Nadra Adam, Sini Kivelä

Early symptoms individuals have experienced linked to poor indoor air quality

Helsinki Metropolia University of Applied Sciences
Bachelor of Health Care
Degree Programme in Nursing
Bachelor's Thesis
4 February 2019

Author(s) Title Number of pages Date	Nadra Adam, Sini Kivelä Early symptoms individuals have experienced linked to poor indoor air quality 16 pages + 3 appendices 4 February 2019
Degree	Bachelor of Health Care
Degree programme	Nursing and Health Care
Instructor(s)	Jukka Kesänen, PhD, Senior Lecturer

In Finland, the effects of poor indoor air quality, such as moisture and mould damage in buildings, has been a very popular topic for the past few years. Moisture and mould damage has been associated and linked to many different health problems. The purpose of this thesis was to examine the early symptoms individuals have experienced linked to poor indoor air quality. The aim of this thesis was to encourage early intervention as soon as symptoms caused by poor indoor air quality are first noticed.

The data collection method for this thesis was an open ended questionnaire. Members of the HomeSweetHome Facebook group had the option to respond to two questions anonymously. The total of 42 answers were analysed inductively. The results were then categorised according to the symptoms the participants had experienced: respiratory, neurological, allergic, and other.

The results of the second question showed the majority of participants did not recognise poor indoor air quality for being a cause of their symptoms in the beginning. These results can be used for healthcare professionals and students for educational purposes.

The topic of indoor air pollution should be researched further in the future. It is difficult for health care professionals to guide or help patients who have had symptoms linked to poor indoor air quality if they are not familiar with possible symptoms. More scientific research on this topic would provide greater awareness on the issue for healthcare professionals and for the general public.

Keywords	Indoor air quality, mould, moisture, symptoms, pollutants,

Tekijä(t) Otsikko Sivumäärä Aika	Nadra Adam ja Sini Kivelä Sisäilmaongelmiin liittyvät varhaiset oirekokemukset 14 sivua + 3 liitettä 4 Helmikuuta 2019
Tutkinto	Sairaanhoitaja AMK
Koulutusohjelma	Hoitotyön koulutusohjelma
Suuntautumisvaihtoehto	Sairaanhoitaja
Ohjaaja(t)	Jukka Kesänen, TtT Lehtori

Rakennuksien kosteus ja homevaurion vaikutukset on hyvin suosittu aihe Suomessa viime vuosina. Erityisesti sisäilma ongelmat kuten kosteus ja homevaurio on yhdistetty moniin erillaisiin terveysongelmiin. Tämän opinnäytetyön tarkoituksena on tutkia yksilöiden ensimmäiset oireet mitkä he ovat kokeneet, liittyen huonoon sisäilman laatuun. Opinnäytetyön tavoitteena on edistää varhaista puuttumista heti kun sisäilmaoireet havaitaan.

Tiedon keräämisen menetelmänä käytimme kyselyä joka sisälsi avoimia kysymyksiä. HomeSweetHome Facebook-ryhmän jäsenillä oli mahdollisuus vastata kyselyyn nimettömästi. Tuloksia saatiin 42 vastauksia mitkä analysoitiin induktiivisella sisältöanalyysillä.

Ensimmäisen kysymyksen tulokset luokiteltiin osallistujien oireiden mukaan; hengitystie oireet, neurologiset oireet, allergiset oireet ja muut. Toisen kysymyksen tulokset osoittavat, että suurin osa osallistujista ei tunnistanut, että sisäilmaongelma oli syynä niihin oireisin mitä he kokivat. Näitä tuloksia voi hyödyntää terveydenhuollon ammattilaisille ja opiskelijoille opetustarkoituksiin.

Suomessa tarvitaan lisätutkimusta erityisesti sisäilmaoireilevan kokemuksiin liittyen. Terveydenhuollon ammattilaisten on vaikea ohjata ja neuvoa potilaita joilla on ollut sisäilmaoireita, jos he eivät tunne mahdollisia oireita. Lisää tieteellistä tutkimusta tästä aiheesta antaa tietoisuutta asiasta terveydenhuollon ammattilaisille sekä myös kansalaisille.

