HOUSING HEALTH FACTORS IN THE VIEWPOINT OF SYMPTOMS

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ABSTRACT

Large portion of our lives is spent at home; therefore the housing environment and quality of living are among the main factors that influence human health and wellbeing. The aim of the thesis was to study associations between certain housing factors and health of adult residents in Finland on a general population level.

The study was based on questionnaire data received from a large national survey used for assessing safety, quality, and health of the Finnish housing stock. The survey was conducted in 2007 and was sent to 3000 adults randomly selected from the Finnish Population Register Centre. The survey consisted of a 100 questions. The final response rate for the survey was 44% with 1312 answers. These data were analyzed using the PASW statistical software by cross tabulations and logistic regression. Six factors generally known to have possible effects on health were included in this study: crowding, drinking water quality, indoor air quality, ventilation, thermal conditions, dampness and mould, and noise. Studied health outcomes included general health status, general symptoms, respiratory tract symptoms and infections, asthma, sleeping disorders, eye and skin symptoms, and residential accidents.

Results showed significant association between all selected housing factors and certain symptoms, excluding drinking water quality. It appears that questionnaire based data can be used to assess relationships between housing factors and health on a general population level.

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This thesis is connected to the ongoing ALTTI-project (Asuinympäristön laatu, terveys ja turvallisuus), which aims to utilize the comprehensive survey for assessing the Finnish housing stock from the aspects of safety, quality, and health, and also to have a way of distributing information to the general public about important housing issues.

All analyses were performed during summer of 2011 in the National Institute for Health and Welfare (THL) in Kuopio, Finland as a part of a traineeship in THL. The analyses were completed with help from THL research team Ulla Haverinen-Shaughnessy, Maria Pekkonen, Mari Turunen, and Ari Paanala. Senior researcher Ulla Haverinen-Shaughnessy and researcher Marko Hyttinen from the University of Eastern Finland have supervised the thesis.

I wish to extend my appreciation to everybody involved in the ALTTI-project, and also to all personnel in THL who were very helpful during the thesis work. I want to especially thank my thesis supervisor Docent Ulla Haverinen-Shaughnessy who guided me in the right direction along the way.

CONTENTS

1 Introduction

The thesis focuses on evaluating multiple housing health factors and their impact on health of Finnish adults. A large portion of our lives is spent at home; therefore the housing environment and quality of housing are among the main factors that influence our health. The physical (e.g. humidity, noise, and temperature), chemical (e.g. asbestos, carbon dioxide, and cigarette smoke) and biological (e.g. microbes in drinking water, mould, and fungus) conditions and factors that are present in homes have an effect on human health. It is important to try to identify the factors that have health effects and to recognize what kind of effects, symptoms, and diseases they may cause in relation to the housing environment. Housing factors that influence human health need to be studied so they may be recognized and controlled resulting in better health of residents. Restrictions, guidelines, recommendations, and policies may be drawn after identifying factors that pose health risks in order to pursue good quality, safe, and healthy housing.

Housing health studies have been carried out on European level, e.g. in the LARES project (Ormandy, 2009a). Previously World Health Organization (WHO) has participated in reviewing evidence of housing health (WHO, 2005). Yet, comprehensive studies and data from Finland on national level are still needed. Characteristics of Finland, such as the changing seasons, challenging temperature variations, and uncommon population structure, make it difficult to draw conclusions from studies performed in other countries and stress the importance of analyzing housing health issues on national scale. In this thesis the main focus is on six factors generally known to have possible harmful effects on health: crowding, low drinking water quality, low indoor air quality and inadequate ventilation, unsatisfactory thermal conditions, dampness and mould, and noise.

The aim of this thesis is to find possible links between certain housing health factors and health of adult residents in Finland on a general population level. The thesis is based on data received from a large national survey (Turunen et al. 2010).

2 Literature Review

2.1 HOUSING AND HEALTH

Decline in oneôs health almost always shows first as an appearance of a symptom or symptoms and potentially later on as a diagnosed illness. The Finnish Ministry of Social Affairs and Health (STM) has published a housing health guide (Asumisterveysohje, 2003) that has information about physical, chemical, and microbiological housing factors and the symptoms and illnesses they may cause. Health effects of living environment factors in Finland have also been discussed in an article written by experts from the National Institute for Health and Welfare (THL) (Hänninen et al, 2010). WHO has highlighted many health issues related to the living environment and inadequate housing (WHO, 2005). One of the latest large studies was the LARES-project, which focused on housing and health in Europe (Ormandy, 2009a). WHO recognized that the amount of research is low in the matters of housing and possible health risks, and set out to conduct a large study that would involve several European countries and cities. The project was carried out in 2002-2003 using a questionnaire, interviews, and home inspections.

Many different factors together influence on how people perceive their homes, how pleased they are with their housing, and also how they evaluate their own health. A large European study (Van Kamp et al, 2009) showed that indoor and outdoor environmental quality have a strong influence on levels of housing satisfaction and, in a lesser extent, on residents` wellbeing. Housing satisfaction on its own was also shown to have a direct effect on wellbeing. There rarely is only one single factor behind a certain symptom, but instead multiple factors combined together. Sometimes a factor or factors may also intensify the effect of another housing health factor. Even though it is proven that a certain level of exposure to a certain factor is harmful, it is difficult, impossible, or sometimes impractical to measure and completely avoid these factors in everyday life.

The experts involved in the WHO LARES-project have made recommendations for safe and healthy housing based on the study and its results. A house should provide shelter and refuge, it should provide for the everyday life of its occupants, offer a link to the outside world (windows), and cope with normal biological and domestic daily activities of residents.

Recommendations also include guidance and advice to all parties involved in developing housing (architects, planners, builders etc.), codes and regulations for design and construction of new homes, and improvements in existing ones, financial assistance for residences faced with housing problems, and effective management of residences and neighborhoods. Minimizing or preventing exposure to health threats related to housing is very important, but the ways of doing so depend on the threat itself, characteristics of the dwelling, and sometimes on the city and location. (Ormandy, 2009b)

In general, the effects of a housing factor are largely depending on the extent, frequency, and duration of residentôs exposure to it.

2.1.1 Size of residence and crowding

The crowding of a household may be measured by self-reported sensation of the residents on the adequate spaciousness of the housing. A better and more objective way is to use measurements of persons per room, persons per bedroom or persons per area (m^2) (WHO, 2005, Dunn). A WHO meeting with housing health experts agreed that there is strong evidence on a European level showing a relationship between crowding and certain health effects, including general health status, but more research on the issue is needed (WHO, 2005).

Crowding is a problem that is strongly related to socio-economic factors; small housing is more affordable to low-income residents with low amount of rent per resident. There are many poverty-related health impacts of housing, crowding being one of the most relevant one. (WHO, 2005, Howden-Chapman)

The LARES-study showed that some domestic accidents, e.g. cuts, falls, and collisions, happen more often in homes where residents are not satisfied with residence size and who desire more space (Moore, 2009). A weak relationship was found with dissatisfaction to residence size and burns. Study also showed strong correlation with the frequency of almost all types of accidents and the increase in amount of people, children or adults, sharing a bedroom.

2.1.2 Drinking water quality

The Finnish Ministry of Social Affairs and Health have set quality standards for water that is used for household consumption, which all Finnish residences and their water systems must fulfill. Each residence must have access to warm and cold water. Minimum temperature for warm water is 50 °C after running for 1-2 minutes. Water must be 50 °C or higher so that the chemical and microbial quality is high enough, and microbial growth is minimized. (Asumisterveysohje, 2003)

Finnish potable water may contain different contaminants capable of causing health hazards: e.g. arsenic, fluoride, and by-products of chlorination. A study conducted in Finland estimated that annually 500 (80 ï 10 000) cases of GI-tract infections are caused by microbes in water (Hänninen et al, 2010).

2.1.3 Indoor air quality and ventilation

Occupants may be exposed to many different contaminants through indoor air, from where they are carried to the lungs with breathing. The purpose of ventilation is to maintain good quality of indoor air by removing impurities, moisture, and excess heat and replacing it with fresh, clean air from outside. There are many sources for indoor air impurities, such as human metabolism (e.g. CO_2), cooking, combustion (e.g. fire places), and materials used in structures and decorations. Impurities may also come from outdoors, e.g. exhaust particles, dust, and pollen. Exposure to indoor air contaminants may be controlled by reducing contaminant emissions, removing the contaminant sources, and by improving ventilation (Asumisterveysohje, 2003).

Imbalanced or malfunctioning ventilation is a possible health risk. Inadequate ventilation fails to remove contaminants from indoor air at a necessary rate resulting in build-up of contaminants such as CO_2. This may lead to symptoms that include fatigue and headache. Over-effective ventilation may cause draught, air dryness, and excess coldness inside during cold seasons. Ventilation system that is not working properly may also cause noise disturbance and carry contaminants to living areas from other parts of the residence, e.g. basement or storage rooms. The Finnish Health Protection Act provides limits for maximum amounts of CO_2 in indoor air for measuring ventilation sufficiency (Asumisterveysohje,

2003). A WHO work group determined that ventilation itself is not a factor causing respiratory and allergic symptoms, but it ñmight be an effect modifier between indoor air quality and certain respiratory outcomesò (WHO, 2005, Matthews).

Small particulate matter ($PM_{2.5}$) has many harmful health effects. Long term exposure may lead to e.g. cardiac disease and lung cancer. $PM_{2.5}$ in outdoor air is evaluated to be the most harmful environmental factor in Finland, causing hundreds of premature deaths and cases of respiratory tract infections, and over two million days with serious respiratory tract symptoms (Hänninen et al, 2010). The presence of $PM_{2.5}$ in indoor air depends on the location of the residence, is it located near to $PM_{2.5}$ sources such as industry and roads, and also on the functioning of ventilation. At this point, there are not many studies or research results on the subject of particulate matter indoors and its health effects (WHO, 2005, Sundell).

2.1.4 Thermal conditions

Thermal conditions inside a residence have a great influence on residents` level of satisfaction towards their home. High and low temperatures also expose inhabitants to possible health risks through many mechanisms. High temperature may increase the release of harmful chemicals from different sources, e.g. building structures. Warm air often adds to the sensation of dryness, which may lead to unnecessary use of humidifiers, which again may add to release of harmful chemicals, if indoor air humidity levels increase too much. Low temperatures may expose structures to moisture damage and, as a consequence, to microbial growth. (Asumisterveysohje. 2003)

The Finnish Ministry of Social Affairs and Health have set limits for good and acceptable indoor temperatures in residences: 21 ï 22 °C is regarded as good, 18 ï 20 °C as acceptable. Indoor temperature should not exceed 24 °C during heating season, and 26 °C at other times, except if it is due to high outdoor temperature. Temperature levels beneath acceptable are regarded as they may have harmful effects to health. (Asumisterveysohje. 2003)

Experts gathered in a WHO meeting agreed that cold indoor temperature is strongly linked with multiple respiratory conditions and self-perceived ill-health. (WHO, 2005, Healy) Symptoms related to excess heat include tiredness, lack of concentration, and respiratory tract symptoms. (Asumisterveysohje, 2003)

2.1.5 Dampness and mould

Studies on the matter of dampness and mould have been conducted in great numbers, and based on the mostly similar results there is a common consensus on the association of dampness and/or mould and ill health in children and adults (WHO, 2009; IOM, 2004).

The LARES ï survey (Rudnai et al, 2009) studied mould growth and dampness by questionnaires and house inspections in 8 European cities. The results showed that approximately 1 house out of 10 suffered from mould growth, with about one third of these having a growth area larger than A3 size. Permanent or recurrent dampness was reported by 6.4 % of households, but with great differences between cities. Experts from THL (Hänninen et al, 2010) have evaluated residential moisture damage as one of the most significant environmental health factors in Finland. They estimated that 15 % (800 000 individuals) of the countryôs residents are exposed to residential moisture damage. Out of these 800 000 exposed individuals, 800 (170 ï 2200) will suffer from asthma, 20 000 (5 000 ï 70 000) from lower respiratory tract symptoms, and 50 000 (10 000 ï 130 000) from upper respiratory tract symptoms due to exposure to moisture damage.

Dampness in buildings may be due to different reasons: water damage caused by e.g. burst pipes and other leakages, capillary rise of groundwater to structure, penetrating dampness by rainwater, and condensation. These may be due to faults in design, construction, maintenance, and protection of the building, and also because of occupant behavior. Normal living activities, such as cooking and showering, generate higher peaks of moisture in the housing environment, but the building should be able to manage minor and short-term increase in humidity without resulting in condensation or other moisture problems (Rudnai et al, 2009).

According to STM, indoor air humidity is recommended to be between 20 and 60 %, whereas experts with WHO suggest humidity percentage of 40 ï 70. Moulds may only grow indoors when there is an adequate level of moisture. Wet structure as itself is not a health risk to the residents, but it acts as a base for microbial growth of molds, yeasts, and bacteria. High humidity may cause condensation in the structure and an increase in the amount of house dust mites by offering favorable conditions for population growth. Dampness may also increase the release of harmful chemicals from structures. Low humidity may cause increase in respiratory tract irritation and infections (Asumisterveysohje, 2003; Rudnai et al, 2009).

Microbial growth in residences may be detectable by sight, smell, or microbial testing methods, for example samples taken from indoor air. Health risks posed by dampness need to be evaluated based on the extent and location of the damaged area, and frequency and duration of exposure. Microbial growth that is detectable on surfaces indoors, on insulation material, or in the structures of the building is always considered a potential health hazard. Though microbial growth which is only detected as small spots in wet areas such as shower, and is removable by cleaning and adjustments of ventilation, is a potential health hazard but not automatically treated as a risk to health (Asumisterveysohje, 2003).

In the LARES-survey (Rudnai et al, 2009), the most important factors associated with dampness and mould were disrepair and heating. According to the authors, the relationship could be with the level of disrepair and illness or overall housing quality and illness, with dampness and mould acting as contributory factors to ill health. Dampness is an indicator of poor-quality housing, which is associated with poor health.

Dampness leads to usage of heat resulting in a cooling effect through evaporation. When this happens with damp clothing and bedding, it may lead to changes in body temperature. Cooling due to evaporation together with the effect of reduction in the insulating capacity of external walls may lead to deterioration of the building fabric and lower indoor temperatures. These effects together may expose residents to impaired health. (Rudnai et al, 2009)

Microbial growth is a health hazard, as the microbes and their metabolism products are released to indoor air and inhaled. According to the STM (Asumisterveysohje, 2003) typical symptoms and health risks caused by molds, fungi, and yeasts include allergies, asthma, respiratory tract symptoms and infections, skin symptoms, eye irritation, and weakening of general health status. Also the LARES-study (Rudnai et al, 2009) showed strong relationships between mould and several diagnosed illnesses and symptoms, including cold/throat illnesses and symptoms such as asthma, headaches, wheezing, eczema, eye irritation, and infection. Residents living in damp homes may also be at higher risk for allergic symptoms, as mould spores and house dust mites act as strong allergens. Prolonged exposure to high levels of these allergens may lead to sensitization and occurrence of allergic symptoms, including rhinitis, eczema, coughing, and wheezing. Asthma may follow with prolonged/repeated exposure of a sensitized individual. Some mould and fungal spores have been identified as toxic and carcinogenic, causing rare but serious health effects like infections, immune system

suppression, and cancer. After reviewing studies on the subject in great extent, a WHO work group consisting of researchers (WHO, 2005, Nevalainen) agreed that there is strong evidence of the association between dampness and mould and respiratory tract symptoms. In their opinion, the association with other health outcomes, such as fatigue, headache, skin symptoms and fever, were not very strong as the results of different studies varied greatly. The work group agreed that in general, the reasons behind agent-specific adverse health effects by dampness and mould are not well understood. Some effects can be explained by IgE-mediated allergies, other mechanisms may have to do with inflammatory and toxic reactions.

2.1.6 Noise

Noise is defined as a sound or sounds that an individual senses as uncomfortable or that may harm or threat individualôs health or wellbeing. Noise in housing environment is a disturbing factor that may also be a health risk. Individuals sense and react to noise levels differently, also time and place of noise disturbance make a difference, but guidelines for harmful and disturbing noise level limits have been determined for residences and other indoor facilities. Guidelines for approvable upper limits are shown in Table 1. (Asumisterveysohje. 2003)

Table 1. Finnish Government guidelines for acceptable noise levels in residences during day time and night time. (Asumisterveysohje. 2003)

Living space	**07 -22 (day)**	**22 – 07 (night)**
Living room and bedroom	35 dB(A)	30 dB(A)
Other areas (e.g. bathroom, sauna, kitchen, closet)	40 dB(A)	40 dB(A)

According to Braubach (2009) the results of WHOôs LARES-survey showed that noise is one of the major public health problems in urban settings. In the study two noise factors; traffic noise and surrounding area noise (bars, discos, events), had a very strong impact on residentôs self-rated sleeping problems. Occupants exposed to noise were over 6 times more likely to report sleep disturbance than individuals without exposure. Environmental noise has been evaluated as one of the most significant environmental health factors also in Finland. A Finnish study (Hänninen et al, 2010) by experts at THL evaluated that 80 000 (30 000 ï 170 000) people in Finland are suffering from considerable sleeping disorder due to environmental noise. The same study estimated that 150 000 (50 000 ï 320 000) individuals are greatly disturbed by environmental noise, and it is very likely, though not proven, that this

level of disturbance also has some kind of negative health effects, such as difficulties in concentration.

The most harmful consequence to health from noise exposure is hearing deficiency, but this issue will not be discussed in the thesis. Noise levels required to cause hearing deficiency are usually related to work environment and public events (e.g. concerts and sport competitions) where there are very loud, short lasting noises, and these are not very common in the living environment (Niemann and Maschke, 2009). Noise disturbance at home is usually caused by nearby traffic (e.g. cars, trains, airplanes), home appliances (kitchen appliances, washing machines, home theatre systems) and HVAC ï systems (heating, plumbing, air-conditioning). (Asumisterveysohje. 2003)

Sleep disturbance is one of the most common effects of housing related noise disturbance and it poses a risk to residentôs health. Sleep disturbance may occur as a difficulty of falling asleep, waking up too early or during the night, and having shallow sleep without waking up. All of these may result in less restorative sleep, causing day time fatigue, headaches, depression, and short disturbances in vital functions (e.g. hormonal activity and blood circulation). Also decrease in alertness and work efficiency are common symptoms of noise disturbance (Asumisterveysohje. 2003). In WHOôs LARES study, Niemann and Maschke (2009) state that ñNoise-induced sleep disturbances are associated in this study with significantly increased risk for the vast majority of diseases in adults.ò

Frequent and long lasting noise may cause sleep disturbance starting from levels of 25-35 dB and occasional, rare noises from of 40 ï 65 dB. There are differences between individuals as to on what level noise begins to disturb. But already noises below 20 dB and on low frequencies may be disturbing and cause sleeping disorders. (Asumisterveysohje, 2003)

In the European housing health survey (Niemann and Maschke, 2009) it was seen that strong traffic noise annoyance had a relationship with multiple illnesses and symptoms among adults, such as cardiovascular symptoms, hypertension, respiratory symptoms, bronchitis, and psychological illnesses. Annoyance by neighborhood noise had the same effects, except the relationship with respiratory symptoms was less clear.

2.1.7 Smoking

Smoking, passive smoking and exposure to environmental tobacco smoke are common health factors which must be taken into account when analyzing data and evaluating effects of the chosen housing factors. Known harmful effects of passive smoking in adults include cardiac diseases and lung cancer, and respiratory tract infections and asthma in children (The Health Consequences of Involuntary Exposure to Tobacco Smoke, 2006). WHO experts list lung cancer, asthma and respiratory symptoms as ETS caused symptoms for adults with reliable and sufficient evidence. (WHO, 2005, Jaakkola) All the same effects are of course also found amongst smokers themselves. There have been many restrictions by law in Finland to smoking in public places such as restaurants and in schools and work places, but exposure to tobacco smoke at home is only controlled by the residents themselves.

3 AIMS OF THE WORK

The objective of the thesis was to examine associations between certain housing factors and health of Finnish residents on a general population level; to assess if certain housing factors (e.g. low quality of drinking water) have effect on the symptoms (e.g. diarrhea) that residents themselves have reported.

3.1 HYPOTHESES

General null hypothesis (H0) ï Housing health factors have no effect on symptoms.
Alternative hypothesis (H1) ï Housing health factors have an effect on symptoms.

Specifically:

Size of residence and crowding
Null hypothesis (H0) ï Crowding does not have an effect on general health status; general symptoms; the amount of accidents; or satisfaction to indoor air quality
Alternative hypothesis (H1) ï Crowding does have an effect on general health status; general symptoms; the amount of accidents; or satisfaction to indoor air quality

Quality of drinking water
Null hypothesis (H0) ï Low quality of drinking water does not have an effect on diarrhea
Alternative hypothesis (H1) ï Low quality of drinking water has an effect on diarrhea

Indoor air quality and ventilation
Null hypothesis (H0) ï Indoor air quality does not have an effect on respiratory tract infections; respiratory tract symptoms; or general symptoms
Alternative hypothesis (H1) ï Indoor air quality has an effect on respiratory tract infections; respiratory tract symptoms; or general symptoms

Thermal conditions
Null hypothesis (H0) ï Low (<20) and high (>24) room temperature does not have an effect on respiratory tract symptoms; asthma; overall health; or general symptoms
Alternative hypothesis (H1) ï Low (<20) and high (>24) room temperature has an effect on respiratory tract symptoms; asthma; overall health; or general symptoms

Dampness and mould
Null hypothesis (H0) ï Dampness does not have an effect on general symptoms; respiratory tract symptoms; respiratory tract infections; asthma; eczema and skin symptoms; or eye symptoms
Alternative hypothesis (H1) ï Dampness does have an effect on general symptoms; respiratory tract symptoms; respiratory tract infections; asthma; eczema and skin symptoms; or eye symptoms

Noise in residence and neighborhood

Null hypothesis (H0) ï Noise annoyance does not have an effect on sleep disturbance; or general symptoms

Alternative hypothesis (H1) ï Noise annoyance has an effect on sleep disturbance; or general symptoms

4 MATERIALS AND METHODS

4.1 DATA

The thesis is based on data received from a large national survey (Turunen et al. 2010; Appendix 1). The overall aims are to utilize the comprehensive survey for assessing the Finnish housing stock from the aspects of safety, quality, and health, and also to have a way of distributing information to the general public about important housing issues. This thesis is mainly based on the results received from the survey conducted in 2007. Additional housing information was received from the Finnish Population Register Center.

