	489	5.7		
	Don´t know	431	5.1		
	Total	922	10.8		
Total		8519	100.0		

Employment status (individual level data)

Employment status 2 groups

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	unemployed	459	5.4	5.4	5.4
	other	8060	94.6	94.6	100.0
	Total	8519	100.0	100.0	

"Other" including students, children, and pensioners not seeking active employment

Problem to pay housing expenditure (household level data)

Problem for household to pay housing expenditure

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	1307	38.7	39.8	39.8
	No	1973	58.5	60.2	100.0
	Total	3280	97.2	100.0	
Missing	0	25	.7		
	Don´t know	68	2.0		
	Total	93	2.8		
Total		3373	100.0		

Single parent household (household level data)

single parent

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	190	5.6	5.6	5.6
	No	3183	94.4	94.4	100.0
	Total	3373	100.0	100.0	

Only households with one adult and one child or more

Even though migration status and ethnicity are very interesting in the field of environmental justice, associations between migrant status / ethnicity and housing-related inequalities could not be covered as the group of immigrants and non-national residents was mostly better situated than home country nationals and thus migrant status could not be considered a social disadvantage. This result is possibly due to the selection of cities which – especially in case of Geneva, but also for the other capitals such as Budapest, Bratislava and Vilnius – may attract mostly highly educated immigrants.

Educational status of individual persons has been considered as a social determinant, but was problematic in implementation as different people with very diverse educational status may be residents of the same household / dwelling. The household income – similar for all household members – was therefore preferred.

Annex 2: Overview of cross tables of social determinants and housing risk factors and outcomes

Column groups and variables:

- **Damp and Mould:** ah_1reco perception of problems of dampness; ah_3reco perception of problems of mould growth; b_2riskgr waterproof roof; mould_sc mould and dampness score; ga_19 worst visual mould growth
- **Housing:** hs_1reco troubles with quantity of water during past year; hs_4reco troubles with the quality of the water drainage system last year; iesc4g immediate environment score 4 groups; iesc2g immediate environment score 2 groups; l_4reco crowding grouped; l_2rec size of the dwellings per groups; HQSrec housing quality score; greenery Greenery score
- **Noise:** gt_nois 8 bothered by general traffic noise; h_27 sleep been disturbed by noise; n_1reco noise disturbance in the dwelling
- **Psychosocial:** salsarec trends of depression
- **Safety:** h_32_1 falls; a_1_3 falls stumbling; ie_15reco feel safe coming home when it is dark
- **Air Quality:** aq_1reco evaluation of indoor air quality; aq_4 Dust as a particular problem; ets1reco Smoking in the dwelling
- **Heating:** t_7_riskgr1 problems with cold in winter or transient season; t_8reco evaluation of heating system quality; ga_16 worst case in windows quality; e_7reco % of income spent on heating

	ah_1reco	ah_3reco	b_2riskgr	mould_sc	ga_19	hs_1reco	hs_4reco	iesc4g	iesc2g	l_4reco	l_2rec	HQSrec	greenery	gt_nois 8	h_27	n_1reco	salsarec	h_32_1	a_1_3	ie_15reco	aq_1reco	aq_4	ets1reco	t_7_riskgr1	t_8reco	ga_16	e_7reco
Health DB:																											
SES_5gr		x					x	x			!	x					!		x		x			x	x		!
Incomegr	!	!	!	!	!		x	x	x		x	x	!				!	x				x	x	!	!	!	
Employment status (hh_8_2gr)	x	x	x	x	x	!		x	x		x	x	x				x	x					x	x	x	x	
Housing DB:																											
Problem to pay housing expenditure (fi_7)	x	!	!	x	x	x	!	x	x	!	x	x	x	x	x		!	x		!	!	x	x	!	!	x	!!!
Singleparent	x	x								x	x				x		x		x	x	x				x		x

X = significant associations identified   ! = highly significant associations identified

Health DB: Health database with data for individual residents
Housing DB: Housing database, with data for dwellings / households

Housing conditions have an influence on residents' health. As different financial capacities - or social determinants in general - may lead to different housing conditions, they can be a potential source of inequalities.

For the presented analysis the WHO LARES data set was used, providing data on housing and health for 8519 individuals in 3373 households compiled from 8 European cities. The study used an exploratory design and identified the magnitude of inequality for a selected number of social determinants, housing factors, and health outcomes.

Within the LARES survey, less affluent residents are more exposed to and affected by inadequate housing conditions. It is shown that inadequate housing conditions have a significant impact on several health outcomes, and that there is a social gradient for both the housing quality and the housing-related exposure, and for housing-associated health outcomes. Within the social category groups, increased exposure to environmental risks was often but not always associated with an increased health outcome. Multiple exposure scores showed the strongest associations.

Housing conditions must be considered as one of the mechanisms through which social inequality translates into health inequality. For the LARES cities, these results indicate a strong need for policymakers and local stakeholders to intervene and develop programmes to overcome such inequalities and provide adequate housing conditions for everyone.