Avainsanat	kosteus- ja homevaurio, terveysongelmat, sisäilma, sisäilmanlaatu, oireet,

Contents

1.	**Introduction**	**1**
2.	**Background**	2
2.1	Causes of Indoor Air Pollution	2
2.2	Symptoms of indoor air quality	2
2.3	Methods for Improving Indoor Air	3
2.4	Finnish Indoor Air Quality Guidelines	4
2.5	Previous Studies	4
3.	**Purpose, Aim and Research Question**	**5**
4.	**Methodology**	6
4.1	Data collection	6
4.2	Data Analysis	7
5.	**Results**	7
5.1	Respiratory symptoms	7
5.2	Neurological symptoms	8
5.3	Allergic symptoms	8
5.4	Experiences of poor indoor air quality	8
6.	**Discussion**	9
6.1	Discussion of results	9
6.2	Reliability and Validity of this Study	10
6.3	Ethics	11
7.	**Conclusion**	12
References		13
References		14
References		15

Appendices

Appendix 1. Information of Study and Consent Form

Appendix 2. Questionnaire

Appendix 3. Results table

1. Introduction

Poor indoor air quality is a serious problem that is a major cause of morbidity and mortality worldwide. In Finland around 600 000-800 000 individuals are exposed to moisture and mould from indoor air annually (Duodecium, 2019). Indoor air quality is affected by factors such as: the location of a building, temperature and humidity, construction methods, contaminants, and occupants Places such as schools, homes, and offices are environments where people spend most of their time and are usually more likely be exposed to poor indoor air quality problems. (EPA, 2014).

Indoor air quality issues arise from the following sources: a source of contamination, heating, ventilation, and air conditioning (HVAC) system, pollutant pathways, and building occupants (EPA, 2014). Indoor air quality issues may cause various types of symptoms for the building occupants. These symptoms may range from the “upper and lower respiratory tract, the eyes and the nervous system…”(Pitarma, 2016). Health effects from sick building syndrome may arise immediately or very quickly and other effects could arise years later (EPA, 2014). The phenomena of poor indoor air quality leading to symptoms and illnesses is referred to as “Sick Building Syndrome” (Pitarma, 2016). Methods for improving indoor air quality include: controlling of the source of contamination, improving the ventilation of a building, and using air cleaners to remove particles from indoor air (EPA, 2014).

In places such as day-cares, retirement homes, and hospitals the poor indoor air quality affects people who are more sensitive and vulnerable to environmental pollutants such as children, sick persons, and elderly (Heseltine & Rosen, 2009). In Finland, numerous schools have problems with ventilation and mould, and up to two-thirds of all schools and day-care facilities have poor indoor air quality (Bukina, 2018). The purpose of this thesis was to examine the early symptoms individuals have experienced linked to poor indoor air quality.

2. Background

Indoor air quality is defined by the United States Environmental Protection Agency (EPA) as the air quality within and around buildings and structures regarding its effect on the health and comfort of the people occupying it. The following elements may lead to problems with indoor air quality: the source of contamination, heating, ventilation, air-conditioning system (HVAC) is not able to control existing air contaminants and ensure thermal comfort, the existence of a pathway from the pollutant source to inside the building or structure, and people occupying the space. These four elements are important to consider in the discussion of indoor air quality (EPA, 2014).

2.1 Causes of Indoor Air Pollution

According to the The National Institute for Health and Welfare of Finland, there may be many pollutants in indoor air which can cause adverse health effects (Lampi & Pekka, 2009). Indoor air pollutants may be categorized as biological agents, gases, particulates, and chemicals (Cincinelli & Martellini 2017). Biological agents may be from building materials, pets and pests, dust mites, moulds and mildew, or infectious agents (Cincinelli & Martellini, 2017). Gases, such as carbon dioxide or nitrogen dioxide may be emitted from stoves. Volatile organic compounds (VOCs) may be emitted from sources such as: building materials, furniture and other equipment, activities including cleaning, renovation, or outdoor sources such as heavy traffic (Salonen, 2009). Other chemicals may be emitted from different chemicals used indoors for cleaning, insect control, or other sources.

Some factors that affect the growth and presence of mould are humidity, temperature, and dampness (Komulainen, 2008).

2.2 Symptoms of indoor air quality

Symptoms related to poor indoor air quality affect building occupants differently. These symptoms may range from respiratory tract, neurological, or allergic (Pitarma, 2016). According to the EPA, some short term symptoms could be irritation of the eyes, nose and throat, headaches, dizziness, and fatigue (EPA, 2017).

Symptoms of asthma may also appear shortly after contact with indoor air pollution (EPA, 2017). For people with increased sensitivity to pollutants, symptoms may appear sooner than others while others may become sensitized to pollutants over time and have no noticeable symptoms (EPA, 2017).