The survey consisted of 100 questions, divided into nine sections:

- Information about respondent, 7 questions
- Information about place of residence, 8 questions
- Information about residence, 19 questions
- Hygiene, 14 questions
- Physical and biological circumstances, 20 questions
- Chemical impurities, particles and fibres, 12 questions
- Safety, 10 questions
- Health and wellbeing, 7 questions
- Additional information and feedback, 3 questions

The survey was sent to 3000 adults, 18 -75 years old, randomly selected from the Finnish Population Register Centre, with only one respondent per household. Respondents had an option of answering on a paper format or online. The final response rate was 44% with 1312 answers.

All survey results were transferred to an electronic form. All survey responses are archived according to protocol inside THL facilities and will not be allowed to be transferred elsewhere. Electronic data are available only to members of the research group involved in the study. Prior to the surveys, ethical approval was sought from the ethics committee of THL.

In this masterôs thesis, housing health factors were evaluated by the quality (e.g. good vs. bad health status) and/or quantity (e.g. daily or weekly) of symptoms and illnesses that were

reported by surveyed residents. Six factors that are generally known to have possible effects on health were included in the study: crowding, drinking water quality, indoor air quality, ventilation, thermal conditions, dampness and mould, and noise. Studied health outcomes included general health status, general symptoms, respiratory tract symptoms and infections, asthma, sleeping disorders and eye and skin symptoms. Also the occurrence of residential accidents was analyzed. From the analyzed health outcomes in the questionnaire, asthma was described as an illness diagnosed by a medical doctor, but other health outcomes did not require diagnosis by a doctor, i.e. they were self-rated.

4.2 ANALYSES

4.2.1 Cross tabulations

All selected housing health factors and symptoms were analyzed using PASW 18 Statistics program. Cross tabulations were performed to see possible associations between housing factors and symptoms. All survey questions that were chosen for the cross tabulations are presented in Table 2. The p-values were calculated with χ^2 - test. The χ^2 - test has certain prerequisites (Karjalainen, 2010):

1) maximum 20% of the expected frequencies are less than 5
2) all expected frequencies are larger than 1
3) the gathered sample is random and independent

In some cases the conditions of the test were not met (prerequisites 1 or 2), and therefore the test results are not reliable. Some results were calculated with the exact-test, these exceptions are mentioned in the results tables.

Table 2. Housing health factors and survey question numbers which were analyzed by cross tabulations.

Housing factor	**Analyzed housing factor survey questions**	**Analyzed health outcomes survey questions**
Crowding	22, 24	91, 92, 49, 87
Drinking water quality	36, 42	92
Indoor air quality and ventilation	49, 51, 55, 56	92, 95
Thermal conditions	57, 58	91, 92, 93
Dampness and mould	61, 63, 64, 75	92, 93, 95
Noise	67	92

4.2.2 Multivariate analyses

Multivariate analyses are statistical methods for examining multiple variables simultaneously (Metsämuuronen, 2008). Based on the cross tabulations results, selection was made to perform further analysis on certain factors and symptoms with logistic regression, which is a multivariate analysis method. Logistic regression presents possible associations between variables, but the model does not explain if one variable is a direct result or consequence of another variable (Metsämuuronen, 2008).

Logistic regression analyses were performed by using PASW 18 Statistics program. Selection of survey questions for logistic regression was made by choosing the cross tabulation results where the p-value was lower than 0.1. Logistic regression analyses were performed to examine associations between symptoms and housing factors, and taking into account socio-demographic factors. The analyses were carried out by using the health outcomes as dependant variables, and housing health factors as independent variables. Logistic regression explains in what odds the independent variables (housing factors) result in the outcome (symptoms) (Metsämuuronen, 2008).

The dependant variables were re-categorized into dichotomous variables, so that two answer categories were available per variable (Karjalainen, 2010). The re-categorizing of health outcome-questions and their answers is presented in Table 3.

Table 3. Recoded health outcomes and dichotomous variables.

Original question number	Recoded question name	Dichotomous answer options
91	General health status	1=good, 0=others
92	General Symptoms	1=daily and weekly, 0=others
92	Upper respiratory tract symptoms	1=daily and weekly, 0=others
92	Lower respiratory tract symptoms	1=daily and weekly, 0=others
95	Respiratory tract infections	1=yes, 0=no
93	Asthma	1=yes, 0=no
92	Eye symptoms	1=daily and weekly, 0=others
92	Skin symptoms	1=daily and weekly, 0=others
92	Sleep disturbance	1=daily and weekly, 0=others
49	Satisfaction to indoor air quality	1=satisfied, 0=others
87	Fire accident	1=yes, 0=others
87	Accidents involving tumbling down/slipping	1=yes, 0=others
87	Accidents involving risk of suffocation	1=yes, 0=others
87	Poisoning by harmful substance	1=yes, 0=others

Socio-demographic factors were included in the analysis to adjust the results. Chosen socio-demographic variables were gender, age, marital status, highest degree of education, occupational group and income spent on living expenses (survey questions 2-7, Appendix 1). Also the presence of ETS (environmental tobacco smoke) was taken into account (question 69, Appendix 1). The results are shown with and without socio-demographic and ETS adjustment.

The independent variables chosen for logistic regression were:

- Planning of moving
- Feeling of adequate housing size
- Temperature inside residence
- Thermal conditions inside in summer/winter
- Satisfaction to indoor air quality
- Fresh air vent in bedroom
- Fireplace inside residence
- Airing the residence with hood
- Moisture or mold on inner wall, floor or ceiling surfaces
- Serious water damage
- Smell of mold inside residence
- Frequency of road and street traffic noise disturbance
- Frequency of yard noise disturbance

- Frequency of HVAC noise disturbance
- Frequency of noise disturbance originating from neighbors
- Frequency of home noise disturbance
- Noise from home

In the first phase of logistic regression analysis the independent variable was chosen with enter-method. In the second phase the socio-demographic and ETS factors were chosen to adjust the results, also with the enter-method. The logistic regression results were evaluated by examining the p-value (statistically significant < 0.05) and odds ratio. The probability towards value 1 (e.g. having asthma, Table 3) was examined in the models.

5 RESULTS

5.1 CROSS TABULATIONS

5.1.1 Size of residence and crowding

Survey respondentsô opinions about the size of their housing and their correlations with selected health outcomes and satisfaction to indoor air quality is presented in Table 4. Table 5 shows the associations between housing size and different domestic accidents and dangerous situations. Association between housing size with general symptoms and indoor air quality were statistically significant. Respondents who feel that their residence is not of adequate size or are planning to move due to need of inadequate housing size seemed to experience general symptoms more often and were less satisfied with the indoor air quality of their home than those who were satisfied with the size of their housing. No association was observed with housing size and general health status. The only statistically significant association between housing size and domestic accidents was with accidents that involved tumbling down or slipping. Respondents who feel that their home is of inadequate size seemed to be more often involved in these kind of accidents inside their residence or in the immediate surroundings of their home than those who were satisfied with their housing size.

Table 4. Feeling of adequate housing size, planning of moving due to inadequate housing size and general health status, general symptoms, and indoor air satisfaction.

Symptom	**Options**	**Inadequate size**	**Adequate size**	**p**	**Moving not planned**	**Moving planned**	**p**
General health status[2]	1. Good	63 (35.2%)	399 (36.4%)	0.579	435 (36.1%)	28 (36.8%)	0.065[1]
	2. Fairly good	77 (43.0%)	431 (39.3%)		473 (39.3%)	36 (47.4%)	
	3. Satisfactory	28 (15.6%)	216 (19.7%)		240 (19.9%)	7 (9.2%)	
	4. Fairly Bad	9 (5%)	43 (3.9%)		49 (4.1%)	3 (3.9%)	
	5. Bad	2 (1.1%)	7 (0.6%)		8 (0.7%)	2 (2.6%)	
General symptoms (headache, fatigue, concentration difficulties)	1. Daily/ almost daily	24 (14.3%)	76 (7.8%)	0.000	91 (8.5%)	10 (13.9%)	0.000
	2. Weekly	51 (30.4%)	156 (16.0%)		182 (16.9%)	26 (36.1%)	
	3. Monthly	36 (21.4%)	191 (19.6%)		215 (20.0%)	13 (18.1%)	
	4. Less frequently	45 (26.8%)	361 (37.1%)		388 (36.1%)	20 (27.8%)	
	5. Never	12 (7.1%)	190 (19.5%)		199 (18.5%)	3 (4.2%)	
Satisfaction to indoor air quality of the residence[2]	1. Satisfied	44 (24.9%)	539 (49.1%)	0.000	565 (46.9%)	18 (24.3%)	0.000
	2. Fairly satisfied	97 (54.8%)	486 (44.3%)		546 (45.3%)	40 (54.1%)	
	3. Fairly unsatisfied	29 (16.4%)	58 (5.3%)		76 (6.3%)	12 (16.2%)	
	4. Unsatisfied	7 (4.0%)	14 (1.3%)		17 (1.4%)	4 (5.4%)	

[1] Calculated with Exact-test
[2] Calculated without the option ñcannot sayò

Table 5. Feeling of adequate housing size, planning of moving due to inadequate housing size and accidents inside the residence or in the immediate surroundings during the last 12 months

Symptom	**Options**	**Inadequate size**	**Adequate size**	**p**	**Moving not planned**	**Moving planned**	**p**
Fire accidents	1. No	169 (92.9%)	1073 (95.9%)	0.068	1180 (95.8%)	69 (90.8%)	0.05[1]
	2. Yes	13 (7.1)	46 (4.1%)		52 (4.2%)	7 (9.2%)	
Accidents resulting in burns	1. No	176 (69.7%)	1098 (98.1%)	0.213[2]	1208 (98.1%)	73 (96.1%)	0.234[2]
	2. Yes	6 (3.3%)	21 (1.9%)		24 (1.9%)	3 (3.9%)	
Accidents involving tumbling down/slipping	1. No	151 (83.0 %)	1000 (89.4%)	0.012	1095 (88.9%)	61 (80.3%)	0.023
	2. Yes	31 (17.0%)	119 (10.6%)		137 (11.1%)	15 (19.7%)	
Accidents involving falling	1. No	176 (96.7%)	1101 (98.4%)	0.117[2]	1210 (98.2%)	74 (97.4%)	0.594[2]
	2. Yes	6 (3.3%)	18 (1.6%)		22 (1.8%)	2 (2.6%)	
Accidents involving risk of suffocation	1. No	181 (99.5%)	1111 (99.3%)	0.803[2]	1224 (99.4%)	75 (98.7%)	0.495[2]
	2. Yes	1 (0.5%)	8 (0.7%)		8 (0.6%)	1 (1.3%)	
Poisoning by harmful substances	1. No	180 (98.9%)	1117 (99.8%)	0.096[1]	1228 (99.7%)	76 (100.0%)	0.619[2]
	2. Yes	2 (1.1%)	2 (0.2%)		4 (0.3%)	0 (0.0%)	

[1] Calculated with Exact-test
[2] The conditions of the test are not met

5.1.2 Quality of drinking water

Association between observed abnormalities of drinking water and habit of letting water run before using it for cooking or drinking with diarrhea is shown in Table 6. The amount of respondents who have observed abnormalities in their drinking water was very low. There was no association between selected factors and diarrhea. No further analysis (logistic regression) was performed for quality of drinking water, as it was clear that no statistical significant association existed between this housing factor and selected health outcome.

Table 6. Abnormalities (smell, taste, sediment or color) in drinking water, usage of warm/unrun tap water for drinking or cooking and diarrhea during the last 12 months.

Symptom	Options	No abnormalities	Abnormalities	p	Warm tap water not used	Warm tap water used	p
Diarrhea	1. Daily / almost daily	8 (0.8%)	1 (0.9%)	0.672[1]	8 (0.9%)	1 (0.5%)	0.935
	2. Weekly	34 (3.6%)	5 (4.4%)		31 (3.6%)	8 (4.2%)	
	3. Monthly	47 (4.9%)	4 (3.5%)		41 (4.7%)	10 (5.2%)	
	4. Less frequently	352 (37.0%)	49 (43.4%)		333 (38.2%)	69 (35.9%)	
	5. Never	510 (53.6%)	54 (47.8%)		458 (52.6%)	104 (54.2%)	

[1] The conditions of the test are not met

5.1.3 Indoor air quality and ventilation

Different indoor air quality factors and their correlation with general symptoms, respiratory tract symptoms, and respiratory tract infections are presented in tables 7, 8, 9 and 10. In table 7 it is shown that residents who were not satisfied with quality of indoor air inside their homes seemed to experience more general symptoms, respiratory tract symptoms and infections than those who were satisfied with indoor air quality. Associations between indoor air quality with selected health outcomes are all statistically significant, but the conditions of the test were not met in the case of lower respiratory tract symptoms.

Existence of a fresh air vent in residents` bedroom and a fireplace inside residence in correlation with general symptoms and respiratory tract health outcomes are presented in table 8. Fresh air vents inside bedroom and occurrence of general symptoms and respiratory tract infections were statistically significant. People with fresh air vents situated in bedroom seemed to have general symptoms and respiratory tract infections less often than people without fresh air vents. No association could be seen with bedroom fresh air vents and respiratory tract symptoms. Having a fireplace such as a wood range or stove inside residence was correlated and statistically significant with having less general symptoms and respiratory tract health outcomes.

Associations between airing of the residence and general symptoms, respiratory tract symptoms and respiratory tract infections are shown in Tables 9 and 10. Airing the residence daily or when needed with hood had statistically significant association with having less general symptoms and respiratory tract infections, but not with respiratory tract symptoms. Airing the residence by opening windows had no association with any of the selected health outcomes.

Table 7. Satisfaction to indoor air quality (calculated without option "cannot say") and general symptoms, respiratory tract symptoms and infections during the last 12 months.

Symptom	Options	Satisfied	Fairly satisfied	Fairly unsatisfied	Unsatisfied	p
General symptoms (headache, fatigue, concentration difficulties)	1. Daily / almost daily	25 (5.0%)	55 (10.5%)	12 (14.6%)	4 (21.1%)	0.000
	2. Weekly	67 (13.4%)	108 (20.6%)	25 (30.5%)	4 (21.1%)	
	3. Monthly	78 (15.6%)	120 (22.9%)	20 (24.4%)	7 (36.8%)	
	4. Less frequently	203 (40.7%)	176 (33.5%)	19 (23.2%)	2 (10.5%)	
	5. Never	126 (25.3%)	66 (12.6%)	6 (7.3%)	2 (10.5%)	
Upper respiratory tract symptoms (blocked nose, head cold, dry or sore throat)	1. Daily / almost daily	35 (6.9%)	68 (12.9%)	16 (19.0%)	7 (35.0%)	0.000
	2. Weekly	23 (4.6%)	58 (11.0%)	14 (16.7%)	3 (15.0%)	
	3. Monthly	53 (10.5%)	83 (15.7%)	15 (17.9%)	3 (15.0%)	
	4. Less frequently	254 (50.3%)	266 (50.3%)	33 (39.3%)	6 (30.0%)	
	5. Never	140 (27.7%)	54 (10.2%)	6 (7.1%)	1 (5.0%)	
Lower respiratory tract symptoms (shortness of breath, cough, mucous secretion)	1. Daily / almost daily	23 (4.7%)	34 (6.7%)	11 (13.1%)	3 (16.7%)	0.000[1]
	2. Weekly	12 (2.4%)	25 (4.9%)	5 (6.0%)	3 (16.7%)	
	3. Monthly	23 (4.7%)	50 (9.8%)	9 (10.7%)	2 (11.1%)	
	4. Less frequently	209 (42.3%)	249 (48.9%)	42 (50.0%)	8 (44.4%)	
	5. Never	227 (46.0%)	151 (29.7%)	17 (20.2%)	2 (11.1%)	
Respiratory tract infections	1. No	461 (84.6%)	412 (73.8%)	56 (65.9%)	12 (63.2%)	0.000
	2. Yes	84 (15.4%)	146 (26.2%)	29 (34.1%)	7 (36.8%)	

[1]The conditions of the test are not met

Table 8. Fresh air vent situated in bedroom and fireplace situated inside residence (wood range, fireplace, stove) and general symptoms, respiratory tract symptoms, and infections during the last 12 months.

Symptom	**Options**	**No vent**	**Yes vent**	**p**	**No fireplace**	**Yes fireplace**	**p**
General symptoms (headache, fatigue, concentration difficulties)	1. Daily/almost daily	57 (11.6%)	42 (6.6%)	0.045	44 (9.2%)	36 (6.8%)	0.012
	2. Weekly	88 (18.0%)	116 (18.2%)		99 (20.8%)	81 (15.4%)	
	3. Monthly	88 (18.0%)	135 (21.1%)		102 (21.4%)	102 (19.4%)	
	4. Less frequently	171 (34.9%)	234 (36.6%)		151 (31.7%)	218 (41.4%)	
	5. Never	86 (17.6%)	112 (17.5%)		81 (17.0%)	89 (16.9%)	
Upper respiratory tract symptoms (blocked nose, head cold, dry or sore throat)	1. Daily/almost daily	66 (13.1%)	61 (9.6%)	0.166	59 (12.3%)	48 (9.0%)	0.003
	2. Weekly	50 (10.0%)	50 (7.8%)		45 (9.4%)	38 (7.1%)	
	3. Monthly	61 (12.2%)	94 (14.7%)		84 (17.5%)	61 (11.5%)	
	4. Less frequently	239 (47.6%)	319 (50.0%)		217 (45.3%)	280 (52.6%)	
	5. Never	86 (17.1%)	114 (17.9%)		74 (15.4%)	105 (19.7%)	
Lower respiratory tract symptoms (shortness of breath, cough, mucous secretion)	1. Daily/almost daily	35 (7.2%)	38 (6.1%)	0.352	31 (6.7%)	28 (5.4%)	0.013
	2. Weekly	24 (4.9%)	20 (3.2%)		21 (4.5%)	15 (2.9%)	
	3. Monthly	36 (7.4%)	46 (7.4%)		47 (10.2%)	27 (5.2%)	
	4. Less frequently	210 (43.3%)	301 (48.3%)		213 (46.1%)	256 (49.2%)	
	5. Never	180 (37.1%)	218 (35.0%)		150 (32.5%)	194 (37.3%)	
Respiratory tract infections	1. No	382 (73.5%)	563 (81.4%)	0.001	370 (75.1%)	458 (80.2%)	0.043
	2. Yes	138 (26.5%)	129 (18.6%)		123 (24.9%)	113 (19.8%)	

Table 9. Airing the residence with hood and general symptoms, respiratory tract symptoms and infections during the last 12 months.

Symptom	**Options**	**Daily**	**seldom/when needed**	**never/not possible**	**p**
General symptoms (headache, fatigue, concentration difficulties)	1. Daily/almost daily	31 (5.9%)	31 (8.8%)	15 (14.7%)	0.018
	2. Weekly	93 (17.6%)	67 (19.0%)	23 (22.5%)	
	3. Monthly	107 (20.2%)	75 (21.3%)	22 (21.6%)	
	4. Less frequently	199 (37.6%)	123 (34.9%)	35 (34.3%)	
	5. Never	99 (18.7%)	56 (15.9%)	7 (6.9%)	
Upper respiratory tract symptoms (blocked nose, head cold, dry or sore throat)	1. Daily/almost daily	50 (9.3%)	43 (12.1%)	13 (12.9%)	0.054
	2. Weekly	34 (6.3%)	39 (11.0%)	8 (7.9%)	
	3. Monthly	79 (14.7%)	44 (12.4%)	13 (12.9%)	
	4. Less frequently	283 (52.5%)	162 (45.6%)	57 (56.4%)	
	5. Never	93 (17.3%)	67 (18.9%)	10 (9.9%)	
Lower respiratory tract symptoms (shortness of breath, cough, mucous secretion)	1. Daily/almost daily	32 (6.1%)	23 (6.6%)	7 (7.0%)	0.771
	2. Weekly	16 (3.0%)	10 (2.9%)	5 (5.0%)	
	3. Monthly	35 (6.7%)	26 (7.5%)	8 (8.0%)	
	4. Less frequently	262 (49.8%)	154 (44.5%)	50 (50.0%)	
	5. Never	181 (34.4%)	133 (38.4%)	30 (30.0%)	
Respiratory tract infections	1. No	458 (79.8%)	277 (75.3%)	66 (66.0%)	0.007
	2. Yes	116 (20.2%)	91 (24.7%)	34 (34.0%)	

Table 10. Airing the residence through window and general symptoms, respiratory tract symptoms and infections during the last 12 months.