Long term effects may occur after exposure to indoor air pollution for extended periods of time. They may appear years after exposure (EPA, 2017). According to the EPA, these may include respiratory diseases, heart disease, and cancer (EPA, 2017).

2.3 Methods for Improving Indoor Air

Indoor air quality is important to consider during planning and building places people will spend time in. In Finland, guidelines provided by the Ministry of the Environment regulate the the development of new buildings (Ministry of the Environment, 2017). All of the potential factors that affect indoor air quality must be considered during the planning and constructing of buildings. Factors such as: heating, ventilation, air conditioning, building materials, and lighting (Sisäilmayhdistys ry, 2008).

The main methods for improving indoor air quality according to the EPA are: source control, ventilation improvements, and using air cleaners (EPA, 2017). The amount of pollution in a building may be lowered by identifying the cause of pollution and preventing emissions inside. Inside or outside sources of pollution may be possible in the forms of mould growth, gases, particles, vehicle exhaust, smoking, cleaners, etc. Ventilation improvements prevent mould growth from warm temperature, dampness, and humidity. Ventilation may also move pollutants out of the room which is especially important during activities such as painting, cleaning, cooking with kerosene heaters, and so on. The methods of ventilation include natural, mechanical, and infiltration. Natural ventilation moves outdoor air inside buildings through windows and doors. Mechanical ventilation refers to the HVAC system which controls the temperature and humidity inside a building. Infiltration is ‘A process by which outdoor air flows into the house through openings, joints and cracks in walls, floors and ceilings, and around windows and

doors'. Air cleaners may be used to remove pollutants, such as particles, from indoor air (EPA, 2014).

2.4 Finnish Indoor Air Quality Guidelines

The National Building Code of Finland is provided by the Ministry of the Environment. It contains specific requirements for ensuring the safety and health of building users. These requirements range from indoor air, humidity, temperature, and lighting conditions and water supply and sewerage. According to the Ministry of the Environment, "the building must not cause risk to health because of impurities in indoor air, radiation, water or soil pollution, smoke, wastewater, the insufficient processing of waste, or the humidity of the building elements or structures" (Ministry of the Environment, 2018).

The Ministry of Social Affairs and Health has also provided guidelines for healthy conditions in buildings under the Health Protection Act (545/2015). In this decree, healthy conditions are defined as the result of physical conditions, chemical and biological conditions of an apartment or other living area (Asumisterveys, 2015). Valvira is "a national agency operating under the Ministry of Social Affairs and Health, charged with the supervision of the social and health care, alcohol and environmental health sectors" in Finland (Valvira, 2018). Valvira is responsible for the renovation of public buildings such as schools and day-cares in order to maintain adequate indoor air quality (Valvira, 2018). Valvira suggests contacting property owners or managers for suspected indoor air quality problems in Finland (Valvira, 2015).

2.5 Previous Studies

Indoor air quality issues have been researched for years. The causes of indoor air quality problems, the symptoms these different problems might cause and methods on improving the indoor air quality. However, in regards to the need for early intervention, methods of diagnosing individuals experiencing faster to avoid long term illnesses there is still an apparent lack of research. Although it is evident what causes poor indoor air quality, from ventilation to the structure of buildings and their maintenance, and the symptoms and risks of exposure are known, there

is not an abundance of information on the importance of early intervention to prevent long term illnesses. Through database searches, we were able to find some information however the articles were not¨. The databases which we used included CINAHL and PubMed. The search terms used were “indoor air quality or pollution,” “indoor air quality and mould or mould,” “indoor air quality and early intervention,” “indoor air quality and early symptoms,” “indoor air quality and symptoms.” All of these searches were limited to texts from 2007-2019.

On CINHAL, the terms “indoor air quality or indoor air pollution” yielded 648 results. The terms “indoor air quality and mould or mould” yielded 87 results. The terms “indoor air quality and early intervention” yielded 0 results. The terms “indoor air quality and early symptoms” yielded 0 results. The terms “indoor air quality and symptoms” yielded 9 results.

On PubMed, the terms “indoor air quality or indoor air pollution” yielded 1439 results. The terms “indoor air quality and mould or mould” yielded 8694 results. The terms “indoor air quality and early intervention” yielded 0 results. The terms “indoor air quality and early symptoms” yielded 0 results. The terms “indoor air quality and symptoms” yielded 196 results.

The amount of research articles about early intervention or early symptoms individuals may experience linked to poor indoor air quality is extremely low. This demonstrates the lack of material on this subject.

3. Purpose, Aim and Research Question

The purpose of this thesis was to examine the early symptoms individuals have experienced linked to poor indoor air quality.

The aim of this thesis is to encourage early intervention as soon as symptoms caused by poor indoor air quality are first noticed.

The study question for this thesis was; *“What are the early symptoms and experiences individuals have had regarding poor indoor air quality?”*

4. Methodology

Qualitative research is a scientific method in which non numerical data is gathered. It is mainly used in social studies where in depth and detailed findings are required. ‘Researches use qualitative approaches to explore the behaviour, feelings and experiences of people and what lies at the core of their lives.’ (Holloway & Galvin, 2017).

4.1 Data collection

The sample size for this study consists of 21 individuals who are part of the HomeSweetHome Facebook group. The Facebook group included around 5000 members who have either personally had problems with indoor air quality or have loved ones who have been affected.

The research method used in this study is a qualitative questionnaire. Questionnaires are a set of research questions which have been formed to gain information on a certain subject. Questionnaires allow the participants independently to answer questions in an order which they prefer in their own time. The questionnaire consists of open-ended questions. Open ended questions require more in-depth answers and it allows the participant to elaborate on their answers in their own words (Johnson & Turner, 2010).

The questionnaire included the following two questions:

1. What symptoms did you notice early on related to poor indoor air quality?

2. Describe your experience in regards to poor indoor air quality in the early stages.

The data has been collected via an online space on Google forms. A Google forms link of the questionnaire was posted on the HomeSweetHome Facebook group and the participants responded and submitted their answers. A short introduction of the research and the purpose of the questionnaire was provided for all the members of the Facebook group. Individuals who then chose to participate

were separately given a privacy agreement form in the beginning of the questionnaire.

4.2 Data Analysis

The analysis of the questionnaire was carried out by using the content analysis method. Content analysis is a research method which is used to analyse writ ten information systematically and objectively.
There are two different approaches in content analysis; deductive and inductive. The deductive approach is used when there are enough previous studies existing on the topic of the research. However, the inductive approach is recommended if there isn't enough earlier theory available (Elo & Kyngäs, 2007)
The inductive content analysis approach will be used for the purpose of this thesis, due to the lack of knowledge available in regards to poor indoor air quality.
Inductive content analysis is a three stage process (Kyngnäs&Vanhanen,1998). Firstly, the results are read thoroughly and a theme or a category is chosen. The original expressions from the results, which are relevant to the research question are kept in the same wording and are categorised. Then the results organised by grouping according to the similarities and dissimilarities into main categories which are shown in Table 1.

5. Results

The data for this research was gathered via Google Forms which is an internet based service. The participants were given two open ended questions to answer in much detail as possible anonymously. The questionnaire was completed by 21 participants, giving altogether 42 answers which shows that that all of the participants answered both questions. The answers have been presented in Table 1

5.1 Respiratory symptoms

The participants have listed clear symptoms for the first question. The most common symptoms mentioned in the findings was respiratory symptoms such as; blocked nose, breathing problems and asthma.

> "I didn't at first think it was due to poor indoor air, up until I got asthma attacks then I realised it was the mould."

5.2 Neurological symptoms

Common neurological symptoms that participants mentioned were odd or abnormal fatigue which they couldn't understand what was causing it.

> ”En sinänsä huomannut mitään erityistä, mutta väsyin tavallista enemmän.”
> “I didn't really recognize anything different, but I was more tired than usually.”

One participant also stated that due to the neurological symptoms their daily physical abilities suffered.

> ”Väsymys ja uneliaisuus; Nukuin vain työpäivien jälkeen enkä jaksanut enää lenkillä entiseen malliin.”
> “Fatigue and sleepiness; I slept after work and I couldn't go for a jog as I would normally.”

One participant described more serious symptoms such as neuropathy, double vision and migraines.

5.3 Allergic symptoms

A few participants mentioned allergic symptoms such as itchiness and redness of the skin

5.4 Experiences of poor indoor air quality

As for the findings of the second question, the one thing majority of the answers had in common was that they didn't at first recognise that the symptoms were due to poor indoor air quality.