Symptom	**Options**	**Daily**	**seldom/when needed**	**never/not possible**	**p**
General symptoms (headache, fatigue, concentration difficulties)	1. Daily/almost daily	76 (9.4%)	22 (7.5%)	0 (0.0%)	0.303[1]
	2. Weekly	155 (19.1%)	48 (16.3%)	3 (20.0%)	
	3. Monthly	151 (18.6%)	68 (23.1%)	6 (40.0%)	
	4. Less frequently	285 (35.1%)	109 (37.1%)	4 (26.7%)	
	5. Never	145 (17.9%)	47 (16.0%)	2 (13.3%)	
Upper respiratory tract symptoms (blocked nose, head cold, dry or sore throat)	1. Daily/almost daily	98 (11.9%)	21 (7.3%)	3 (16.7%)	0.186[1]
	2. Weekly	74 (9.0%)	23 (8.0%)	2 (11.1%)	
	3. Monthly	113 (13.7%)	42 (14.6%)	0 (0.0%)	
	4. Less frequently	400 (48.7%)	147 (51.0%)	12 (66.7%)	
	5. Never	137 (16.7%)	55 (19.1%)	1 (5.6%)	
Lower respiratory tract symptoms (shortness of breath, cough, mucous secretion)	1. Daily/almost daily	60 (7.5%)	10 (3.5%)	2 (12.5%)	0.111[1]
	2. Weekly	38 (4.8%)	7 (2.5%)	0 (0.0%)	
	3. Monthly	60 (7.5%)	22 (7.7%)	0 (0.0%)	
	4. Less frequently	364 (45.6%)	136 (47.9%)	10 (62.5%)	
	5. Never	277 (34.7%)	109 (38.4%)	4 (25.0%)	
Respiratory tract infections	1. No	665 (76.6%)	249 (80.1%)	12 (70.6%)	0.364
	2. Yes	203 (23.4%)	62 (19.9%)	5 (29.4%)	

[1]The conditions of the test are not met

5.1.4 Thermal conditions

Associations between indoor temperatures during heating season with perceived general health status and symptoms, and respiratory tract symptoms are presented in Table 11. Housing indoor temperature of above 24 °C seemed to be associated and statistically significant with residents having poorer general health status and more general and lower respiratory tract symptoms than with indoor temperatures being lower than 24 °C. The conditions set for the test were not fulfilled in the case of general health status and general symptoms. Indoor temperature during heating season was not associated with upper respiratory tract symptoms or asthma.

Thermal conditions inside residence during summertime and general symptoms, and respiratory tract symptoms are presented in Table 12. Residents perceiving to have good thermal conditions appeared to have better health status, less general symptoms, and less upper and lower respiratory tract symptoms than those who perceived their homes to be excessively warm or chilly, draughty, or having cold floor surfaces. All these associations were statistically significant, but the conditions of the test were not met in the case of general health status. Thermal conditions during summertime and asthma were not associated.

Thermal conditions inside residence during winter and general health status and symptoms, and respiratory tracts symptoms are shown in Table 13. Having a chilly or draughty home or cold floor surfaces during wintertime was associated and statistically significant with residents having more general, and upper and lower respiratory tract symptoms than when conditions were experienced to be good or too warm, but none of these fulfilled the conditions set for the test. No association could be found with winter thermal conditions and general health status or asthma. For thermal conditions and asthma as a symptoms, there was no further analysis performed (logistic regression), as it was clear that no statistical significance existed between this housing factor and asthma.

Table 11. Temperature inside residence during heating season and general health status, general symptoms, respiratory tract symptoms, and asthma during the last 12 months.

Symptom	**Options**	**< 20 °C**	**20 - 24 °C**	**> 24 °C**	**p**
General health status[1]	1. Good	100 (37.5%)	357 (36.0%)	5 (31.3%)	0.000[2]
	2. Fairly good	108 (40.4%)	396 (39.9%)	4 (25.0%)	
	3. Satisfactory	42 (15.7%)	199 (20.0%)	4 (25.0%)	
	4. Fairly Bad	14 (5.2%)	37 (3.7%)	1 (6.3%)	
	5. Bad	3 (1.1%)	4 (0.4%)	2 (12.5%)	
General symptoms (headache, fatigue, concentration difficulties)	1. Daily/almost daily	20 (8.7%)	75 (8.4%)	6 (35.3%)	0.028[2]
	2. Weekly	43 (18.6%)	160 (17.9%)	3 (17.6%)	
	3. Monthly	44 (19.0%)	180 (20.1%)	4 (23.5%)	
	4. Less frequently	85 (36.8%)	320 (35.7%)	2 (11.8%)	
	5. Never	39 (16.9%)	161 (18.0%)	2 (11.8%)	
Upper respiratory tract symptoms (blocked nose, head cold, dry or sore throat)	1. Daily/almost daily	27 (11.5%)	96 (10.6%)	5 (31.3%)	0.094[2]
	2. Weekly	23 (9.8%)	77 (8.5%)	0 (0.0%)	
	3. Monthly	26 (11.1%)	131 (14.5%)	1 (6.3%)	
	4. Less frequently	113 (48.3%)	448 (49.6%)	5 (31.3%)	
	5. Never	45 (19.2%)	152 (16.8%)	5 (31.3%)	
Lower respiratory tract symptoms (shortness of breath, cough, mucous secretion)	1. Daily/almost daily	16 (7.1%)	55 (6.3%)	3 (18.8%)	0.03[3]
	2. Weekly	10 (4.4%)	34 (3.9%)	0 (0.0%)	
	3. Monthly	10 (4.4%)	70 (8.0%)	4 (25.0%)	
	4. Less frequently	99 (43.8%)	412 (46.9%)	6 (37.5%9	
	5. Never	91 (40.3%)	307 (35.0%)	3 (18.8%)	
Asthma	1. No	245 (92.5%)	907 (92.5%)	15 (83.3%)	0.353
	2. Yes	20 (7.5%)	74 (7.5%)	3 (16.7%)	

[1] Calculated without the option ñcannot sayò
[2] The conditions of the test are not met
[3] Calculated with Exact-test

Table 12. Feeling of thermal conditions inside residence during summer and general health status, general symptoms, respiratory tract symptoms, and asthma during the last 12 months.

Symptom	**Options**	**Good conditions**	**Too warm**	**Too chilly, draughty or cold floors**	**p**
General health status[1]	1. Good	327 (38.7%)	115 (31.7%)	14 (37.8%)	0.000[2]
	2. Fairly good	326 (38.5%)	161 (44.4%)	10 (27.0%)	
	3. Satisfactory	162 (19.1%)	65 (17.9%)	8 (21.6%)	
	4. Fairly Bad	29 (3.4%)	19 (5.2%)	2 (5.4%)	
	5. Bad	2 (0.2%)	3 (0.8%)	3 (8.1%)	
General symptoms (headache, fatigue, concentration difficulties)	1. Daily/almost daily	48 (6.4%)	43 (12.6%)	7 (21.2%)	0.000
	2. Weekly	119 (15.8%)	78 (22.8%)	9 (27.3%)	
	3. Monthly	145 (19.3%)	72 (21.1%)	7 (21.2%)	
	4. Less frequently	284 (37.8%)	109 (31.9%)	9 (27.3%)	
	5. Never	156 (20.7%)	40 (11.7%)	1 (3.0%)	
Upper respiratory tract symptoms (blocked nose, head cold, dry or sore throat)	1. Daily/almost daily	77 (10.2%)	42 (12.2%)	8 (23.5%)	0.008
	2. Weekly	64 (8.5%)	33 (9.6%)	3 (8.8%)	
	3. Monthly	89 (11.8%)	58 (16.8%)	5 (14.7%)	
	4. Less frequently	376 (49.7%)	166 (48.1%)	17 (50.0%)	
	5. Never	151 (19.9%)	46 (13.3%)	1 (2.9%)	
Lower respiratory tract symptoms (shortness of breath, cough, mucous secretion)	1. Daily/almost daily	42 (5.7%)	23 (6.9%)	7 (21.9%)	0.007
	2. Weekly	35 (4.8%)	10 (3.0%)	0 (0.0%)	
	3. Monthly	49 (6.7%)	30 (9.0%)	4 (12.5%)	
	4. Less frequently	335 (45.5%)	162 (48.5%)	11 (34.4%)	
	5. Never	275 (37.4%)	109 (32.6%)	10 (31.3%)	
Asthma	1. No	775 (92.2%)	333 (93.3%)	32 (88.9%)	0.579
	2. Yes	66 (7.8%)	24 (6.7%)	4 (11.1%)	

[1] Calculated without the option ñcannot sayò

[2] The conditions of the test are not met

Table 13. Feeling of thermal conditions inside residence during winter and general health status, general symptoms, respiratory tract symptoms, and asthma during the last 12 months.

Symptom	**Options**	**Good conditions**	**Too warm**	**Too chilly, draughty or cold floors**	**p**
General health status[1]	1. Good	323 (37.0%)	10 (40.0%)	119 (33.9%)	0.068[2]
	2. Fairly good	344 (39.4%)	11 (44.0%)	146 (41.6%)	
	3. Satisfactory	173 (19.8%)	3 (12.0%)	61 (17.4%	
	4. Fairly Bad	30 (3.4%)	0 (0.0%)	21 (6.0%)	
	5. Bad	3 (0.3%)	1 (4.0%)	4 (1.1%)	
General symptoms (headache, fatigue, concentration difficulties)	1. Daily/almost daily	51 (6.6%)	2 (9.5%)	46 (13.9%)	0.000[2]
	2. Weekly	124 (16.0%)	2 (9.5%)	79 (23.9%)	
	3. Monthly	144 (18.5%)	9 (42.9%)	72 (21.8%)	
	4. Less frequently	299 (38.5%)	5 (23.8%)	96 (29.1%)	
	5. Never	159 (20.5%)	3 (14.3%)	37 (11.2%)	
Upper respiratory tract symptoms (blocked nose, head cold, dry or sore throat)	1. Daily/almost daily	66 (8.5%)	1 (4.8%)	60 (17.8%)	0.000[2]
	2. Weekly	61 (7.8%)	2 (9.5%)	36 (10.7%)	
	3. Monthly	106 (13.6%)	2 (9.5%)	49 (14.5%)	
	4. Less frequently	387 (49.6%)	9 (42.9%)	163 (48.2%)	
	5. Never	161 (20.6%)	7 (33.3%)	30 (8.9%)	
Lower respiratory tract symptoms (shortness of breath, cough, mucous secretion)	1. Daily/almost daily	42 (5.5%)	1 (5.0%)	30 (9.1%)	0.001[2]
	2. Weekly	27 (3.6%)	2 (10.0%)	15 (4.6%)	
	3. Monthly	47 (6.2%)	3 (15.0%)	32 (9.8%)	
	4. Less frequently	342 (45.1%)	6 (30.0%)	166 (50.6%)	
	5. Never	300 (39.6%)	8 (40.0%)	85 (25.9%)	
Asthma	1. No	793 (92.2%)	23 (95.8%)	325 (92.1%)	0.799
	2. Yes	67 (7.8%)	1 (4.2%)	28 (7.9%)	

[1] Calculated without the option ñcannot sayò

[2] The conditions of the test are not met

5.1.5 Dampness and mould

Occurrence of serious and extensive water damage due to e.g. burst pipes or storm damages in correlation with general symptoms, respiratory tract symptoms and infections, and asthma is presented in Table 14, and association with eye and skin symptoms is seen in Table 15. No statistically significant association was found with any of the selected health outcomes.

Association of visible moisture or mould damage on inner surfaces of residence and smell of mold inside residence with general symptoms, respiratory tract symptoms and infections, and asthma are presented in Table 16, and association with eye and skin symptoms is presented in Table 17. There was a statistically significant association with damage on surfaces and all selected health outcomes excluding asthma. Having visible moisture or mold damage on the inner surfaces of the residence seemed to have a connection to increased occurrence of general symptoms, upper and lower respiratory tract symptoms, respiratory infections, and skin and eye symptoms, though the conditions of the test were not met in the case of lower respiratory tract symptoms. Detecting mould odor inside residence was statistically significantly associated with increased occurrence of upper respiratory tract symptoms, eye symptoms, and skin symptoms but not with the other selected health outcomes, though the conditions of the test were not met for the eye and skin symptoms.

Table 14. Occurrence of serious water damage (e.g. pipe leaks, storm damages, flooding) with large amounts of water wetting extensive areas inside residence or in the structures and general symptoms, respiratory tract symptoms and infections, and asthma during the last 12 months.

Symptom	**Options**	**Yes**	**No**[1]	**p**
General symptoms (headache, fatigue, concentration difficulties)	1. Daily/almost daily	4 (13.3%)	92 (8.5%)	0.739
	2. Weekly	5 (16.7%)	200 (18.5%)	
	3. Monthly	8 (26.7%)	218 (20.1%)	
	4. Less frequently	9 (30.0%)	386 (35.6%)	
	5. Never	4 (13.3%)	187 (17.3%)	
Upper respiratory tract symptoms (blocked nose, head cold, dry or sore throat)	1. Daily/almost daily	5 (51.6%)	121 (11.1%)	0.821[2]
	2. Weekly	4 (12.5%)	95 (8.7%)	
	3. Monthly	4 (12.5%)	149 (13.7%)	
	4. Less frequently	15 (46.9%)	540 (49.5%)	
	5. Never	4 (12.5%)	186 (17.0%)	
Lower respiratory tract symptoms (shortness of breath, cough, mucous secretion)	1. Daily/almost daily	3 (9.7%)	67 (6.3%)	0.451[2]
	2. Weekly	3 (9.7%)	40 (3.8%)	
	3. Monthly	2 (6.5%)	81 (7.6%)	
	4. Less frequently	12 (38.7%)	497 (46.9%)	
	5. Never	11 (35.5%)	374 (35.3%)	
Respiratory tract infections	1. No	26 (81.3%)	891 (77.3%)	0.596
	2. Yes	6 (18.8%)	262 (22.7%)	
Asthma	1. No	25 (83.3%)	1103 (92.6%)	0.072[3]
	2. Yes	5 (16.7%)	88 (7.4%)	

[1]Combined options No water damage, Do not know, and Yes water damage over 12 months ago
[2] The conditions of the test are not met
[3] Calculated with Exact-test

Table 15. Occurrence of serious water damage (e.g. pipe leaks, storm damages, flooding) with large amounts of water wetting extensive areas inside residence or in the structures and eye and skin symptoms during the last 12 months.

Symptom	**Options**	**Yes**	**No**[1]	**p**
Eye symptoms (itch, dryness, foreign body sensation)	1. Daily/almost daily	1 (3.3%)	97 (8.9%)	0.152[2]
	2. Weekly	5 (16.7%)	87 (8.0%)	
	3. Monthly	6 (20.0%)	116 (10.7%)	
	4. Less frequently	8 (26.7%)	376 (34.6%)	
	5. Never	10 (33.3%)	410 (37.8%)	
Skin symptoms or rash (redness, dryness, itch)	1. Daily/almost daily	4 (12.9%)	97 (9.2%)	0.582[2]
	2. Weekly	3 (9.7%)	76 (7.2%)	
	3. Monthly	5 (16.1%)	99 (9.4%)	
	4. Less frequently	8 (25.8%)	346 (32.7%)	
	5. Never	11 (35.5%)	439 (41.5%)	

[1]Combined options No water damage, Do not know, and Yes water damage over 12 months ago
[2] The conditions of the test are not met

Table 16. Moisture or mold damage on inner wall, floor or ceiling surfaces inside residence, smell of mold inside residence and general symptoms, respiratory tract symptoms and infections, and asthma during the last 12 months.

Symptom	**Options**	**No,damage**	**Yes,damage**	**p**	**No,smell**	**Yes,smell**	**p**
General symptoms (headache, fatigue, concentration difficulties)	1. Daily / almost daily	90 (8.3%)	11 (16.9%)	0.000	99 (8.7%)	2 (15.4%)	0.491[1]
	2. Weekly	188 (17.4%)	20 (30.8%)		204 (18.0%)	4 (30.8%)	
	3. Monthly	211 (19.5%)	17 (26.2%)		225 (19.8%)	3 (23.1%)	
	4. Less frequently	398 (36.8%)	10 (15.4%)		406 (35.8%)	2 (15.4%)	
	5. Never	195 (18.0%)	7 (10.8%)		200 (17.6%)	2 (15.4%)	
Upper respiratory tract symptoms (blocked nose, head cold, dry or sore throat)	1. Daily / almost daily	114 (10.4%)	15 (23.1%)	0.000	124 (10.8%)	5 (35.7%)	0.013[2]
	2. Weekly	95 (8.7%)	6 (9.2%)		98 (8.6%)	3 (21.4%)	
	3. Monthly	144 (13.2%)	14 (21.5%)		156 (13.6%)	2 (14.3%)	
	4. Less frequently	538 (49.3%)	28 (43.1%)		563 (49.3%)	3 (21.4%)	
	5. Never	201 (18.4%)	2 (3.1%)		202 (17.7%)	1 (7.1%)	
Lower respiratory tract symptoms (shortness of breath, cough, mucous secretion)	1. Daily / almost daily	67 (6.3%)	8 (13.1%)	0.001[1]	73 (6.6%)	2 (15.4%)	0.193[1]
	2. Weekly	39 (3.7%)	6 (9.8%)		44 (4.0%)	1 (7.7%)	
	3. Monthly	76 (7.1%)	9 (14.8%)		83 (7.5%)	2 (15.4%)	
	4. Less frequently	490 (46.1%)	27 (44.3%)		510 (45.9%)	7 (53.8%)	
	5. Never	391 (36.8%)	11 (18.0%)		401 (36.1%)	1 (7.7%)	
Respiratory tract infections	1. No	916 (78.5%)	40 (61.5%)	0.001	946 (77.6%)	10 (76.9%)	0.953[1]
	2. Yes	251 (21.5%)	25 (38.5%)		273 (22.4%)	3 (23.1%)	
Asthma	1. No	1111 (92.6%)	59 (86.8%)	0.080	1158 (92.4%)	12 (80.0%)	0.073[1]
	2. Yes	89 (7.4%)	9 (13.2%)		95 (7.6%)	3 (20.0%)	

[1] The conditions of the test are not met

[2] Calculated with Exact-test

Table 17. Moisture or mold damage on inner wall, floor or ceiling surfaces inside residence, smell of mold inside residence and eye and skin symptoms during the last 12 months.

Symptom	Options	No, damage	Yes, damage	p	No, smell	Yes, smell	p
Eye symptoms (itch, dryness, foreign body sensation)	1. Daily/almost daily	94 (8.7%)	11 (17.2%)	0.039	103 (9.1%)	2 (14.3%)	0.000[1]
	2. Weekly	87 (8.0%)	8 (12.5%)		89 (7.8%)	6 (42.9%)	
	3. Monthly	119 (11.0%)	8 (12.5%)		125 (11.0%)	2 (14.3%)	
	4. Less frequently	367 (33.8%)	22 (34.4%)		386 (34.0%)	3 (21.4%)	
	5. Never	419 (38.6%)	15 (23.4%)		433 (38.1%)	1 (7.1%)	
Skin symptoms or rash (redness, dryness, itch)	1. Daily/almost daily	91 (8.6%)	13 (20.6%)	0.002	102 (9.2%)	2 (16.7%)	0.006[1]
	2. Weekly	73 (6.9%)	7 (11.1%)		76 (6.9%)	4 (33.3%)	
	3. Monthly	95 (9.0%)	9 (14.3%)		103 (9.3%)	1 (8.3%)	
	4. Less frequently	342 (32.4%)	17 (27.0%)		356 (32.2%)	3 (25.0%)	
	5. Never	453 (43.0%)	17 (27.0%)		468 (42.4%)	2 (16.7%)	

[1] The conditions of the test are not met

5.1.6 Noise in residence and neighborhood

Associations between different kinds of noise disturbance inside the respondents` residence or in the living environment and self reported occurrence of general symptoms and sleep disturbance are shown in Tables 18 ï 26.

Table 18 shows that daily or almost daily noise disturbance from road or street traffic had a statistically significant association with experiencing general symptoms more often, but no association could be seen with sleep disturbance.

Table 19 shows that there was no association between rail traffic noise and general symptoms and sleep disturbance. The conditions of the test were not met with either one of the selected health outcomes. Also, no association existed between air traffic noise or industrial noise, and general symptoms and sleep disturbance, as is seen in tables 20 and 21, respectively. In the case of industrial noise and selected health outcomes, the conditions of the test were not met.

Yard noise disturbance caused by e.g. leaf blowers or equipment used for clearing snow was associated with general symptoms and sleep disturbance as is presented in Table 22. Daily yard noise disturbance appeared to have an association with general symptoms and sleep disturbance, but the conditions set for the test were not fulfilled in the case of general symptoms. Table 23 shows that also HVAC noise, which is caused by e.g. ventilation systems, was associated to general symptoms and sleep disturbance, but the conditions of the test were not met for either of these health outcomes.

In Table 24 it is seen that daily or weekly noise disturbance from neighbors was associated to experiencing general symptoms more often than with occasional disturbance or no disturbance at all. Daily and weekly neighbor noise disturbance was also associated with sleeping problems. Associations were statistically significant with both health outcomes. Noise disturbance originating from respondents` own homes, such as noise caused by music and home appliances, was associated and statistically significant with general symptoms but not with sleeping problems, as is seen in Table 25.

Table 26 shows that other sources of noise disturbance was not associated with general symptoms or sleep disturbance.

Table 18. Frequency of road and street traffic noise disturbance inside residence or in the living environment and general symptoms and sleep disturbances during the last 12 months.

Symptom	Options	No disturbance	Daily / almost daily disturbance	Weekly disturbance	Occasional/seasonal disturbance	p
General symptoms (headache, fatigue, concentration difficulties)	1. Daily/almost daily	53 (8.2%)	32 (12.7%)	1 (2.5%)	13 (7.9%)	0.000
	2. Weekly	107 (16.6%)	53 (21.1%)	13 (32.5%)	27 (16.4%)	
	3. Monthly	123 (19.1%)	53 (21.1%)	7 (17.5%)	38 (23.0%)	
	4. Less frequently	219 (34.0%)	83 (33.1%)	12 (30.0%)	70 (42.4%)	
	5. Never	143 (22.2%)	30 (12.0%)	7 (17.5%)	17 (10.3%)	
Sleep disturbance	1. Daily/almost daily	51 (7.9%)	21 (8.7%)	3 (7.7%)	6 (3.6%)	0.248
	2. Weekly	65 (10.1%)	26 (10.7%)	5 (12.8%)	20 (12.1%)	
	3. Monthly	72 (11.2%)	33 (13.6%)	6 (15.4%)	22 (13.3%)	
	4. Less frequently	200 (31.2%)	91 (37.6%)	9 (23.1%)	58 (35.2%)	
	5. Never	254 (39.6%)	71 (29.3%)	16 (41.0%)	59 (35.8%)	

Table 19. Frequency of rail traffic noise disturbance inside residence or in the living environment and general symptoms and sleep disturbances during the last 12 months.

Symptom	Options	No disturbance	Daily / almost daily disturbance	Weekly disturbance	Occasional/seasonal disturbance	p
General symptoms (headache, fatigue, concentration difficulties)	1. Daily/almost daily	77 (8.1%)	6 (11.3%)	1 (8.3%)	2 (6.3%)	0.394[1]
	2. Weekly	166 (17.5%)	14 (26.4%)	3 (25.0%)	7 (21.9%)	
	3. Monthly	190 (20.1%)	16 (30.2%)	1 (8.3%)	6 (18.8%)	
	4. Less frequently	339 (35.8%)	12 (22.6%)	5 (41.7%)	13 (40.6%)	
	5. Never	175 (18.5%)	5 (9.4%)	2 (16.7%)	4 (12.5%)	
Sleep disturbance	1. Daily/almost daily	66 (7.0%)	5 (9.4%)	1 (8.3%)	2 (6.3%)	0.381[1]
	2. Weekly	100 (10.6%)	4 (7.5%)	0 (0.0%)	4 (12.5%)	
	3. Monthly	107 (11.3%)	13 (24.5%)	1 (8.3%)	6 (18.8%)	
	4. Less frequently	311 (33.0%)	16 (30.2%)	5 (4.7%)	10 (31.3%)	
	5. Never	359 (38.1%)	15 (28.3%)	5 (4.7%)	10 (31.3%)	

[1] The conditions of the test are not met

Table 20. Frequency of air traffic noise disturbance inside residence or in the living environment and general symptoms and sleep disturbances during the last 12 months.

Symptom	Options	No disturbance	Daily / almost daily disturbance	Weekly disturbance	Occasional/seasonal disturbance	p
General symptoms (headache, fatigue, concentration difficulties)	1. Daily/almost daily	65 (8.0%)	5 (8.1%)	6 (12.8%)	10 (7.8%)	0.114
	2. Weekly	143 (17.5%)	21 (33.9%)	7 (14.9%)	20 (15.5%)	
	3. Monthly	171 (21.0%)	9 (14.5%)	11 (23.4%)	24 (18.6%)	
	4. Less frequently	285 (35.0%)	17 (27.4%)	19 (40.4%)	54 (41.9%)	
	5. Never	151 (18.5%)	10 (16.1%)	4 (8.5%)	21 (16.3%)	
Sleep disturbance	1. Daily/almost daily	58 (7.2%)	6 (10.2%)	3 (6.8%)	8 (6.1%)	0.951
	2. Weekly	85 (10.5%))	7 (11.9%)	3 (6.8%)	15 (11.5%)	
	3. Monthly	98 (12.1%)	7 (11.9%)	4 (9.1%)	17 (13.0%)	
	4. Less frequently	258 (31.9%)	21 (35.6%)	17 (38.6%)	48 (36.6%)	
	5. Never	310 (38.3%)	18 (30.5%)	17 (38.6%)	43 (32.8%)	

Table 21. Frequency of industrial noise disturbance inside residence or in the living environment and general symptoms and sleep disturbances during the last 12 months.

Symptom	Options	No disturbance	Daily / almost daily disturbance	Weekly disturbance	Occasional/seasonal disturbance	p
General symptoms (headache, fatigue, concentration difficulties)	1. Daily/almost daily	78 (8.1%)	2 (13.3%)	1 (11.1%)	4 (8.2%)	0.969[1]
	2. Weekly	172 (17.8%)	3 (20.0%)	1 (11.1%)	13 (26.5%)	
	3. Monthly	198 (20.5%)	2 (13.3%)	2 (22.2%)	11 (22.4%)	
	4. Less frequently	345 (35.8%)	5 (33.3%)	3 (33.3%)	13 (26.5%)	
	5. Never	171 (17.7%)	3 (20.0%)	2 (22.2%)	8 (16.3%)	
Sleep disturbance	1. Daily/almost daily	63 (6.6%)	1 (7.1%)	1 (11.1%)	6 (12.2%)	0.797[1]
	2. Weekly	100 (10.4%)	1 (7.1%)	2 (22.2%)	4 (8.2%)	
	3. Monthly	114 (11.9%)	2 (14.3%)	1 (11.1%)	8 (16.3%)	
	4. Less frequently	313 (32.7%)	6 (42.9%)	2 (22.2%)	18 (36.7%)	
	5. Never	367 (38.3%)	4 (28.6%)	3 (33.3%)	13 (26.5%)	

[1] The conditions of the test are not met

Table 22. Frequency of yard noise disturbance (e.g. leaf blowers and snow clearing) inside residence or in the living environment and general symptoms and sleep disturbances during the last 12 months.

Symptom	Options	No disturbance	Daily / almost daily disturbance	Weekly disturbance	Occasional/seasonal disturbance	p
General symptoms (headache, fatigue, concentration difficulties)	1. Daily/almost daily	44 (6.7%)	2 (9.5%)	7 (13.0%)	38 (11.9%)	0.000[1]
	2. Weekly	102 (15.5%)	6 (28.6%)	13 (24.1%)	72 (22.6%)	
	3. Monthly	131 (19.9%)	3 (14.3%)	17 (31.5%)	65 (20.4%)	
	4. Less frequently	248 (37.6%)	7 (33.3%)	11 (20.4%)	106 (33.2%)	
	5. Never	134 (20.3%)	3 (14.3%)	6 (11.1%)	38 (11.9%)	
Sleep disturbance	1. Daily/almost daily	47 (7.2%)	2 (10.0%)	4 (7.4%)	23 (7.3%)	0.003
	2. Weekly	58 (8.8%)	3 (15.0%)	12 (22.2%)	35 (11.1%)	
	3. Monthly	72 (11.0%)	2 (10.0%)	10 (18.5%)	44 (13.9%)	
	4. Less frequently	204 (31.1%)	7 (35.0%)	17 (31.5%)	121 (38.3%)	
	5. Never	275 (41.9%)	6 (30.0%)	11 (20.4%)	93 (29.4%)	

[1] The conditions of the test are not met

Table 23. Frequency of HVAC noise disturbance (e.g. air conditioning, ventilation, elevators) inside residence or in the living environment and general symptoms and sleep disturbances during the last 12 months.

Symptom	Options	No disturbance	Daily / almost daily disturbance	Weekly disturbance	Occasional/seasonal disturbance	p
General symptoms (headache, fatigue, concentration difficulties)	1. Daily/almost daily	68 (7.4%)	8 (15.1%)	2 (18.2%)	8 (14.8%)	0.002[1]
	2. Weekly	155 (16.9%)	12 (22.6%)	3 (27.3%)	18 (33.3%)	
	3. Monthly	190 (20.7%)	16 (30.2%)	1 (9.1%)	8 (14.8%)	
	4. Less frequently	333 (36.2%)	12 (22.6%)	5 (45.5%)	15 (27.8%)	
	5. Never	173 (18.8%)	5 (9.4%)	0 (0.0%)	5 (9.3%)	
Sleep disturbance	1. Daily/almost daily	62 (6.8%)	3 (5.9%)	3 (27.3%)	7 (12.5%)	0.002[1]
	2. Weekly	89 (9.8%)	5 (9.8%)	1 (9.1%)	11 (19.6%)	
	3. Monthly	105 (11.5%)	12 (23.5%)	2 (18.2%)	7 (12.5%)	
	4. Less frequently	297 (32.6%)	20 (39.2%)	2 (18.2%)	20 (35.7%)	
	5. Never	358 (39.3%)	11 (21.6%)	3 (27.3%)	11 (19.6%)	

[1] The conditions of the test are not met

Table 24. Frequency of noise disturbance originating from neighbors (e.g. talk, music or steps from balcony or residence) inside residence or in the living environment and general symptoms and sleep disturbances during the last 12 months.

Symptom	Options	No disturbance	Daily / almost daily disturbance	Weekly disturbance	Occasional/seasonal disturbance	p
General symptoms (headache, fatigue, concentration difficulties)	1. Daily/almost daily	47 (6.6%)	12 (17.4%)	8 (12.3%)	23 (11.0%)	0.000
	2. Weekly	104 (14.6%)	21 (30.4%)	19 (29.2%)	50 (23.8%)	
	3. Monthly	143 (20.1%)	12 (17.4%)	18 (27.7%)	41 (19.5%)	
	4. Less frequently	271 (38.1%)	18 (26.1%)	17 (26.2%)	69 (32.9%)	
	5. Never	147 (20.6%)	6 (8.7%)	3 (4.6%)	27 (12.9%)	
Sleep disturbance	1. Daily/almost daily	51 (7.2%)	6 (9.0%)	8 (12.1%)	14 (6.8%)	0.001
	2. Weekly	69 (9.7%)	14 (20.9%)	4 (6.1%)	24 (11.7%)	
	3. Monthly	73 (10.3%)	12 (19.7%)	12 (18.2%)	31 (15.0%)	
	4. Less frequently	225 (31.7%)	22 (32.8%)	25 (37.9%)	74 (359%)	
	5. Never	292 (41.4%)	13 (19.4%)	17 (25.8%)	63 (30.6%)	

Table 25. Frequency of home noise disturbance (e.g. music, home appliances) inside residence or in the living environment and general symptoms and sleep disturbances during the last 12 months.

Symptom	Options	No disturbance	Daily / almost daily disturbance	Weekly disturbance	Occasional/seasonal disturbance	p
General symptoms (headache, fatigue, concentration difficulties)	1. Daily/almost daily	59 (7.3%)	6 (12.0%)	7 (16.3%)	13 (9.0%)	0.000
	2. Weekly	130 (16.2%)	15 (30.0%)	12 (27.9%)	31 (21.4%)	
	3. Monthly	157 (19.6%)	17 (34.0%)	6 (14.0%)	34 (23.4%)	
	4. Less frequently	299 (37.2%)	11 (22.0%)	12 (27.9%)	52 (35.9%)	
	5. Never	158 (19.7%)	1 (2.0%)	6 (14.0%)	15 (10.3%)	
Sleep disturbance	1. Daily/almost daily	57 (7.2%)	3 (6.1%)	4 (9.3%)	10 (7.0%)	0.099
	2. Weekly	66 (8.3%)	11 (22.4%)	6 (14.0%)	21 (14.7%)	
	3. Monthly	97 (12.2%)	7 (14.3%)	6 (14.0%)	15 (10.5%)	
	4. Less frequently	268 (33.6%)	14 (28.6%)	16 (37.2%)	48 (33.6%)	
	5. Never	309 (38.8%)	14 (28.6%)	11 (25.6%)	49 (34.3%)	

Table 26. Frequency of other noise disturbance inside residence or in the living environment and general symptoms and sleep disturbances during the last 12 months.

Symptom	Options	No disturbance	Daily / almost daily disturbance	Weekly disturbance	Occasional/seasonal disturbance	p
General symptoms (headache, fatigue, concentration difficulties)	1. Daily/almost daily	22 (8.1%)	3 (11.1%)	0 (0.0%)	1 (5.6%)	0.227[1]
	2. Weekly	48 (17.8%)	7 (25.9%)	1 (16.7%)	4 (22.2%)	
	3. Monthly	58 (21.5%)	9 (33.3%)	1 (16.7%)	2 (11.1%)	
	4. Less frequently	89 (33.0%)	8 (29.6%)	1 (16.7%)	5 (27.8%)	
	5. Never	53 (19.6%)	0 (0.0%)	3 (50.0%)	6 (33.3%)	
Sleep disturbance	1. Daily/almost daily	22 (8.1%)	1 (3.7%)	0 (0.0%)	0 (0.0%)	0.254[1]
	2. Weekly	26 (9.6%)	5 (18.5%)	0 (0.0%)	3 (16.7%)	
	3. Monthly	34 (12.5%)	4 (14.8%)	1 (16.7%)	3 (16.7%)	
	4. Less frequently	79 (29.2%)	13 (48.1%)	1 (16.7%)	5 (27.8%)	
	5. Never	110 (40.6%)	4 (14.8%)	4 (60.7%)	7 (38.9%)	

[1] The conditions of the test are not met

5.2 LOGISTIC REGRESSION

5.2.1 General Health Status

Based on the cross tabulation results, there were crude associations between general health status and size of residence, and thermal conditions inside residence. For logistic regression analysis the answer categories for general health status were recoded: 1= good health status, 0= fairly good to bad health status (Table 3).

The associations between general health status and housing health factors are shown in Table 27. Logistic regression results showed that in the unadjusted model the thermal conditions during winter had a statistically significant association with general health status, and also too warm conditions during summer was associated as a single factor. In the adjusted model the thermal conditions inside the residence during summer and winter had statistically significant association with general health status. During summer too warm thermal conditions as compared to good conditions increased the odds to good health to 1.9 (unadjusted odds ratio 0.7). During winter too warm conditions as compared to good conditions lowered the probability to good health status to 0.6 (unadjusted 0.9). Planning of moving and temperature inside the residence were not statistically significant.

Table 27. Associations between general health status and planning of moving due to inadequate housing size, temperature inside residence during heating season, feeling of thermal conditions inside residence during summer and feeling of thermal conditions inside residence during winter

Housing health factor	**Unadjusted odds ratio**	**Unadjusted CI**	**Unadjusted p**	**Adjusted odds ratio[1]**	**Adjusted CI[1]**	**Adjusted p[1]**
Planning of moving	1.044	0.640-1.706	0.862	0.636	0.376-1.074	0.091
Temperature inside residence			0.809			0.378
< 20 °C	1			1		
20 - 24 °C	1.41	0.482-4.127	0.531	1.788	0.581-5.504	0.311
> 24 °C	1.349	0.471-3.862	0.577	1.492	0.496-4.486	0.477
Thermal conditions inside, summer			0.072			0.000
Good conditions	1			1		
Too warm	0.736	0.563-0.963	0.025	1.893	1.391-2.577	0.000
Too chilly, draughty or cold floors	1.100	0.536-2.260	0.795	1.573	0.712-3.476	0.263
Thermal conditions inside, winter			0.000			0.000
Good conditions	1			1		
Too warm	0.878	0.295-2.616	0.815	0.554	0.413-0.744	0.000
Too chilly, draughty or cold floors	2.131	1.605-2.830	0.000	0.798	0.363-1.751	0.573

[1] Odds ratio adjusted for gender, age, marital status, education, occupational group, income spent on living expenses, and smoking inside the residence.

5.2.2 General Symptoms

General symptoms (e.g. headaches, fatigue) were associated with crowding, indoor air quality, thermal conditions, moisture, and noise disturbance in the cross tabulation analyses. For logistic regression the answer categories for general symptoms were recoded: 1= daily/almost daily and weekly symptoms, 0= monthly and more rarely appearing symptoms (Table 2).

The associations between having frequent general symptoms and crowding, and indoor air quality are presented in Table 28. There was statistically significant association for feeling of adequate housing size, planning of moving due to inadequate housing size, and satisfaction to indoor air quality and general symptoms. For residents who felt that the housing size was adequate, the adjusted odds for daily or weekly symptoms was lowered to 0.49. With residents who were planning to move due to inadequate housing size the likelihood for frequently appearing symptoms was 2.1. With satisfaction to indoor air quality, the fairly satisfied residents had a chance of 1.7 and fairly unsatisfied residents a chance of 2.9 to having daily and weekly symptoms, as compared to satisfied residents. In the unadjusted model also fresh air vent being situated in the bedroom (OR 0.8), having a fireplace inside residence (OR 0.6), and airing the residence with hood (option ñneverò, OR 2.1) were associated with the health outcome and statistically significant, but in the adjusted model these associations were no longer statistically significant.

Logistic regression results for associations between suffering from frequent general symptoms and thermal conditions, and moisture or mold on residence surfaces are shown in Table 29. In both models, unadjusted and adjusted, the thermal conditions inside residence during summer and winter, and moisture or mold on residence surfaces had statistically significant association and increased probability of frequent appearance of general symptoms. Also, the association for having over 24 °C temperature inside residence was statistically significant, with 3 times the probability (with a wide confidence interval) for the dependant variable as compared to temperatures under 20 °C. Too warm conditions during summer raised the odds of general symptoms to approximately 2 in adjusted and unadjusted model. In the unadjusted model chilly, draughty or, cold floors had a statistically significant odds ratio of 2.6, but in the adjusted model the odds ratio decreased and was no longer statistically significant. Chilly,

draughty, or cold floors during winter increased odds for frequent general symptoms by 1.7, the unadjusted model gave a slightly higher odds ratio. Presence of moisture or mold on inner wall, floor, or ceiling surfaces gave a two-fold probability for symptoms.

Associations between having frequent general symptoms and noise disturbance from different sources are presented in Table 30. In the unadjusted model the associations with all the examined noise disturbances were statistically significant, but in the adjusted model only HVAC and neighbor originated noise remained statistically significant, with addition of occasional yard noise disturbance as a single factor. In the adjusted model occasional yard noise disturbance increased the probability of general symptoms to 1.5 as compared to no yard noise disturbance, unadjusted model had a slightly higher odds ratio. Occasional HVAC noise disturbance appeared to increase the odds to having frequent symptoms by approximately 2.5 in both unadjusted and adjusted model. Daily and occasional noise disturbance originating from neighbors had an effect on the dependant variable with odds ratios of 2.5 and 1.6, respectively. Odds ratios were slightly higher in the unadjusted model. Weekly noise disturbance from neighbors also increased the probability of having frequent general symptoms in the unadjusted model, but the association was not statistically significant in the adjusted model.

Table 28. Associations between general symptoms and feeling of adequate housing size, planning of moving due to inadequate housing size, satisfaction to indoor air quality of the residence, fresh air vent situated in bedroom, fireplace situated inside residence, and airing the residence with hood.

Housing health factor	**Unadjusted odds ratio**	**Unadjusted CI**	**Unadjusted p**	**Adjusted odds ratio[1]**	**Adjusted CI[1]**	**Adjusted p[1]**
Feeling of adequate housing size	0.367	0.261-0.514	0.000	0.49	0.339-0.707	0.000
planning of moving	3.115	1.925-5.038	0.000	2.139	1.266-3.615	0.004
Satisfaction to indoor air quality			0.000			0.000
satisfied	1			1		
fairly satisfied	1.975	1.462-2.666	0.000	1.727	1.261-2.367	0.001
fairly unsatisfied	4.139	2.541-6.742	0.000	2.865	1.704-4.815	0.000
unsatisfied	2.478	0.916-6.702	0.074	1.937	0.691-5.432	0.209
Fresh air vent in bedroom	0.76	0.580-0.995	0.046	0.796	0.598-1.059	0.117
fireplace inside residence	0.592	0.442-0.792	0.000	0.796	0.569-1.113	0.182
Airing the residence with hood			0.005			0.34
daily	1			1		
seldom	1.317	0.959-1.808	0.089	1.134	0.807-1.591	0.469
never	2.107	1.325-3.349	0.002	1.463	0.870-2.458	0.151

[1] Odds ratio adjusted for gender, age, marital status, education, occupational group, income spent on living expenses, and smoking inside the residence.

Table 29. Associations between general symptoms and temperature inside residence during heating season, feeling of thermal conditions inside residence during summer, feeling of thermal conditions inside residence during winter, and moisture or mold damage on inner wall, floor or ceiling surfaces inside residence.

Housing health factor	**Unadjusted odds ratio**	**Unadjusted CI**	**Unadjusted p**	**Adjusted odds ratio[1]**	**Adjusted CI[1]**	**Adjusted p[1]**
Temperature inside residence			0.025			0.141
< 20 °C	1			1		
20 - 24 °C	1.002	0.720-1.395	0.988	1.079	0.762-1.527	0.669
> 24 °C	3.802	1.404-10.297	0.009	3.005	1.010-8.941	0.048
Thermal conditions inside, summer			0.000			0.000
Good conditions	1			1		
Too warm	2.124	1.597-2.825	0.000	1.893	1.391-2.577	0.000
Too chilly, draughty or cold floors	2.571	1.230-5.374	0.012	1.573	0.712-3.476	0.263
Thermal conditions inside, winter			0.000			0.002
Good conditions	1			1		
Too warm	0.878	0.295-2.616	0.815	0.639	0.203-2.015	0.445
Too chilly, draughty or cold floors	2.131	1.605-2.830	0.000	1.687	1.246-2.285	0.001
Moisture or mold on inner wall, floor or ceiling surfaces	2.472	1.480-4.127	0.001	1.987	1.151-3.428	0.014

[1] Odds ratio adjusted for gender, age, marital status, education, occupational group, income spent on living expenses, and smoking inside the residence.