> “ I had symptoms for 15 years without understanding their relationship to indoor air, even in homes and workplaces with visible meld. I didn't smell anything, but had an umbrella of diagnosis coming at me, rheumatism, neuropathic pain etc. I had no clue until one day I couldn't manage any perfumes, or meld smells anymore and had to live outdoors to recover.”

Also the participants described where and when they remember having their first symptoms in regards to poor indoor air quality. The environment where the participants believed they were first exposed to poor indoor air was predominantly at schools or at home.

> “Nine months of being at home and getting constant flu and allergy symptoms.”

One of the participant showed their frustration of how under diagnosed the symptoms of poor indoor air quality are. Also the participant indicated that doctors find it difficult to link these symptoms to poor indoor air quality/mould.

> "I wish doctors would have thought of poor indoor air, instead of cancer and immunity problems when I had flues coming every second week. Then I could have removed myself earlier from these factors and recover better health completely."

6. Discussion

6.1 Discussion of results

The participants of the study describe experiencing symptoms and continuing to spend time in the places causing their symptoms. Although there is existing research on causes of indoor air pollution, different symptoms these problems could cause, and methods and guidelines for improving indoor air quality, healthcare professionals have trouble linking unspecific symptoms to indoor air quality and buildings are not renovated timely. Guidelines are written in Finland to avoid these issues, yet residents spend years in sick buildings. Healthcare professionals should consider indoor air pollution when searching for the cause of patient's symptoms. If healthcare professionals asked questions about the places that people spend the majority of their time they might be able to connect the symptoms to the indoor air quality. Individuals experiencing symptoms could also consider the places where they spend lots of their time indoors. If the public were more informed on the symptoms indoor air pollution could cause and when to seek help from medical professionals, some long term illnesses caused by indoor air pollution could be avoided. Property owners have responsibility in maintaining and testing the quality of indoor air in their buildings and municipalities in Finland have the responsibility with public buildings such as schools and day cares.

The findings in this research study demonstrates different types of early experiences individuals have had regarding poor indoor air quality. The majority of participants had symptoms that could be considered "flu-like". These types of symptoms might not be enough to visit a doctor or even consider the cause. This makes early intervention and diagnosis of indoor air pollution health effects challenging. Early intervention may also be difficult due to issues pinpointing sources of indoor air quality problems, or due to unspecific symptoms that could be easily

overlooked or ignored. The wide range of symptoms individuals may experience from indoor air pollution also makes diagnosis difficult. Participants responded to the questionnaire with early symptoms ranging from neurological, to respiratory, to allergic. These symptoms may continue for weeks or months until intervention, which may increase the chance of developing long lasting or more serious health effects.

The findings of the questionnaire provided a clear and in detail answer to the research question of this thesis

6.2 Reliability and Validity of this Study

The quality of this content analysis may be assessed through validity and reliability (Leung, 2015). Validity in qualitative research assesses the suitability of the methods and data for the research question through the assessment of the appropriateness of the tools, processes and data (Leung, 2015). Reliability may be assessed through the consistency of the research (Leung, 2015). This means that the data gathered is useful and consistent but differs enough to deepen the results (Leung, 2015).

The methods used to gather data for this qualitative research were researching the topic on trusted databases such as CINAHL and PubMed. These databases are recognized as being reliable sources of information. Gathering data through the online questionnaire was done through the HomeSweetHome Facebook group which is a closed group consisting of people living in Finland who have personal experiences with indoor air quality problems.

The reliability, or 'trustworthiness' of the sample group could impact the reliability of the results. Each participant reads and interprets the survey questions in their own manner. It is the researchers' responsibility to write clear, concise, easy to understand questions in order to avoid misinterpretations. The questions were written in both English and Finnish in order to prevent unusable responses due to a language barrier.

The validity of the data gathered has been assessed through content analysis. Each response was categorized into a subcategory and then further into a main

category. Any responses that did not answer the question asked would be discarded.

6.3 Ethics

In order to implement this research study ethically, the three key points to consider are: respecting the autonomy of research subjects, avoiding harm, and privacy and data protection (TENK, 2008). Autonomy of participants includes the voluntary participation and informed consent of the subjects (TENK, 2008). In this research study, the participants were aware of the study and what it entailed beforehand and were given the choice to answer the questions and then submit their response if they wished. Avoiding harm in research studies includes storage of information that could lead to harm, mental harm of subjects, or financial and social harm (TENK, 2008). In the privacy agreement, the participants were informed of the intentions of the study and were informed on the privacy of their responses.