Table 30. Associations between general symptoms and frequency of road and street traffic noise disturbance inside residence or in the living environment, frequency of yard noise disturbance (e.g. leaf blowers and snow clearing) inside residence or in the living environment, frequency of HVAC noise disturbance (e.g. air conditioning, ventilation, elevators) inside residence or in the living environment, frequency of noise disturbance originating from neighbors (e.g. talk, music or steps from balcony or residence) inside residence or in the living environment, frequency of home noise disturbance (e.g. music, home appliances) inside residence or in the living environment

Housing health factor	**Unadjusted odds ratio**	**Unadjusted CI**	**Unadjusted p**	**Adjusted odds ratio[1]**	**Adjusted CI[1]**	**Adjusted p[1]**
Frequency of road and street traffic noise disturbance			0.02			0.112
no	1			1		
daily	1.593	1.153-2.200	0.005	1.345	0.954-1.895	0.091
weekly	1.541	0.765-3.103	0.227	1.262	0.599-2.657	0.541
occasional	0.939	0.620-1.421	0.765	0.763	0.493-1.180	0.224
Frequency of yard noise disturbance			0.000			0.108
no	1			1		
daily	1.996	0.791-5.040	0.143	1.496	0.557-4.018	0.425
weekly	1.825	0.982-3.392	0.057	1.097	0.564-2.136	0.785
occasional	1.865	1.378-2.522	0.000	1.488	1.076-2.059	0.016
Frequency of HVAC noise disturbance			0.000			0.012
no	1			1		
daily	1.946	1.074-3.526	0.028	1.6	0.854-2.997	0.143
weekly	2.973	0.898-9.838	0.074	1.826	0.498-6.695	0.364
occasional	2.594	1.500-4.487	0.001	2.444	1.352-4.419	0.003
Frequency of noise disturbance originating from neighbors			0.000			0.003
no	1			1		
daily	3.874	2.309-6.499	0.000	2.457	1.410-4.284	0.002
weekly	2.708	1.606-4.567	0.000	1.653	0.932-2.932	0.085
occasional	1.991	1.411-2.810	0.000	1.602	1.111-2.311	0.012
Frequency of home noise disturbance			0.005			0.511
no	1			1		
daily	1.86	1.015-3.406	0.045	1.181	0.614-2.269	0.618
weekly	2.479	1.289-4.768	0.006	1.587	0.785-3.207	0.198
occasional	1.473	0.986-2.201	0.059	1.218	0.795-1.866	0.364

[1] Odds ratio adjusted for gender, age, marital status, education, occupational group, income spent on living expenses, and smoking inside the residence.

5.2.3 Upper Respiratory Tract Symptoms

On the cross tabulations analysis there were crude associations between upper respiratory tract symptoms (e.g. stuffy nose, sore throat) and indoor air quality, thermal conditions, and moisture. For logistic regression the answer categories for upper respiratory tract symptoms were recoded: 1= daily/almost daily and weekly symptoms, 0= monthly and less often appearing symptoms (Table 3).

Associations between upper respiratory tract symptoms and satisfaction to indoor air quality, having a fireplace inside residence, and airing the residence with hood are presented in Table 31. All indoor air quality factors had statistically significant associations with the health outcome in the unadjusted model, but having a fireplace inside residence was no longer statistically significant in the adjusted model. With decreasing satisfaction to indoor air quality the chance for upper respiratory tract symptoms grew considerably: as compared to satisfied residents, the probability for having symptoms went from fairly satisfied residents and 2.4 times likelihood, fairly unsatisfied residents with 4.5 times likelihood to unsatisfied residents with 5.4 times likelihood. The results were very similar in the adjusted and unadjusted models. Seldom airing of residence with hood had an increasing effect on the appearance of upper respiratory symptoms with and odds ratio of 1.7 as compared to daily airing. The adjusted and unadjusted model results were quite similar.

Results of logistic regression between upper respiratory symptoms and thermal conditions, and moisture or mold inside residence are presented in Table 32. Thermal conditions during winter, moisture or mold on residence surfaces, and smell of mold inside residence had statistically significant associations with the health outcome. With too chilly, draughty, or cold floors during winter the probability for frequent upper respiratory tract symptoms was doubled as compared to good thermal conditions. The results were quite similar in the adjusted and unadjusted model. Detection of moisture or mold on inner wall, floor, or ceiling surface of the residence increased the likelihood for the health outcome 1.8 times. The adjusted model had a higher p-value than the unadjusted model (0.047 vs. 0.015, respectively), adjusted p-value was on the limit of being statistically significant. With smell of mold inside residence the probability of having frequent symptoms was 4.1 (wide confidence interval). The odds ratio was a bit higher in the unadjusted model.

Table 31. Associations between upper respiratory tract symptoms and satisfaction to indoor air quality of the residence, fireplace situated inside the residence, and airing the residence with hood.

Housing health factor	**Unadjusted odds ratio**	**Unadjusted CI**	**Unadjusted p**	**Adjusted odds ratio[1]**	**Adjusted CI[1]**	**Adjusted p[1]**
Satisfaction to indoor air quality			0.000			0.000
satisfied	1			1		
fairly satisfied	2.423	1.715-3.423	0.000	2.356	1.653-3.358	0.000
fairly unsatisfied	4.76	2.816-8.048	0.000	4.491	2.588-7.793	0.000
unsatisfied	6.347	2.449-16.453	0.000	5.449	2.025-14.659	0.001
fireplace inside residence	0.661	0.478-0.915	0.013	0.814	0.567-1.170	0.267
Airing the residence with hood			0.013			0.016
daily	1			1		
seldom	1.68	1.186-2.379	0.003	1.706	1.185-2.457	0.004
never	1.381	0.786-2.425	0.261	1.29	0.704-2.364	0.41

[1] Odds ratio adjusted for gender, age, marital status, education, occupational group, income spent on living expenses, and smoking inside the residence.

Table 32. Associations between upper respiratory tract symptoms and temperature inside residence during heating season, feeling of thermal conditions during summer, feeling of thermal conditions during winter, moisture or mold damage on inner wall, floor or ceiling surfaces inside residence, and smell of mold inside residence.

Housing health factor	**Unadjusted odds ratio**	**Unadjusted CI**	**Unadjusted p**	**Adjusted odds ratio[1]**	**Adjusted CI[1]**	**Adjusted p[1]**
Temperature inside residence			0.375			0.667
< 20 °C	1			1		
20 - 24 °C	0.891	0.623-1.273	0.525	0.908	0.630-1.310	0.607
> 24 °C	1.788	0.601-5.316	0.296	1.409	0.451-4.403	0.556
Thermal conditions inside, summer			0.285			0.374
Good conditions	1			1		
Too warm	1.219	0.883-1.682	0.228	1.243	0.884-1.748	0.211
Too chilly, draughty or cold floors	1.637	0.720-3.722	0.239	1.434	0.607-3.389	0.412
Thermal conditions inside, winter			0.000			0.000
Good conditions	1			1		
Too warm	0.869	0.254-2.969	0.823	0.71	0.200-2.520	0.597
Too chilly, draughty or cold floors	1.992	1.460-2.718	0.000	2.036	1.463-2.833	0.000
Moisture or mold on inner wall, floor or ceiling surfaces	1.994	1.143-3.477	0.015	1.797	1.009-3.200	0.047
smell of mold inside residence	5.53	1.840-16.625	0.002	4.122	1.300-13.067	0.016

[1] Odds ratio adjusted for gender, age, marital status, education, occupational group, income spent on living expenses, and smoking inside the residence.

5.2.4 Lower respiratory tract symptoms

Lower respiratory tract symptoms (e.g. cough) were associated with indoor air quality, thermal conditions, and moisture based on the cross tabulation results. For multivariate analysis the answer categories for lower respiratory analysis were recoded: 1= daily/almost daily and weekly symptoms, 0= monthly and more rarely appearing symptoms (Table 3).

Logistic regression results for lower respiratory tract symptoms and selected housing health factors are presented in Table 33. Probability of having frequent lower respiratory tract symptoms was increased statistically significantly with lowered satisfaction to indoor air quality and detection of moisture or mold on residence interior surfaces in both the unadjusted and adjusted models. In the adjusted model fair satisfaction towards indoor air quality had a 1.6 times higher likelihood for the health outcome, when compared to being satisfied. Being fairly unsatisfied increased the probability to 3.3 times higher likelihood for the dependant variable. Being unsatisfied was statistically significant in the unadjusted model with an odds ratio of 4.1, but the adjusted model was not statistically significant. Also as a single statistically significant value chilly, draughty, or cold floors during winter increased the chance for the symptoms 1.7 times as compared to good conditions. Having a fireplace in the residence was not statistically significant in either models.

Table 33. Associations between lower respiratory tract symptoms and satisfaction to indoor air quality of the residence, fireplace situated inside the residence, temperature inside residence during heating season, feeling of thermal conditions during summer, feeling of thermal conditions during winter, and moisture or mold damage on inner wall, floor or ceiling surfaces inside residence.

Housing health factor	Unadjusted odds ratio	Unadjusted CI	Unadjusted p	Adjusted odds ratio[1]	Adjusted CI[1]	Adjusted p[1]
Satisfaction to indoor air quality			0.000			0.004
satisfied	1			1		
fairly satisfied	1.68	1.070-2.636	0.024	1.645	1.030-2.626	0.037
fairly unsatisfied	3.527	1.845-6.743	0.000	3.343	1.660-6.734	0.001
unsatisfied	4.057	1.274-12.912	0.018	3.322	0.945-11.684	0.061
fireplace inside residence	0.658	0.422-1.026	0.065	0.964	0.579-1.607	0.889
Temperature inside residence			0.457			0.736
< 20 °C	1			1		
20 - 24 °C	0.926	0.574-1.492	0.751	0.979	0.598-1.605	0.934
> 24 °C	2.054	0.551-7.656	0.284	1.698	0.408-7.061	0.467
Thermal conditions inside, summer			0.435			0.592
Good conditions	1			1		
Too warm	0.94	0.602-1.467	0.785	0.966	0.600-1.557	0.888
Too chilly, draughty or cold floors	1.839	0.687-4.921	0.225	1.687	0.591-4.815	0.328
Thermal conditions inside, winter			0.096			0.058
Good conditions	1			1		
Too warm	1.747	0.506-6.035	0.378	1.498	0.398-5.639	0.55
Too chilly, draughty or cold floors	1.553	1.024-2.354	0.038	1.72	1.098-2.695	0.018
Moisture or mold on inner wall, floor or ceiling surfaces	2.146	1.087-4.238	0.028	2.243	1.087-4.628	0.029

[1] Odds ratio adjusted for gender, age, marital status, education, occupational group, income spent on living expenses, and smoking inside the residence.

5.2.5 Respiratory tract infections

Cross tabulation analysis showed crude associations between having a respiratory tract infection during the previous 12 months and indoor air quality, and moisture. In logistic regression analysis the respiratory tract infections were coded as 1= yes, 0= no (Table 3).

Associations between respiratory tract infections and satisfaction to indoor air quality, fresh air vent being situated in bedroom, having a fireplace inside residence, airing the residence with hood, and detection of moisture or mold on residence indoor surfaces are presented in Table 34. All of the above-mentioned housing health factors, excluding having a fireplace, were statistically significant in the unadjusted model. In the adjusted model also airing the residence with hood changed to not being statistically significant. Decreased satisfaction to indoor air quality increased the probability for respiratory tract infection in the adjusted model: as compared to satisfied residents, likelihood for having symptoms among fairly satisfied residents was 1.9 times greater and with fairly unsatisfied residents 2.4 times higher. Unsatisfied residents had a 3.1 times likelihood towards the health outcome in the statistically significant, unadjusted model, but the adjusted model was not statistically significant. Having a fresh air vent in the bedroom decreased the probability for having a respiratory tract infection, with an odds ratio of 0.6. The results for having a fresh air vent in bedroom were very alike in the adjusted and unadjusted models. Detected moisture or mold inside the residence increased the odds towards the dependant variable by 1.9 in the adjusted model, with a slightly higher odds ratio of 2.2 in the unadjusted model.

Table 34. Associations between respiratory tract infections and satisfaction to indoor air quality of the residence, fresh air vent situated in bedroom, fireplace situated inside residence, airing the residence with hood, and moisture or mold damage on inner wall, floor or ceiling surfaces inside residence.

Housing health factor	**Unadjusted odds ratio**	**Unadjusted CI**	**Unadjusted p**	**Adjusted odds ratio[1]**	**Adjusted CI[1]**	**Adjusted p[1]**
Satisfaction to indoor air quality			0.000			0.000
satisfied	1			1		
fairly satisfied	2.04	1.493-2.786	0.000	1.899	1.374-2.627	0.000
fairly unsatisfied	3.067	1.834-5.130	0.000	2.394	1.394-4.109	0.002
unsatisfied	3.057	1.098-8.515	0.032	2.46	0.843-7.181	0.099
Fresh air vent in bedroom	0.637	0.481-0.845	0.002	0.634	0.472-0.851	0.002
fireplace inside residence	0.759	0.563-1.024	0.071	0.842	0.599-1.183	0.322
Airing the residence with hood			0.008			0.215
daily	1			1		
seldom	1.334	0.967-1.841	0.079	1.167	0.832-1.637	0.37
never	2.051	1.274-3.302	0.003	1.576	0.936-2.655	0.087
Moisture or mold on inner wall, floor or ceiling surfaces	2.234	1.302-3.833	0.004	1.889	1.072-3.331	0.028

[1] Odds ratio adjusted for gender, age, marital status, education, occupational group, income spent on living expenses, and smoking inside the residence.

5.2.6 Asthma

On the cross tabulations analysis there were crude associations between asthma and moisture. In logistic regression analysis asthma as a symptom was coded as 1= yes, 0= no (Table 3).

Associations between asthma and having a serious water damage in the residence, detected moisture or mold on the residence surfaces, and smell of mold indoors are presented in Table 35. Having a serious water damage was statistically significant in the unadjusted model, with an odds ratio 0.4 and p-value 0.046. The adjusted model for water damage was not statistically significant. Moisture or mold on the residence surfaces and smell of mold indoors were not statistically significant in either models.

Table 35. Associations between asthma and occurrence of serious water damage (e.g. pipe leaks, storm damages, flooding) with large amounts of water wetting extensive areas inside residence or in the structures, moisture or mold damage on inner wall, floor or ceiling surfaces inside residence, and smell of mold inside residence.

Housing health factor	**Unadjusted odds ratio**	**Unadjusted CI**	**Unadjusted p**	**Adjusted odds ratio[1]**	**Adjusted CI[1]**	**Adjusted p[1]**
Serious water damage	0.364	0.135-0.981	0.046	0.393	0.138-1.115	0.079
Moisture or mold on inner wall, floor or ceiling surfaces	1.904	0.876-4.137	0.104	1.859	0.829-4.166	0.132
smell of mold inside residence	2.539	0.547-11.774	0.234	2.96	0.586-14.944	0.189

[1] Odds ratio adjusted for gender, age, marital status, education, occupational group, income spent on living expenses, and smoking inside the residence.

5.2.7 Eye Symptoms

Cross tabulation results showed crude associations between eye symptoms (e.g. itch, dryness) and moisture. For multivariate analysis the eye symptoms were coded as 1= daily/almost daily and weekly, 0= monthly and more rarely appearing symptoms (Table 3).

Results for eye symptoms and moisture housing factors are presented in Table 36. All associations were statistically significant. The housing factors had an increasing effect on the likelihood of the dependant variable. In the adjusted model detected moisture or mold on the surfaces of the residence doubled the probability for having eye symptoms when compared to not having moisture/mold signs indoors. The adjusted and unadjusted models had quite similar odds ratios and p-values. Smell of mold increased the chance for eye symptoms 4.6 times (wide confidence interval) in the adjusted model, the unadjusted model had a higher odds ratio of 6.6.

Table 36. Associations between eye symptoms and moisture or mold damage on inner wall, floor or ceiling surfaces inside residence, and smell of mold inside residence.

Housing health factor	**Unadjusted odds ratio**	**Unadjusted CI**	**Unadjusted p**	**Adjusted odds ratio[1]**	**Adjusted CI[1]**	**Adjusted p[1]**
Moisture or mold on inner wall, floor or ceiling surfaces	1.854	1.031-3.336	0.039	1.95	1.050-3.622	0.035
smell of mold inside residence	6.572	2.184-19.781	0.001	4.625	1.420-15.063	0.011

[1] Odds ratio adjusted for gender, age, marital status, education, occupational group, income spent on living expenses, and smoking inside the residence.

5.2.8 Skin symptoms

Skin symptoms (e.g. redness, dryness) and moisture were shown to have crude associations in the cross tabulation analysis. For multivariate analysis having skin symptoms were coded as 1= daily/almost daily and weekly symptoms, 0= monthly and more rarely appearing symptoms (Table 3).

Associations between skin symptoms and moisture are presented in Table 37. Moisture or mold on residence indoor surfaces and smell of mold had a statistically significant, increasing effect on the likelihood of the health outcome. The adjusted and unadjusted models had very alike values for the moisture and mold signs on indoor surfaces. In the adjusted model detected moisture or mold on the surfaces of the residence resulted in 2.4 times greater likelihood for skin symptoms when compared to not detecting moisture/mold on surfaces. Smell of mold inside residence increased the odds for skin symptoms 3.9 times (wide confidence interval) in the adjusted model, with a very similar odds ratio in the unadjusted model (OR 3.8).

Table 37. Associations between skin symptoms or rash and moisture or mold damage on inner wall, floor or ceiling surfaces inside residence, and smell of mold inside residence.

Housing health factor	**Unadjusted odds ratio**	**Unadjusted CI**	**Unadjusted p**	**Adjusted odds ratio[1]**	**Adjusted CI[1]**	**Adjusted p[1]**
Moisture or mold on inner wall, floor or ceiling surfaces	2.457	1.391-4.341	0.002	2.438	1.350-4.402	0.003
smell of mold inside residence	3.844	1.243-11.889	0.019	3.908	1.184-12.906	0.025

[1] Odds ratio adjusted for gender, age, marital status, education, occupational group, income spent on living expenses, and smoking inside the residence.

5.2.9 Sleep disturbance

Cross tabulation analysis showed crude associations between sleep disturbance and noise disturbance originating from varying sources. Sleep disturbance symptoms were coded as 1= daily/almost daily and weekly symptoms, 0= monthly and more rarely appearing symptoms for the logistic regression analysis (Table 3).

Associations between having frequent sleep disturbance and noise disturbance from different sources are presented in Table 38. HVAC noise, noise originating from neighbors and noise originating from own home all had a statistically significant effect on increasing the likelihood of the dependant variable. Also weekly yard noise as a single value was statistically significant in the unadjusted and adjusted model, with an adjusted odds ratio of 2.3. In the adjusted model, occasional HVAC noise seemed to increase the likelihood of sleep disturbance 2.7 times as compared to no HVAC noise. Daily noise that originated from neighbors increased the probability of sleep disturbance 2.4 times. For noise that originated from the respondentsô own home, daily noise disturbance increased likelihood of sleep disturbance 2.5 times, and with occasional noise the probability of having sleep disturbance was 1.9 times as compared to no noise disturbance.

Table 38. Associations between sleep disturbances during the last 12 months and frequency of yard noise disturbance (e.g. leaf blowers and snow clearing), HVAC noise disturbance (e.g. air conditioning, ventilation, elevators), noise disturbance originating from neighbors (e.g. talk, music or steps from balcony or residence), and home noise disturbance (e.g. music, home appliances) inside residence or in the living environment.

Housing health factor	Unadjusted odds ratio	Unadjusted CI	Unadjusted p	Adjusted odds ratio[1]	Adjusted CI[1]	Adjusted p[1]
Yard noise			0.119			0.14
no	1			1		
daily	1.872	0.671-5.224	0.231	1.358	0.451-4.083	0.586
weekly	2.049	1.054-3.982	0.034	2.282	1.125-4.627	0.022
occasional	1.203	0.835-1.733	0.322	1.187	0.806-1.749	0.385
HVAC noise			0.008			0.01
no	1			1		
daily	0.913	0.403-2.067	0.827	0.919	0.392-2.158	0.847
weekly	3.279	0.947-11.346	0.061	2.45	0.642-9.359	0.19
occasional	2.438	1.345-4.421	0.003	2.705	1.448-5.053	0.002
Noise from neighbors			0.034			0.045
no	1			1		
daily	2.341	1.324-4.139	0.003	2.418	1.305-4.479	0.005
weekly	1.241	0.644-2.390	0.519	1.35	0.662-2.756	0.409
occasional	1.112	0.732-1.691	0.618	1.083	0.693-1.691	0.727
Noise from home			0.037			0.008
no	1			1		
daily	2.157	1.115-4.172	0.022	2.519	1.241-5.111	0.011
weekly	1.576	0.709-3.505	0.265	1.908	0.810-4.494	0.139
occasional	1.562	0.988-2.470	0.056	1.869	1.149-3.040	0.012

[1] Odds ratio adjusted for gender, age, marital status, education, occupational group, income spent on living expenses, and smoking inside the residence.

5.2.10 Satisfaction to indoor air quality

Cross tabulation analysis results showed crude associations between residents` satisfaction to indoor air quality and crowding. For logistic regression satisfaction to indoor air quality was recoded as 1= satisfied, 0= fairly satisfied, fairly unsatisfied and unsatisfied. (Table 3).

Associations between satisfaction to indoor air quality and feeling of adequate housing size, and planning of moving due to inadequate residence size are presented in Table 39. Both housing factors had a statistically significant effect on the dependant variable in the adjusted and unadjusted model. The adjusted model showed that residents who feel that the housing size is adequate were 2.7 times more probable to be satisfied with indoor air quality. Unadjusted odds ratio was slightly higher (3.1). People who were planning to move due to inadequate housing size were 0.4 times less likely to be satisfied with indoor air quality when compared to people who were not planning to move because of inadequate residence size according to both adjusted and unadjusted model.

Table 39. Associations between satisfaction to indoor air quality of the residence and feeling of adequate housing size, and planning of moving due to inadequate housing size.

Housing health factor	**Unadjusted odds ratio**	**Unadjusted CI**	**Unadjusted p**	**Adjusted odds ratio[1]**	**Adjusted CI[1]**	**Adjusted p[1]**
Feeling of adequate housing size	3.088	2.124-4.489	0.000	2.709	1.830-4.010	0.000
Planning of moving	0.361	0.207-0.629	0.000	0.426	0.239-0.761	0.004

[1] Odds ratio adjusted for gender, age, marital status, education, occupational group, income spent on living expenses, and smoking inside the residence

5.2.11 Fire accidents

Cross tabulations analysis showed crude associations between accidents with fire during the previous 12 months and crowding. In logistic regression analysis fire accidents was coded as 1= yes, 0= no (Table 3).

Associations between fire accidents and feeling of adequate housing size, and planning of moving due to inadequate housing size are presented in Table 40. Planning of moving was statistically significant (p-value 0.049) in the unadjusted model, with an odds ratio 2.3. The adjusted model for planning of moving was not statistically significant. Feeling of adequate housing size was not statistically significant in adjusted or unadjusted model.

Table 40. Associations between fire accidents inside the residence or in the immediate surroundings during the last 12 months and feeling of adequate housing size, and planning of moving due to inadequate housing size.

Housing health factor	**Unadjusted odds ratio**	**Unadjusted CI**	**Unadjusted p**	**Adjusted odds ratio[1]**	**Adjusted CI[1]**	**Adjusted p[1]**
Feeling of adequate housing size	0.614	0.318-1.186	0.147	0.728	0.364-1.454	0.368
Planning of moving	2.299	1.004-5.268	0.049	2.046	0.857-4.885	0.107

[1] Odds ratio adjusted for gender, age, marital status, education, occupational group, income spent on living expenses, and smoking inside the residence.

5.2.12 Accidents involving tumbling down or slipping

Crude associations were found between accidents involving tumbling down/slipping inside the residence or in the immediate surroundings during the previous 12 months and crowding in the cross tabulations analysis. In logistic regression analysis tumbling down/slipping was coded as 1= yes, 0= no (Table 3).

Associations between accidents involving tumbling down/slipping and feeling of adequate housing size, and planning of moving due to inadequate housing size are presented in Table 41. Feeling of adequate housing size was statistically significant in the unadjusted model, having an odds ratio 0.6 and p-value 0.031. The adjusted model for tumbling down/slipping was not statistically significant. Planning of moving was not statistically significant in either models.

Table 41. Associations between accidents involving tumbling down/slipping inside the residence or in the immediate surroundings during the last 12 months and feeling of adequate housing size, and planning of moving due to inadequate housing size.

Housing health factor	**Unadjusted odds ratio**	**Unadjusted CI**	**Unadjusted p**	**Adjusted odds ratio[1]**	**Adjusted CI[1]**	**Adjusted p[1]**
Feeling of adequate housing size	0.613	0.393-0.956	0.031	0.736	0.456-1.187	0.209
Planning of moving	1.659	0.886-3.104	0.113	1.297	0.662-2.543	0.448

[1] Odds ratio adjusted for gender, age, marital status, education, occupational group, income spent on living expenses, and smoking inside the residence.

5.3 SUMMARY OF RESULTS

The results related to the thesis hypotheses are presented in Table 42. The results were based on the cross tabulation and logistic regression analyses. The general null hypothesis was rejected and therefore the alternative hypothesis was approved: housing health factors have an effect on symptoms. From the 20 specific null hypotheses that were presented in the beginning of the thesis, 15 were rejected and five were approved.

Size of residence and crowding as a housing factor had two approved null hypotheses and two rejected hypotheses. The results showed that crowding had an effect on general symptoms and satisfaction to indoor air quality.

Low quality of drinking water did not have an effect on diarrhea. This result was clear already on the basis of cross tabulation analysis (p-value 0.935), and no logistic regression analysis was performed. Therefore, the null hypothesis for quality of drinking water was approved.

All null hypotheses were rejected concerning indoor air quality and ventilation and its effects. Indoor air quality had an effect on respiratory tract symptoms and infections, and general symptoms.

Low and high room temperatures were shown to have effect on respiratory tract symptoms, general health status, and general symptoms, therefore the null hypotheses for thermal conditions and the above-mentioned symptoms were rejected. The null hypothesis for asthma was approved, low and high room temperature did not have an effect on asthma.

Dampness and mould had an effect on general symptoms, respiratory tract symptoms, respiratory tract infections, eczema and skin symptoms, and eye symptoms. The null hypotheses for these symptoms and dampness were rejected. The null hypothesis was approved for dampness and asthma, as dampness and mould did not have an effect on asthma.

Noise in residence and neighborhood as a housing factor had effect on sleep disturbance and general symptoms. Both null hypotheses concerning noise annoyance were rejected.

Table 42. Results of thesis hypotheses based on cross tabulation and logistic regression analyses.

Null hypothesis (H0)		**Result**
GENERAL Housing health factors have no effect on	symptoms	rejected
SIZE OF RESIDENCE AND CROWDING Crowding does not have an effect on	general health status	approved
	general symptoms	rejected
	the amount of accidents	approved
	satisfaction to indoor air quality	rejected
QUALITY OF DRINKING WATER Low quality of drinking water does not have an effect on	diarrhea	approved[1]
INDOOR AIR QUALITY AND VENTILATION Indoor air quality does not have an effect on	respiratory tract infections	rejected
	respiratory tract symptoms	rejected
	general symptoms	rejected
THERMAL CONDITIONS Low and high room temperature does not have an effect on	respiratory tract symptoms	rejected
	asthma	approved[1]
	general health status	rejected
	general symptoms	rejected
DAMPNESS AND MOULD Dampness does not have an effect on	general symptoms	rejected
	respiratory tract symptoms	rejected
	respiratory tract infections	rejected
	asthma	approved
	eczema and skin symptoms	rejected
	eye symptoms	rejected
NOISE IN RESIDENCE AND NEIGHBORHOOD Noise annoyance does not have an effect on	sleep disturbance	rejected
	general symptoms	rejected

[1]Result based only on cross tabulation analysis, no logistic regression performed.

6 DISCUSSION

6.1 SIZE OF RESIDENCE AND CROWDING

The thesis results showed that size of residence and crowding had an effect on general symptoms and satisfaction to indoor air quality. Multivariate analyses strongly indicated that for residents with adequate housing size the likelihood for frequently appearing general symptoms was lower than with residents who felt their housing size was inadequate. If residents were planning to move due to inadequate housing size, the odds for frequently appearing general symptoms was doubled. These results follow the views of WHO experts, who agreed that there is strong evidence between size of residence and general wellbeing of residents. (WHO, 2005).

Strong associations were found between crowding and indoor air quality satisfaction in logistic regression analyses: residents who felt satisfied with the housing size were 2.7 times more likely to be satisfied with indoor air quality. Residents who were planning to move due to inadequate housing size were less likely (OR 0.4) to be satisfied with indoor air quality. This was a new finding, and it may be explainable by other factors that are associated with crowding. Crowding is strongly linked with poverty and low affordability of housing (WHO, 2005, Howden-Chapman). Low affordability is usually linked to lower quality of residence itself, and therefore possibly to low quality ventilation systems. Also, in crowded residences more people residing per room can lead to sensations of stuffy air, as there are more contaminant sources (people) for e.g. CO_2 and different odors.

The null hypothesis was approved for amount of accidents, as no statistically significant associations were found. Although the cross tabulation analyses showed associations between crowding and fire accidents, and accidents involving tumbling down, there were no statistically significant associations in logistic regression analysis. The LARES-study showed that accidents (e.g. falls, cuts, burns) occur more often in homes where residents are not satisfied with the housing size (Moore, 2009). The results of this thesis cannot confirm these views.

No statistically significant associations were found for general health status, therefore the null hypothesis was approved. A WHO meeting of experts agreed that there is a connection between crowding and general health status (WHO, 2005). Logistic regression results showed a connection for crowding and general symptoms, but not for general health status. What is meant with general health status and how survey responders understand it (e.g. are examples given/what are answering possibilities) can of course vary in different studies, and therefore they are not always comparable.

Crowding is strongly connected to socio-economic factors (WHO, 2005). Socio-economic adjustment in the logistic regression analyses for crowding and accidents, and general health status changed the p-values quite significantly, but there was almost no change in the odds ratios or p-values after adjustment for general symptoms or satisfaction to indoor air quality.

The survey responses do not give information about the actual size of the residence, survey responses only tell how the residents perceive the size and feel about it. Responses concerning the residence size are therefore subjective. A better and more objective way for assessing housing size is by comparing the number of residents to the living area size (m^2) (WHO, 2005, Dunn). If further analyses are done with the survey data, more objective results could be achieved by taking into account the number of residents and actual size of residence when evaluating the sufficiency of the residence size.

6.2 DRINKING WATER QUALITY

There were no associations found for low quality of drinking water and diarrhea, therefore the null hypothesis was approved. Only a small amount of respondents had observed anomalies in their drinking water. The results were up to expectations, as Finnish potable water is commonly believed to be of very high standards. Municipal water and sewage services cover close to 90 % of residences (Turunen et al, 2010), and municipal water quality is observed with constant regularity. THL experts estimated that every year hundreds of GI-tract infections are caused by low quality potable water in Finland. (Hänninen et al, 2010). This connection was not found in the analyses of the thesis, perhaps due to an insufficient sample size.

6.3 INDOOR AIR QUALITY AND VENTILATION

Results of the thesis indicated that indoor air quality and ventilation had an effect on respiratory tract infections, upper and lower respiratory tract symptoms, and general symptoms. Indoor air quality was analysed with various survey questions: residents` satisfaction to indoor air quality, having a fresh air vent in the bedroom, having a fireplace in the residence, and habit of airing the residence with a hood or with a window.

Low indoor air quality is known to be linked with people suffering from general symptoms such as headaches and fatigue (Asumisterveysohje, 2003), and the thesis results are in accordance with this information. A large majority of the survey respondents, almost 90 %, were satisfied or fairly satisfied with the residence indoor air quality (Turunen et al, 2010). Cross tabulations showed crude associations between satisfaction to indoor air quality and all selected health outcomes. Logistic regression analyses indicated that residents who were fairly satisfied with indoor air quality had almost a doubled and fairly unsatisfied residents almost a tripled probability to having daily and weekly general symptoms, as compared to satisfied residents. Being unsatisfied was strongly affected by socio-economic adjustment, and it was not statistically significant. In the thesis work there was no examination of the possible reasons (e.g. defective ventilation, contaminant sources indoors) for lowered satisfaction to indoor air quality, except for the possible association of crowding and satisfaction to air quality (chapter 6.1).

Particulate matter is one of the most harmful environmental contaminants in Finland, and among injurious health effects are respiratory tract symptoms and infections (Hänninen et al, 2010). Particulate matter may be transported indoors from outdoors, but it can also originate from indoors (e.g. fireplaces) (WHO, 2005, Sundell). Impaired ventilation may increase the amount of particulate matter indoors, as it also possibly increases the general dissatisfaction towards indoor air quality. Likelihood for upper respiratory tract symptoms increased strongly with decreasing satisfaction to indoor air quality: Likelihood for symptoms went from fairly satisfied residents and OR of 2.4 (1.6 for lower respiratory tract symptoms), fairly unsatisfied residents with OR of 4.5 (3.3 for lower respiratory tract symptoms), to unsatisfied residents with OR of 5.4 (not statistically significant for lower respiratory tract symptoms). Decreased satisfaction to indoor air quality increased the probability for respiratory tract infection: as compared to satisfied residents, likelihood for having symptoms among fairly satisfied

residents was 1.9 times greater and with fairly unsatisfied residents 2.4 times higher (being unsatisfied was not statistically significant).

A large portion of the day is spent in the bedroom, sleeping. During the sleep we inhale great amounts of air into our lungs. Air quality of a person`s home is very important, and particularly the air quality in the bedroom (WHO, 2005, Sundell). Almost 60 % of survey respondents reported having a fresh air vent in their bedroom (Turunen et al, 2010). A fresh air vent being situated in the bedroom brings good quality air to the sleeping area (if vent is working properly). Having a fresh air vent in the bedroom was not associated with respiratory tract symptoms in the cross tabulations analyses, or with general symptoms in the logistic regression analysis. There was a statistically significant association with respiratory infections, as having a fresh air vent in the bedroom decreased the probability for having a respiratory tract infection with an odds ratio of 0.6.

A fireplace inside the residence is a potential source for impurities (e.g. particulate matter) in indoor air, and using fireplaces may lower the quality of indoor air. About a third of the survey respondents reported having at least one fireplace (e.g. wood stove or wood heated sauna) (Turunen et al, 2010). Having a fireplace inside the residence was not statistically significant with any of the examined health outcomes. The survey did not inquire the usage of the fireplace, only if the residence had a fireplace. Separating the residences where the fireplace was actually used, and also knowing how often it was used, would have helped to get more accurate results and possibly a link between fireplace usage and health outcomes. These kind of data were not possible to get from the survey answers.

Airing the residence with hood can be used to remove low quality air from the residence (e.g. humid air, cooking impurities). Airing the residence with hood was not statistically significantly associated with general symptoms, lower respiratory tract symptoms, or respiratory tract infections. Seldom airing of residence with hood had an increasing effect on the appearance of upper respiratory symptoms with and odds ratio of 1.7 as compared to daily airing. The option of ñneverò-airing the residence with hood was not statistically significant. This result encourages the use of a hood for airing, although the survey does not examine in which situations the hood has been used.

Airing the residence through a window is an efficient way to get fresh air inside the residence. The need for airing through a window may be a sign of insufficient ventilation system otherwise. Over 70 % of the survey respondents aired the residence daily by opening a window, but the duration of the window or windows being open was not asked. No previous studies about airing the residence through windows and the possible health effects were examined, their possible associations were analysed in the thesis out of curiosity Airing the residence through a window was not associated with any of the health outcomes in the cross tabulations analyses, therefore no logistic regression analyses were performed.

Indoor air quality was analysed by residents own perception of indoor air quality, which is subjective. A better and more objective way is by doing measurements of e.g. amounts of CO_2 in the air, or by independent professionals checking the operational capabilities of ventilation systems. These actions are of course expensive and require resources, and are impossible and/or impractical to perform on a large scale such as this survey.

Results obtained from the thesis analyses for links between indoor air quality and health outcomes strongly support previous studies with significant associations between lowered indoor air quality and increased frequency of general symptoms, respiratory tract symptoms, and respiratory tract infections.

6.4 THERMAL CONDITIONS

The associations between indoor thermal conditions and general health status, general symptoms, upper and lower respiratory symptoms and asthma were studied. The null hypothesis was approved in relation to asthma, but all other health effects were associated with unsatisfactory thermal conditions.

Athma was not associated with any of the thermal condition factors examined in the cross tabulation analyses. Therefore no further analyses were performed with logistic regression. Asthma was not specifically linked to unsatisfactory thermal conditions in the reviewed literature, but the possible connection was studied out of curiosity, as other respiratory tract symptoms were also being examined.

The Finnish Ministry of Social Affairs and Health (STM) have set limits for indoor temperatures during heating season: 18-20 °C is acceptable, 20-22 °C is good, and temperatures should not exceed 24 °C. Majority of the survey respondents had indoor temperature between 20 and 24 °C. Quite a large amount of residents had temperatures below 20 °C, but only some had temperatures higher than 24 °C.

In cross tabulations temperatures above 24 °C seemed to be associated and statistically significant with residents having poorer general health status and more general and lower respiratory tract symptoms than with indoor temperatures being lower than 24 °C. Some associations were found in the unadjusted models (for general symptoms), but with socio-economic adjustment the associations were not statistically significant. In logistic regression, temperature inside residence was not associated with any of the selected health outcomes with statistic significance. According to thesis results, indoor temperatures of above 24 °C or lower than 20 °C could not be associated with impaired health.

Residents who perceived housing thermal conditions to be good seemed to have better health status, less general symptoms, and less upper and lower respiratory tract symptoms than those who perceived their homes to be excessively warm or chilly according to the cross tabulation results. Thermal conditions inside the residence during summer and winter had statistically significant association with general health status in the logistic regression analysis. During summer too warm thermal conditions inside residence increased good health in residents, as too warm thermal conditions almost doubled the odds to good health when comparing to good conditions. There was a large difference in the odds ratio between adjusted and unadjusted models (OR 1.9 vs. OR 0.7, respectively), showing opposing odds. During winter the results showed that too warm conditions lowered the odds towards good health (OR 0.6) as compared to good conditions.

According to thesis results, too warm conditions during summer time was good for one`s general health, and too warm conditions during winter was bad for one`s general health. During summer excessive heat indoors is usually the result of temperatures outdoors, as opposed to winter conditions and indoor heat being caused by heating systems. This might be a possible link to help explain the interesting health outcomes in relation to indoor excessive heat in different seasons, and further analyses could be performed with heating system differences and heating habits taken into account. Also the influence of different seasons to

survey respondents is a possible explanation for the results, as seasons (summer vs. winter) can have a strong influence on people, their moods, and perspectives about their surroundings.

In cross tabulations, having a chilly residence during wintertime was associated with residents having more general symptoms, and upper and lower respiratory tract symptoms than when conditions were perceived to be good or too warm. With logistic regression, too warm conditions inside residence during summer and too chilly conditions during winter increased probability of frequent appearance of general symptom (ORs 1.9 and 1.7, respectively). Incresed odds for general symptoms during summer with too warm conditions partly contradicts the results presented in previous paragraph in relation to general health status, if one wants to draw similarities to general health status and general symptoms as health outcomes, although they are not the same thing. Based on these results, excess heat during warm season and excess cold during cold season increase propabilities for frequent general symptoms. Too chilly conditions during summer and too warm conditions during winter were not statistically significant in the logistic regression.

With logistic regression, none of the thermal conditions housing factors were associated with lower respiratory tract symptoms. There was also no association for upper respiratory tract symptoms and thermal conditions inside during summer. With chilly housing during winter the probability for frequent upper respiratory tract symptoms was doubled as compared to good thermal conditions. This result is in accordance with a WHO report which stated that residences in Ireland with cold temperatures had almost a tripled likelihood for reporting respiratory symptoms (WHO, 2005, Healy).

According to Healy, socio-economic factors may be strongly linked to cold indoor temperatures (WHO, 2005). This was not seen in the thesis results, as socio-economic adjustment did not significantly change the logistic regression results in relation to thermal conditions, excluding a few exceptions (e.g. good health and too warm conditions). Of course, only a limited amount of socio-economic factors were taken into account in the thesis.

According to the STM housing and health guide (Asumisterveysohje, 2003), excess heat is related to general symptoms such as fatigue and lack of concentration, and to respiratory tract symptoms. Thesis results confirm the association with general symptoms, as temperatures above 24 °C tripled the likelihood for general symptoms (p-value 0.048) and too warm

thermal conditions during summer almost doubled the likelihood for symptoms. There was no such association found for excess heat and respiratory symptoms.

There were interesting, partially inconsistent results obtained with logistic regression concerning residence thermal conditions and selected health outcomes. The exact temperature degrees were not widely associated with symptoms, rather the residents` perceptions about the thermal conditions were more linked with the health outcomes. Perhaps this is an indication of how setting thermal conditions according to sensations of residents is more reasonable than setting the temperature according to recommended values, as different people feel comfortable in different thermal environments. Results indicated that thermal conditions do have an effect on respiratory tract symptoms, general health, and general symptoms, but more analyses are required to understand the true associations and what other factors are also possibly involved.

6.5 DAMPNESS AND MOULD

Associations were examined between dampness and mould and several health outcomes. Null hypothesis was rejected in regards to general symptoms, respiratory tract symptoms, respiratory tract infections, eczema and skin symptoms, and eye symptoms, as the results showed that dampness and mould had an effect on the listed health outcomes. Dampness and mould did not have a significant association with asthma. Socio-economic adjustment did not have strong influence on the logistic regression results concerning moisture and mould and their health effects.

The amount of survey respondents with dampness or mould in the residence was quite low when compared with estimates made in previous studies. Only 5 % of respondents reported having dampness or mould damage in the residence (Turunen et al, 2010). The european LARES-study showed that 1 out of 10 houses suffered from mould growth and permanent or recurrent dampness affected 6,4 % of residences (Rudnai et al, 2009). A study by THL researchers estimated that 15 % of households in Finland are exposed to moisture damage (Hänninen et al, 2010).

The appearance of dampness and mould in residences was studied by choosing three questions from the survey: occurrence of serious water damage in the residence during the last

12 months; having visible moisture or mold damage on inner wall, floor, or ceiling surfaces inside residence; and smell of mold inside residence. Sight and smell are acceptable methods for detecting mould growth, and mould growth on indoor surfaces is a potential health hazard (excluding small spots in wet areas of the residence) (Asumisterveysohje, 2003).

The analyses showed no associations between occurence of serious water damage in the residence during the last 12 months and any of the health outcomes. This supports the housing health guide`s statement that water damage in itself does not cause ill health (Asumisterveysohje, 2003). If mould growth develops because of a water damage in the residence, the growth of moulds and appearance of symptoms may take longer than 12 months that were given as a time limitation in the survey question concerning water damage.

In cross tabulation analysis, no association was found between mould odour and general symptoms (e.g. headaches). An association was found between visible moisture or mould on indoor surfaces and general symptoms, and this was further examined in logistic regression analyses. Results showed that having moisture or mould on surfaces doubled the likelihood for frequent general symptoms. Results support the findings of the LARES-study, which showed associations between mould and headaches (Rudnai et al, 2009).

There is a general consensus that respiratory tract symptoms are connected with dampness and mould (WHO, 2005, Nevalainen). A study by THL researchers concluded that 15% of Finnish residents are exposed to moisture damage. They estimated that 2.5% of exposed individuals will suffer from lower respiratory tract symptoms and 6.3% will suffer from upper respiratory tract symptoms (Hänninen et al, 2010). Also in this study there were associations found between dampness and mould and respiratory tract symptoms. An association was found between mould odour and upper respiratory tract symptoms, but not with lower respiratory tract symptoms in cross tabulation analyses. Visible moisture or mould on indoor surfaces was associated with upper and lower respiratory tract symptoms. Mould on surfaces and mould odour were both associated with upper respiratory symptoms in the logistic regression analyses: dampness or mould on surfaces almost doubled the odds for symptoms and smell of mould had an odds ratio of 4.1. Mould on surfaces more than doubled the likelihood for lower respiratory tract symptoms.

Housing health guide published by STM lists respiratory infections as one of generally known health effects of mould exposure (Asumisterveysohje, 2003). The LARES-survey also linked dampness and mould with infections (Rudnai et al, 2009). This association was confirmed in the thesis analyses. In cross tabulation analysis, no association was found between mould odor and respiratory tract infections, but there was a link between visible moisture or mould on indoor surfaces and respiratory infections. This was examined further with logistic regression, and results showed that moisture or mould signs indoors almost doubled the likelihood for respiratory infections.

Thesis analyses showed no statistically significant associations between the dampness and mould housing factors and asthma. Therefore it does not support previous studies which connect asthma to moisture and mould damages. A THL study suggested that out of 15% of Finnish residents who are exposed to moisture damage, about 800 (0,1%) will suffer from asthma (Hänninen et al, 2010). The LARES-study also showed an association between mould and asthma (Rudnai et al, 2009). It is possible that the sample analysed in the thesis is not large enough to find associations for asthma and mould if the percentage of people who suffer from asthma due to moisture and mould is as small as the THL experts suggest (Hänninen et al, 2010).

STM`s housing health guide lists skin symptoms as one of the health effects of mould exposure (Asumisterveysohje, 2003). The LARES-study indicated an association between mould and eczema (Rudnai et al, 2009). These associations were found in analyses of the thesis also. An association was found between visible moisture or mould on indoor surfaces and mould odor with skin symptoms in cross tabulation analyses. Logistic regression indicated that moisture or mould on residence surfaces more than doubled the odds for skin symptoms and with smell of mould residents had almost four times the likelihood for skin symptoms.

STM housing health guide presents eye irritation as a symptom caused by exposure to moulds (Asumisterveysohje, 2003), and the LARES-study indicated a strong link between dampness and mould and eye irritation (Rudnai et al, 2009). With cross tabulations an association was found for visible moisture or mould on indoor surfaces and mould odour with respiratory infections. Signs of moisture or mould on residence surfaces almost doubled the odds for eye symptoms. Smell of mould had a much stronger effect: the odds ratio for eye symptoms in

residences with smell of mould was 4.6. Therefore the thesis results concur with previous knowledge concerning dampness and mould and eye symptoms.

Thesis results support previous studies and generally accepted associations between detected mould indoors and its damaging effect on general symptoms, respiratory tract symptoms, respiratory infections, skin symptoms, and eye symptoms. The results do not support previous studies that have linked moisture and mould to asthma.

6.6 NOISE

Associations were studied between noise disturbance originating from several different sources with general symptoms and sleep disturbance. Null hypothesis was rejected for both health outcomes, as noise in residence and neighborhood had an effect on sleep disturbance and general symptoms.

There are guidelines and limits set for acceptable noise levels in residences (Asumisterveysohje, 2003). The thesis analyses noise disturbance perceived by residents, not the actual noise levels, and people naturally experience different kind of noises and on different volume levels to be disturbing.

There were no statistically significant associations found between noise originating from rail traffic, air traffic, road and street traffic, yards, industry, or other sources and general symptoms and sleep disturbance. Noise originating from respondent`s own home was associated with sleep disturbance, but not with general symptoms. Socio-economic adjustment had some effect on the values, spesifically when looking at associations between noise disturbance and general symptoms (e.g. yard noise unadjusted p-value 0.000 vs. adjusted p-value 0.108).

In the analysed survey the most common daily noise disturbance originated from traffic (Turunen et al, 2010), but this was not associated with any of the health outcomes. Traffic noise was indicated to have a strong impact on sleep disturbance in the LARES-study, with more than 6 times the likelihood for reporting sleeping problems as compared to residents not exposed to traffic noise (Braubach, 2009). Thesis results do not support the LARES-study results, as there were no associations found between traffic noises and sleep disturbance. This

could perhaps be due to different traffic practices in Finland and the European cities where the LARES-study was performed (e.g. Budapest and Vilnius). It is possible, that the traffic disturbance in Finland occurs mostly during the day and therefore it won`t affect the sleeping during night. Night time traffic noise is more likely an urban problem on a general level. There are also many other possible explanations for the differences in the thesis results and the LARES-study results, such as differences in study and analysis methods.

Noise disturbance that is sensed in the residence is most often originated from traffic, home appliances and HVAC-systems according to the STM housing health guide (Asumisterveysohje, 2003). Noise from home appliances (regarded as noise originating from respondents`own home in the thesis) and noise from HVAC-systems were linked with health outcomes according to the thesis results.

Out of the survey respondents 7% suffered from regular sleeping disturbance (Turunen et al, 2010). Sleep disturbance is one the most usual health effects of residential noise disturbance. Sleep disturbance may also cause other health effects and symptoms, such as fatigue and headaches (Asumisterveysohje, 2003). In the thesis analyses, HVAC ï noise, noise originating from neighbors and noise originating from respondents`own home were all found to have statistically significant effects on sleep disturbance. Occasional HVAC noise almost tripled the likelihood for sleep disturbance as compared to no HVAC noise. Daily noise originating from neighbors increased the probability of sleep disturbance 2.4 times,. Daily noise disturbance from own home increased probability of sleep disturbance 2.5 times, and with occasional noise the probability of having sleep disturbance was 1.9 times as compared to no noise disturbance.

THL experts estimated that 1.5 % of Finnish population is affected by sleeping disturbances caused by noise disturbance, and this likely results in impaired health such as concentration difficulties (Hänninen et al, 2010). Difficulties in concentration is one of the symptoms listed under general symptoms in the thesis analyses. Cross tabulation and logistic regression analyses indicated that HVAC-noise (e.g. air conditioning, ventilation) and noise originating from neighbors were associated with more frequent general symptoms. Occasional HVAC noise disturbance more than doubled the likelihood to having general symptoms. Daily and occasional noise disturbance originating from neighbors affected the health outcome with odds ratios of 2.5 and 1.6, respectively.

The analyses revealed that noises originating from same sources had effect on general symptoms and sleep disturbance and also with quite similar odds ratios: occasional HVAC-noise and daily noise from neighbors increased both health outcomes, general symptoms and sleep disturbance. This may be due to the effect of sleep disturbance: noise disturbance causes sleep disturbance, which then causes general symptoms (e.g. headaches), as was presented in the STM housing health guide (Asumisterveysohje, 2003). This possibly indicates that sleep disturbance and general symptoms as health outcomes are linked together. The LARES-study indicated that sleep disturbance caused by noise was associated with an increased risk for a wide range of diseases in adults (Niemann and Maschke, 2009).

7 CONCLUSIONS AND SUMMARY

The aim of the thesis was to study associations between housing health factors and health outcomes on a general population level in Finland. The general null hypothesis was rejected based on the analyses results, as 15 out of 20 spesific null hypotheses were rejected: housing health factors have an effect on self-reported health and symptoms.

Inadequate size of residence and crowding were indicated to increase the risk for frequent general symptoms and to lowered satisfaction to residential indoor air quality. General health status and the amount of residential accidents were not affected by the size of residence and crowding.

Low quality of drinking water did not have an effect on diarrhea. Finnish potable water is commonly believed to be of very high quality and anomalies in drinking water are very rare.

Perceived low indoor air quality was indicated to increase the risk for frequent general symptoms, upper and lower respiratory tract symptoms, and of having one or more respiratory tract infections.

Unsatisfactory thermal conditions perceived by residents were indicated to increase risk for frequent upper respiratory tract symptoms and general symptoms, and of having an effect on general health status. Too warm conditions during summer increased likelihood for good general health status, and too warm conditions during winter decreased likelihood for good general health status. Asthma was not affected by thermal conditions.

Moisture damage and/or mould in residence was indicated to increase the risk for frequent general symptoms, respiratory tract symptoms, respiratory tract infections, skin symptoms, and eye symptoms. Asthma was not affected by dampness and mould in residence.

Noise annoyance originating from HVAC-systems and neighbors were indicated to increase the risk for frequent sleep disturbance and general symptoms. Also noise originating from residents` own home was indicated to have effect on sleep disturbance. Sleep disturbance and general symptoms as health outcomes are possibly linked together, as sleep disturbance may cause general symptoms. The most common noise annoyance, noise disturbance from traffic, was not associated with the health outcomes.

The data for analyses were received from a large, national survey. The survey had 1312 respondents. Cross tabulation and logistic regression analyses were performed with statisticial program PASW 18 Statistics. The survey responses were partly subjective, which is a possible source for errors. The survey data offers possibilities for further analyses concerning housing factors and health of residents. On a large scale, evaluating associations between housing factors and health based on survey response data is cost effective, as studies with e.g. visits to residences and specific measurements require much more resources.

The results of the thesis may be used in discussion concerning housing health in Finland, as the results represent the Finnish population on a general level. Thesis results may also be utilized when planning and conducting further research on the subject.

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ASUINYMPÄRISTÖN LAATU, TERVEYS JA TURVALLISUUS –TIEDONKERUU JA PALAUTEJÄRJESTELMÄ (ALTTI) – KYSELYLOMAKE

Tervetuloa vastaamaan asuinympäristönne laatua, terveellisyyttä ja turvallisuutta kartoittavaan kyselyyn! Kysymme aluksi joitakin taustatietojanne. Niitä kysytään vastausten analysoinnin mahdollistamiseksi. Tutkimuksen tuloksia käsitellään ehdottoman luottamuksellisesti ja niin, ettei yksittäisen vastaajan antamia tietoja voida tunnistaa. Vastaaminen vie aikaa noin 20 - 40 minuuttia.

Ohje: Rastittakaa oikea vaihtoehto/vaihtoehdot tai kirjoittakaa vastaus sille varattuun paikkaan.

VASTAAJAN TIEDOT

1. | **TUNNUSKOODI:** |

2. Vastaajan sukupuoli
Nainen
Mies

3. Vastaajan ikä _____ vuotta

4. Oletteko
Naimaton
Avoliitossa
Naimisissa
Rekisteröidyssä parisuhteessa
Eronnut
Leski

5. Vastaajan koulutustaso
Kansakoulu
Peruskoulu / keskikoulu
Lukio / ylioppilas
Ammatillinen perustutkinto
Opistotason tutkinto
Korkeakoulututkinto

6. Vastaajan ammattiryhmä
Johtaja / ylempi toimihenkilö
Toimihenkilö / työntekijä
Yrittäjä
Opiskelija
Eläkeläinen / ei työelämässä

7. Kuinka suuren osan kotitaloutenne yhteenlasketuista kuukausituloista ennen verojen vähentämistä käytätte asumiskustannuksiin? (Asumiskustannuksilla tarkoitetaan tässä yhteydessä: vuokraa, yhtiövastiketta, lainaa/lainakuluja, lämmitystä, sähköä ja vettä, jätehuoltoa, jne.)

Alle 15 %
16 - 25 %
26 - 35%
36 ï 50 %
51 ï 65 %
Yli 65 %

ASUINPAIKKAKUNNAN TIEDOT

8. Millaisella alueella asuntonne sijaitsee?

Kaupungin keskustassa
Lähiössä tai kaupungin muulla asuntoalueella
Kaupungin reuna-alueella
Taajamassa maaseudulla (kirkonkylä tms.)
Haja-asutusalueella, maaseudulla

9. Asutteko maatilalla?

Ei, **siirtykää kysymykseen 11.**
Kyllä

10. Millaisella maatilalla asutte?

Maatilalla, jolla harjoitetaan viljelystä
Maatilalla, jolla on tuotantoeläimiä (nautakarjaa, sikoja, tms.)
Maatilalla, jolla on lemmikkieläimiä (esim. hevosia, lampaita, kaneja) mutta ei aktiivista viljelyä
Maatilalla, joka ei ole aktiivisessa viljelyssä, eikä ole eläimiä
Jokin muu, mikä? _____

11. Mikä on asuntonne etäisyys seuraavista kohteista? (Mikäli etäisyys on alle 1 kilometri, kirjoita etäisyys metreinä toiseen sarakkeeseen. Muutoin rastita oikea vaihtoehto.)

	Etäisyys metreinä, jos alle 1 km	**1 - 5 km**	**yli 5 km**	**En tiedä**
Vilkasliikenteisestä tiestä tai kadusta				
Rautatiestä tai metrosta				
Lentokentästä				
Tehtaasta, teollisuudesta, voimalaitoksesta, kaivoksesta				
Huoltoasemasta tai autokorjaamosta				
Kaatopaikasta tai jätevedenpuhdistamosta				
Maataloudesta (kuten sikalat, minkkitarhat, jne.)				
Korkeajännitejohdoista				

12. Miten kuljette pääasiassa työ/koulumatkanne, ja kuinka pitkä tämä aika ja matka tavallisesti on? (vastatkaa niihin kohtiin, joita käytätte yleensä yhdellä työ/koulumatkalla)

	Aika (minuutteina)	Matka (kilometreinä)
Kävellen		
Pyörällä		
Autolla		
Julkisilla kulkuvälineillä (juna, linja-auto, raitiovaunu, tms.)		
Muuten*		

***Miten?** _____

13. Kuinka tyytyväinen olette asuinympäristönne mahdollisuuksiin tai palveluihin?

	Tyytyväinen	Melko tyytyväinen	Melko tyytymätön	Tyytymätön	En osaa sanoa
Julkiseen liikenteeseen					
Liikunta- ja harrastusmahdollisuuksiin					
Työmahdollisuuksiin					
Päivähoitopalveluihin / kouluihin					
Pankki- / postipalveluihin					
Kirjastopalveluihin					
Elintarvikeliikkeisiin (ruokakaupat tms.)					
Ravintoloihin ja kahviloihin					
Terveydenhuoltoon (terveyskeskukset, sairaalat, apteekit)					
Kotipalveluihin (siivouspalvelut, kuljetuspalvelut, tms.)					
Luonnonläheisyyteen, puisto- / viheralueisiin					
Yleiseen viihtyisyyteen					

14. Mihin asuinympäristönne mahdollisuuksiin tai palveluihin olette erityisen tyytymätön?

_____

_____

15. Koetteko tarvitsevanne tietoa asuinalueenne terveellisyyteen/turvallisuuteen liittyvistä tekijöistä?

Ei
Kyllä

ASUINRAKENNUKSEN TIEDOT

16. Kuinka tyytyväinen olette nykyiseen asuntoonne / taloonne?

Tyytyväinen
Melko tyytyväinen
Melko tyytymätön
Tyytymätön
En osaa sanoa

17. Millaisessa asunnossa asutte ja mikä on asuintalonne kerrosten lukumäärä?

	Kerrosten lukumäärä
Omakotitalo	
Paritalo	
Rivitalo	
Kerrostalo	

18. Mikäli asutte kerrostalossa, missä kerroksessa asuinhuoneistonne sijaitsee? _____.kerros

19. Kuinka monta vuotta olette asuneet nykyisessä asunnossanne? Merkitkää vuoden tarkkuudella._____

20. Mikä on asuntonne hallintamuoto?

Vuokrahuoneisto vuokratalossa
Vuokrahuoneisto osaketalossa
Omistusasunto
Työsuhdeasunto
Asumisoikeusasunto
Jokin muu, mikä? _____

21. Asunnossanne asuu vakituisesti itsenne mukaan lukien (ilmoita asukkaiden lukumäärä ikäryhmittäin).

Aikuisia (18-v tai yli) _____

7-17-vuotiaita lapsia _____

Alle 7-vuotiaita lapsia _____

22. Koetteko asuntonne riittävän tilavaksi?

Ei
Kyllä

23. Suunnitteletteko asunnon vaihtoa seuraavien 12 kuukauden aikana?

Ei, **siirtykää kysymykseen 25**
Kyllä

24. Miksi suunnittelette asunnon vaihtoa? Voitte valita useita vaihtoehtoja.

Asunto on liian pieni
Asunto on liian suuri
Asunnon kunto (esim. liian suuri korjaustarve)
Asunto ei vastaa muutoin tarpeita
Halutaan vaihtaa asuinaluetta
Taloudelliset syyt
Muu syy, mikä? _____

25. Mikä on asuntonne kattotyyppi?

Harjakatto
Aumakatto
Tasakatto
Pulpettikatto
En tiedä
Jokin muu, mikä? _____

26. Millainen on talonne alimman kerroksen lattiarakenne?

Ryömintätilallinen lattia (esim. lattiarakenne, jonka alapuolella on tuuletustilalla varustettu rossipohja tai muu ilmatila)

Maanvarainen lattia (esim. betonilaatta jonka alla ei ole ilmatilaa, sen sijaan maapohjan päällä voi olla esim. lämmöneriste ja alussora)

En tiedä
Muu, mikä? _____

27. Onko rakennuksessa käytössä kokonaan tai osittain maanpinnan alapuolella olevaa kellaria/kellaritilaa? Voitte valita useita vaihtoehtoja.

Ei ole kellaria
Kyllä, säilytystilana
Kyllä, pesutilana
Kyllä, harraste-/oleskelutilana
Kyllä, makuuhuoneena
Kyllä, muuna tilana
Muussa käytössä, missä? _____

28. Mitä seuraavista sisäverhoustyypeistä on käytetty asuinhuoneidenne (makuuhuone/olohuone/keittiö) seinäpinnoissa? Valitse 1 - 3 yleisintä vaihtoehtoa.

Lakattu puu / paneeli
Maalattu puu / paneeli
Maalattu tiili / betoni / kivi / rappaus
Maalaamaton tiili / betoni / kivi / rappaus
Maalattu rakennuslevy (puukuitu, kipsi, lastulevy, tms.)
Tapetoitu rakennuslevy (puukuitu, kipsi, lastulevy, tms.)
Tapetoitu kivi / betoni tms.
En tiedä
Muu, mikä? _____

29. Mitä seuraavista pintamateriaaleista on käytetty asuinhuoneidenne lattioissa? Valitse 1 - 3 yleisintä vaihtoehtoa.

Puu / parketti
Laminaatti
Laatta / klinkkeri / luonnonkivi
Muovimatto / -laatta
Linoleum
Kokolattiamatto
En tiedä
Muu, mikä? _____

30. Millaiset asuntonne ikkunat ovat?

2-kertaiset lasit
3-kertaiset lasit
4-kertaiset lasit
En tiedä
Jokin muu, mikä? _____

31. Mitkä seuraavista kuuluvat asuntonne varustukseen? Voitte valita useita vaihtoehtoja.

Sisä-wc
Suihku
Suihkukaappi
Kylpyamme
Sauna
Jääkaappi
Pakastin
Liesi
Keskuslämmitys
Parveke
Lasitettu parveke

32. Onko talossanne hissiä?

Ei
Kyllä

33. Onko taloon tehty seuraavia peruskorjaustoimenpiteitä? Peruskorjauksella tarkoitetaan tässä yhteydessä suhteellisen suurta ja erillistä hanketta, jossa korjataan tai uusitaan kiinteistön olemassa olevia rakenteita, rakennusosia, kalusteita, varusteita, järjestelmiä ja laitteita (kuten ulkoseiniä, parvekkeita, ikkunoita sekä lämmitys- vesi- ja viemärijärjestelmiä).

	Ei	**Kyllä, viimeisen 12 kuukauden aikana**	**Kyllä, viimeisen 5 vuoden aikana**	**En tiedä**
Katon korjaus				
Julkisivuremontti (lisälämmöneristys tms.)				
Perustusten korjaus				
Salaojakorjaus				
Putkiremontti				
Ilmanvaihtojärjestelmän korjaus				
Parvekeremontti				
Ikkunaremontti				
Lämmitysjärjestelmän korjaus				
Jotain muuta*				

***Mitä muita peruskorjaustoimenpiteitä on tehty?_**_____

34. Koetteko tarvitsevanne tietoa asuinrakennuksenne terveellisyyteen/turvallisuuteen liittyvistä tekijöistä?

Ei
Kyllä

HYGIENIA

35. Mistä käyttämänne juomavesi tulee?
Kunnallisesta järjestelmästä (vesijohtovesi)
Vesiosuuskunnalta
Omasta porakaivosta
Omasta rengaskaivosta
Lähteestä
Jostakin muualta, mistä? _____

36. Oletteko havainneet juomavedessä epätavallista hajua, makua (esim. kemikaalien, puhdistusaineen, suolaista tai pilaantuneen), sakkaa tai väriä (esim. punaruskeaa tai kellertävää)?
Ei
Kyllä

37. Onko juomaveden laatua tutkittu?
Ei, **siirtykää kysymykseen 39**
Kyllä
En tiedä, **siirtykää kysymykseen 39**

38. Mitä juomaveden tutkimuksissa on havaittu? Voitte valita useita vaihtoehtoja.
Mikrobiologisia epäpuhtauksia (pieneliöt, bakteerit, virukset)
Kemiallisia epäpuhtauksia (rautaa, mangaania, nitraatteja)
Kohonneita radonpitoisuuksia
Kohonneita arseenipitoisuuksia
Kohonneita uraanipitoisuuksia
Ei mitään edellisistä
En tiedä
Jotain muuta, mitä? _____

39. Onko käytössänne veden suodatus- tai puhdistuslaitteistoja tai -aineita?
Ei
Kyllä
En tiedä

40. Onko kotitaloutenne talousveden saannissa ollut seuraavista syistä johtuneita katkoksia viimeisen 12 kuukauden aikana?

	Ei	Kyllä	En tiedä
Järjestelmän vian takia			
Jäätymisen takia			
Kuivuuden takia			
Korjausten takia			
Muusta syystä*			

***Miksi?**_____

41. Minkälaista on asuntonne lämmin talousvesi mielestänne? (Suositeltava lämpötila on 55 - 65 astetta.)
Vesi on liian kylmää
Vesi on liian kuumaa
Vesi on sopivan lämpöistä
Ei lämmintä vesijohtovettä saatavilla

42. Käytättekö lämmintä vesijohtovettä (suoraan hanasta) juotavaksi ja / tai ruuanlaittoon?
Ei
Kyllä

43. Onko tapananne juoksuttaa kylmää vettä ennen sen ottamista juotavaksi tai ruuanlaittoon?
Ei
Kyllä

44. Mihin asuntonne jätevedet johdetaan? Voitte valita useita vaihtoehtoja.

	Pesuvedet	Käymälävedet
Kunnalliseen järjestelmään		
Umpisäiliöön (umpikaivo)		
Saostuskaivoon + maahanimeyttämöön/-suodattamoon		
Pienpuhdistamoon		
En tiedä		
Muualle*		

***Minne?** _____

45. Kuinka usein kotonanne tehdään seuraavia siivoustoimenpiteitä?

	Viikoittain	Kuukausittain	Vähintään kerran vuodessa	Harvemmin
Pölyjen pyyhintä				
Lakaisu				
Imurointi				
Lattian pesu/moppaus (kostealla)				
Mattojen tamppaus				
Pyykinpesu				
Lakanoiden vaihtaminen				
Sängyn ja patjan imuroiminen				
Vuodevaatteiden (sijauspatja / päällinen, peite, tyyny) tuuletus				
Sijauspatjan / päällisen, peitteen ja tyynyn pesu yli +60 asteessa				
Roskien vienti ulos				

46. Onko Teillä lemmikkieläimiä kotonanne?

	Ei	Kyllä, sisätiloissa	Kyllä, mutta ei sisätiloissa
Koiria, kissoja, marsuja tms.			
Lintuja			
Akvaario			
Terraarioeläimiä (liskoja, käärmeitä tms.)			
Muita eläimiä*			

***Mitä?** _____

47. Oletteko nähneet merkkejä haittaeläimistä (eläviä tai kuolleita hyönteisiä tai jyrsijöitä, jyrsimisjälkiä, ulosteita, tms.)? Voitte valita useita vaihtoehtoja.

	Ei	Kyllä, sisätiloissa	Kyllä, pihapiirissä
Jyrsijöistä (hiiret, rotat tms.)			
Hyönteisistä (tupajumit, torakat, hevosmuurahaiset, tms.)			

48. Mistä seuraavista asumisterveyteen liittyvistä tekijöistä kaipaisitte lisätietoa? Voitte valita useita vaihtoehtoja.

Käyttämänne veden laatu
Jätevesien käsittely
Asunnon siisteys
Lemmikkieläinten pitoon liittyvät kysymykset
Haittaeläimiin liittyvät kysymykset
Ei mistään edellä mainitusta
Muusta, mistä? _____

FYSIKAALISET JA BIOLOGISET OLOSUHTEET

49. Miten tyytyväinen olette asuntonne sisäilman laatuun?

Tyytyväinen
Melko tyytyväinen
Melko tyytymätön
Tyytymätön
En osaa sanoa

50. Millainen ilmanvaihto asunnossanne on?

Koneellinen tulo ja poisto
Koneellinen poisto
Painovoimainen
Ei ilmanvaihtoa
En tiedä

51. Onko makuuhuoneessanne/-huoneissanne tuloilma- tai raitisilmaventtiileitä?

Ei
Kyllä

52. Kuuluvatko seuraavat laitteet asuntonne varustukseen?

Ilmankostutin, **siirtykää kysymykseen 54**
Ilmanpuhdistin
Ei kumpikaan edellä mainituista, **siirtykää kysymykseen 54**

53. Tuottaako ilmanpuhdistimenne otsonia?

Ei
Kyllä
En tiedä

54. Mikä on asuntonne ensisijainen ja mahdollinen toissijainen lämmitysmuoto?

	Ensisijainen	Toissijainen
Kauko-/aluelämpö		
Sähkö		
Polttoöljy		
Maalämpö		
Aurinkolämpö		
Ilmalämpöpumppu		
Puu/pelletti/hake keskuslämmitys		
Huonekohtaisia tulisijoja (takka, uuni, tms.)		
En tiedä		
Ei ole		
Jokin muu*		

***Mikä?** _____

55. Millaisia liesiä tai tulisijoja asunnossanne on? Voitte valita useita vaihtoehtoja.

Kaasuliesi / -uuni
Puuliesi / -uuni tai leivinuuni
Puukiuas
Takka
Kamina
Ei mitään yllämainituista
Jokin muu, mikä? _____

56. Kuinka usein ja miten tuuletatte asuntoanne?

	Päivittäin / lähes päivittäin	Harvemmin	Tarvittaessa (esim. ruuanlaiton yhteydessä)	Ei koskaan	Ei mahdollista
Käytän liesituuletinta					
Avaan ikkunoita					

57. Mikä on asuntonne sisälämpötila lämmityskauden aikana tyypillisesti?

Alle 18 astetta
18 - 20 astetta
20 - 22 astetta
22 - 24 astetta
Yli 24 astetta

58. Millaiset ovat asuntonne lämpöolosuhteet? Voitte valita useita vaihtoehtoja.

	Sopivan lämmintä	Liian kylmää	Liian kuumaa	Vetoisaa	Kylmiä lattiapintoja tms.
Kesällä					
Talvella					

59. Missä kuivaatte pyykkinne? Voitte valita useita vaihtoehtoja.

Kuivaushuoneessa, jossa on ilmanvaihto
Kuivausrummussa/-kaapissa
Pesutiloissa
Muualla sisätiloissa (makuuhuone, olohuone, tms.)
Parvekkeella
Ulkona sään salliessa
Muualla, missä? _____

60. Tiivistyykö asuntonne ikkunoihin kosteutta?

	Päivittäin / lähes päivittäin	Viikoittain	Harvemmin	Ei koskaan
Kesällä				
Talvella				

61. Onko asunnossa sattunut vakavia vesivahinkoja (esim. putkivuotoja, myrskyvahinkoja, tulvimisia tms.), jossa suuret vesimäärät ovat kastelleet laajoja alueita / rakennusosia?

Ei, **siirtykää kysymykseen 63**
Kyllä, viimeisen 12 kuukauden aikana
Kyllä, yli 12 kuukautta sitten
En tiedä, **siirtykää kysymykseen 63**

62. Miten vahingosta aiheutuneita vaurioita on korjattu? Voitte valita useita vaihtoehtoja.

Ei ole tehty korjaustoimenpiteitä
Kuivaamalla rakenteita
Purkamalla / poistamalla vaurioituneita materiaaleja
Ei tietoa
Muuten, miten? _____

63. Onko asuntonne seinä-, lattia- tai kattopinnoissa kosteus- tai homevaurioita? Voitte valita useita vaihtoehtoja.

Ei , **siirtykää kysymykseen 66**
Kyllä, sisäpinnoissa / asunnon sisäpuolella
Kyllä, ulkopinnoissa / asunnon ulkopuolella, **siirtykää kysymykseen 66**
En tiedä, **siirtykää kysymykseen 66**

64. Mikä on vaurioiden sijainti ja laajuus?

	Pistemäinen	Paikallinen (alle 1m2 / rajoittuu yhteen tilaan / rakennuksen osaan)	Laaja (yli 1m2 / käsittää useita tiloja / rakennuksen osia)
Keittiössä			
Pesutiloissa			
Olo-/makuuhuoneessa			
Muissa tiloissa			

65. Mikä on vaurion syy? Voitte valita useita vaihtoehtoja.

Ulkopuolelta tuleva kosteus (sadevedet, vuodot, jne.)
Rakennuksen alta tuleva kosteus (maakosteus, puutteelliset salaojat, jne.)
Sisälähteet (käyttövedet, vesikalusteisiin ym. liittyvät vuodot, pyykinkuivatus, jne.)
Rakennusaikainen kosteus
En tiedä
Muu syy, mikä? _____

66. Onko asuinympäristönne valaistuksessa puutteita?

	Ei	Kyllä
Asunnon sisävalaistuksessa, luonnonvalo		
Asunnon sisävalaistuksessa, keinovalo		
Asuinrakennuksen sisävalaistuksessa (rappukäytävät, varastotilat, tms.)		
Piha-alueen valaistuksessa (kulkureitit, parkkipaikat)		
Alueen katu- ja yleisvalaistuksessa		
Muualla*		

***Missä?** _____

67. Mitkä seuraavista aiheuttavat meluhaittaa asunnossanne tai asuinympäristössänne ja kuinka usein?

	Ei meluhaittaa	Meluhaittaa on päivittäin / lähes päivittäin	Meluhaittaa on viikoittain	Meluhaitta on satunnaista / kausittaista
Tie- ja katuliikenne				
Raideliikenne				
Lentoliikenne				
Teollisuus				
Pihamelu (lumityöt, lehtipuhaltimet, jne.)				
Rakennuksen LVIS-melu (ilmastointi-, vesi- tai viemärilaitteet, hissit, jne.)				
Naapurimelu (asunnosta, parvekkeelta; kuten puhe, musiikki, askeläänet, jne.)				
Kotimelu (musiikki, työkoneet, jne.)				
Muuta melua*				

***Mitä?** _____

68. Mistä seuraavista asumisterveyteen liittyvistä tekijöistä kaipaisitte lisätietoa? Voitte valita useita vaihtoehtoja.

Ilmanvaihto
Asunnon huolto ja kunnossapito
Varusteet / kalusteet
Lämmitysjärjestelmä
Lämpöolosuhteet
Kosteus/homevauriot
Valaistus
Melu
Ei mistään edellä mainitusta
Jostakin muusta, mistä? _____

KEMIALLISET EPÄPUHTAUDET, HIUKKASET JA KUIDUT

69. Tupakoiko kukaan sisällä asunnossanne?

	Ei lainkaan	Päivittäin / lähes päivittäin	Viikoittain	Satunnaisesti
Itse				
Joku toinen				

70. Käytättekö säännöllisesti (itse/joku muu kotitaloutenne jäsenistä) seuraavanlaisia tuotteita? Voitte valita useita vaihtoehtoja.

	Parfyymeja, hiuslakkoja	Hajustettuja lattioiden ja pintojen pesu- ja puhdistusaineita	Ilmanraikastimia
Ei käytetä			
Kyllä, itse			
Kyllä, joku toinen			

71. Käytetäänkö kotitaloudessanne torjunta-aineita tuholaisten ja/tai rikkakasvien torjuntaan?

	Ei käytetä, siirtykää kysymykseen 74	Käytetään
Hyönteismyrkkyjä / torjunta-aineita		
Rikkaruohomyrkkyjä		

72. Kuinka usein ja missä käytätte torjunta-aineita?

	Viikoittain	Kuukausittain	Muutamia kertoja vuodessa	Harvemmin
Sisätiloissa				
Piha-alueella				

73. Kuinka suojaudutte? Voitte valita useita vaihtoehtoja.

Ei lainkaan
Tuulettamalla
Poistumalla asunnosta / paikalta
Käyttämällä suoja-varusteita
Muutoin, miten? _____

74. Onko asuntonne läheisyydessä voimakkaita siitepölylähteitä (isoja peltoalueita, koivikoita tms.)?

Ei
Kyllä, mitä? _____

75. Onko asunnossanne tai sen lähiympäristössä aistittavissa epämiellyttäviä hajuja, ja mihin ne liittyvät? Voitte valita useita vaihtoehtoja.

	Asunnossa	Muualla sisätiloissa	Ulkona
Ruuan haju			
Tupakansavu			
Homeen haju			
Rakennusmateriaalit			
Yleinen tunkkaisuus			
Viemärin haju			
Savun haju			
Maatalouden hajut			
Teollisuuden hajut			
Liikenteestä aiheutuvat hajut			
Jätteenkäsittely			
Ei hajuhaittoja			
Muita hajuja*			

***Mitä?** _____

76. Onko asuinrakennuksessanne asbestipitoisia materiaaleja?

Ei, **siirtykää kysymykseen 78**
Kyllä, asuintiloissa
Kyllä, mutta ei asuintiloissa, **siirtykää kysymykseen 78**
En tiedä, **siirtykää kysymykseen 78**

77. Onko materiaali ehjä ja hyvin kiinni alustassaan (ei vaurioitunut, irrallaan, halkeillut tai lohkeillut)?

Ei
Kyllä
En tiedä

78. Onko asunnossanne kohonneita radonpitoisuuksia (ts. pitoisuus yli ohjearvojen mukaisen 400 Bq/m3, tai jos asunto rakennettu v. 1992 jälkeen, yli 200 Bq/m3)?

Ei, **siirtykää kysymykseen 80**
Kyllä
En tiedä, **siirtykää kysymykseen 80**

79. Onko rakennuksessa tehty toimenpiteitä radonpitoisuuden alentamiseksi? Voitte valita useita vaihtoehtoja.

Ei
Kyllä, rakennusvaiheessa asennettu järjestelmä otettu käyttöön
Kyllä, myöhemmässä vaiheessa on tehty korjaustoimenpiteitä
En tiedä

80. Koetteko tarvitsevanne tietoa seuraavista asumisterveyteen liittyvistä tekijöistä? Voitte valita useita vaihtoehtoja.

Sisäilman epäpuhtaudet
Kemikaalien käyttö
Torjunta-aineiden käyttö
Hajuhaitat
Asbesti
Radon
Ei mistään edellä mainitusta
Jostain muusta, mistä? _____

TURVALLISUUS

81. Kuinka turvalliseksi koette asuinalueenne?

Turvalliseksi
Melko turvalliseksi
Melko turvattomaksi
Turvattomaksi
En osaa sanoa

82. Onko asuntoonne tai lähinaapurustoon murtauduttu/yritetty murtautua viimeisen 12 kuukauden aikana tai onko omaisuuttanne muuten vahingoitettu? Voitte valita useita vaihtoehtoja.

Ei, **siirtykää kysymykseen 84**
Kyllä, omaan asuntoon / omaa omaisuutta
Kyllä, naapurin asuntoon / naapurin omaisuutta, **siirtykää kysymykseen 84**
En tiedä, **siirtykää kysymykseen 84**

83. Ilmoititteko tapauksesta poliisille?

Ei
Kyllä

84. Oletteko kokeneet olevanne henkilökohtaisesti uhattuna liikkuessanne asuinympäristössänne viimeisen 12 kuukauden aikana?

Ei
Kyllä

85. Mitkä seuraavista kuuluvat asuntonne turvajärjestelmiin? Voitte valita useita vaihtoehtoja.

Palovaroitin
Häkävaroitin
Palosammutin/sammutuspeitto
Liesivahti
Ensiapulaukku/-välineistöä
Murtohälytin
Erikoislukot / varmuuslukko / oven murtosuojat tms.
Ovisilmä
Muuta, mitä? _____

86. Säilytetäänkö lääkkeitä ja kemikaaleja asianmukaisessa ja turvallisessa tilassa (eli lukitussa tilassa, lasten ulottumattomissa)?

Ei
Kyllä
Ei tarpeen

87. Onko asunnossanne tai lähiympäristössänne viimeisen 12 kuukauden aikana sattunut seuraavanlaisia tapaturmia? Voitte valita useita vaihtoehtoja.

Tulipaloja
Palovammoja
Kaatumisia / liukastumisia
Putoamisia
Veden varaan joutumisia
Tukehtumisvaaraa
Haitallisten aineiden aiheuttamia myrkytyksiä
Ei ole sattunut yllämainittuja tapaturmia
En tiedä
Muita, mitä? _____

88. Onko asuntonne lähiympäristössä kiinnitetty huomiota turvallisuuteen?

	Ei	Kyllä	Ei ongelmaa	En tiedä
Estämällä putoamiset kaiteiden avulla				
Rakentamalla portaat jyrkästi viettäville kulkureiteille				
Hiekoittamalla jäisiä kulkureittejä talvella riittävästi				
Tarkastamalla lasten leikkipaikkojen turvallisuus (kiipeilytelineet, keinut) systemaattisesti vähintään kerran vuodessa				
Muuten*				

***Miten?** _____

89. Kuinka liikkumisesteetön asuntonne ja lähiympäristönne mielestänne on?

Esteetön (asunnossa ja lähiympäristössä voi hyvin liikkua esim. pyörätuolilla)
Lähes esteetön (asunnossa ja lähiympäristössä on pieniä tasoeroja, jyrkkiä luiskia, ahtaita paikkoja tms.)
Melko esteellinen (tasoerot ja mitoitus vaikeuttavat huomattavasti liikkumista)
Hyvin esteellinen (asunnossa tai lähiympäristössä on mahdoton liikkua yksin pyörätuolilla)

90. Mistä seuraavista asuinturvallisuuteen liittyvistä tekijöistä kaipaisitte lisätietoa? Voitte valita useita vaihtoehtoja.

Asuinalueen turvallisuus / rikosten ennaltaehkäisy
Tapaturmien ennaltaehkäisy
Kulkureittien turvallisuus
Asunnon turvajärjestelmät
Haitallisten aineiden säilytys
Esteettömyys
Ei mistään edellä mainitusta
Jostain muusta, mistä? _____

HYVINVOINTI JA TERVEYS

91. Millaiseksi koette yleisen terveydentilanne tällä hetkellä?

Hyväksi
Melko hyväksi
Tyydyttäväksi
Melko huonoksi
Huonoksi
En osaa sanoa

92. Mitä seuraavista oireista Teillä on ollut viimeisten 12 kuukauden aikana ja kuinka usein?

	Päivittäin / lähes päivittäin	Viikoittain	Kuukausittain	Harvemmin	Ei lainkaan
Yleisoireita (päänsärky, väsymys, keskittymisvaikeudet)					
Ylähengitystieoireita (nenän tukkoisuus, nuha, kuiva tai kipeä kurkku)					
Alahengitystieoireita (hengenahdistus, yskä, limannousu)					
Silmäoireita (kutinaa, kuivumista, roskan tunnetta silmässä)					
Ihottumaa tai iho-oireita (ihon punoitus, kuiva iho, kutina)					
Nivelkipuja tai turvotusta					
Lihaskipuja					
Ripulia					
Univaikeuksia					

93. Onko Teillä lääkärin toteama astma?

Ei
Kyllä

94. Onko Teillä lääkärin toteamaa allergiaa?

	Ei	Kyllä
Pölypunkeille		
Siitepölylle		
Kotieläimille		
Homeelle		
Jollekin muulle * **Mille?** _____		

95. Oletteko sairastaneet viimeisen 12 kuukauden aikana hengitystietulehduksia (kuten välikorvan-, poskiontelo- tai keuhkoputkentulehduksia), joista on aiheutunut lääkärissä käyntejä tai poissaoloja töistä tai koulusta?

	Ei	Kyllä
Sairastanut hengitystietulehduksia		
Käynyt lääkärissä hengitystietulehdusten vuoksi		
Ollut poissa töistä tai koulusta hengitystietulehdusten vuoksi		

96. Onko Teillä lääkärin toteamaa kuulon heikkenemistä, joka ei ole perinnöllistä tai työperäistä?

Ei
Kyllä

97. Liikutteko/kuntoiletteko vähintään puoli tuntia päivässä?

	Kyllä, useita kertoja viikossa	Kyllä, noin kerran viikossa	Harvemmin kuin kerran viikossa	Ei lainkaan
Asuinympäristössä / sen lähettyvillä				
Koulu- tai työmatkalla				
Muualla				

LISÄTIETOJA JA PALAUTE

98. Millaisia tieto- ja neuvontapalveluita kaipaisitte liittyen terveelliseen ja turvalliseen asumiseen, rakentamiseen ja korjaamiseen? Voitte valita useita vaihtoehtoja.

Kunnallisia palveluita
Maksullisia asiantuntijapalveluita
Ilmaisia neuvontapalveluita
Asumiseen, rakentamiseen ja korjaamiseen keskittyvien yritysten palveluita (esim. isännöintiliikkeiden, huoltoyhtiöiden, urakoitsijoiden välittämä tieto heidän välittämänsä toiminnan ohessa)
Verkkopalveluita
En tarvitse kyseisiä palveluita
Jotain muita, mitä? _____

99. Haluatteko yksilöityä palautetta vastauksiinne liittyen?

Ei
Kyllä, postitse
Kyllä, sähköpostitse osoitteeseen:_____

100. Sana on vapaa (kommentteja, ehdotuksia, mielipiteitä, mieltä askarruttavia asioita, jne.).

_____

_____

_____

_____

_____

Kiitos vastauksistanne!