The participants were informed that the answers would be saved in a Google account that only the researchers had access to and the responses would be deleted following the completion of the study. Humans all experience things differently and this could lead to mental harm from a study that asks personal questions about things such as symptoms and illnesses. This research study was conducted in a way to prevent harm to participants by allowing participants to answer as vaguely or in depth as they chose to. The questions themselves were not prying or leading. The study itself was free for participants so financial harm was not an issue for this. The data collection and analysis strayed away from violations such as; fabrication, falsification and plagiarism. Only data provided by research participants from the chosen sample were used, and all literature from outside sources has been cited properly to avoid plagiarism. The participants were all thoroughly informed (via a consent form) of the usage of their responses, the purpose, and confidentiality.

7. Conclusion

During the process of this study there were many limitations and obstacles due to the lack of literature related to our research question.
As indoor air pollution continues to be a popular current issue in Finland, it is important that sufficient research studies are conducted. The National institute of Health and Welfare (Terveyden ja Hyvinvoinnin Laitos, THL) are currently conducting research on the health issues caused by moisture damage in school, homes and day cares. Also THL are forming a questionnaire which will gather data on the experiences of individuals who have been affected by poor indoor air in school specifically (Ympäristöterveys, 2018).

The collected results of this thesis show that individuals who have experienced symptoms linked to poor indoor air, feel unheard and helpless when it comes to getting the right diagnosis. The results can be utilised as an educational source for health care professionals such as nurses. Nurses who work in health care centres or the emergency face patients who are constantly needing medical attention for respiratory or allergic symptoms This increases the health care costs and also the amount of health care visits patients will have. However, if nurses are aware of the symptoms caused by poor indoor air, they are able to consult doctors and other healthcare professionals to find the right care path for the patient thus saving time and money.
The limitations of this study include, the data gathered being from only one closed Facebook group. There are many individuals who may have had experiences of poor indoor air quality and do not use social media. In the future to improve this study it would be useful to widen the pool of participants by for example sending out questionnaires via post. Also the participants who have completed the questionnaire are anonymous so therefore their credibility cannot be assessed.

The aim of this thesis was to encourage early intervention as soon as symptoms caused by poor indoor air quality are first noticed. It is important that the public are aware of the symptoms which can occur in order to intervene at an early stage. The data gathered from the questionnaire provides potential symptoms to be aware of.

References

Asumisterveys, 2015, Valvira, <https://www.valvira.fi/> Viewed January 7, 2019.

Bord, J. D., 2014. *Informed Consent,* < https://depts.washington.edu/bio-ethx/topics/consent.html> Viewed 8 Dec 2018.

Bukina, Klavdiia, 2018. *Most Prominent Issues of Indoor Air Quality (IAQ) Problems in Finnish Schools*, <http://epublications.uef.fi/pub/urn_nbn_fi_uef-20180701/urn_nbn_fi_uef-20180701.pdf> Viewed Jan 7 2019

Cincinelli, A. and Martellini, T., 2017. *Indoor Air Quality and Health.* International Journal of Environmental Research and Public Health. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5707925/> Viewed 6 Nov 2018.

Duodecium, 2017. *Kostetus- ja homevaurioista oireileva potilas*, <http://www.kaypahoito.fi/web/kh/suositukset/suositus?id=hoi50111> Viewed 6 Nov 2018.

Elo, S. & Kyngäs,H, 2008. *The qualitative content analysis process. Journal of Advanced Nursing* 62(1), 107–115

Environmental Protection Agency. Publications about Indoor Air Quality, 2017. <https://19january2017snapshot.epa.gov/indoor-air-quality-iaq/publications-about-indoor-air-quality_.html> Viewed 4 Feb 2019.

Environmental Protection Agency. Factors Affecting Indoor Air Quality, 2014. <https://www.epa.gov/sites/production/files/2014-08/documents/sec_2.pdf> Viewed 6 Nov 2018.

Heseltine, E. & Rosen, J., 2009. WHO Guidelines for Indoor Air Quality. 1st Edition ed. Copenhagen: World Health Organisation.

References

Holloway, I. and Galvin, K., 2017. Qualitative Research in Nursing and Healthcare**.** 4th ed. <https://ebookcen- tral.proquest.com/lib/metropolia-ebooks/detail.action?docID=4622920#> Viewed 11 Feb 2019.

Homepakolaiset ry, n.d. *Homepakolaiset*, <http://homepakolaiset.fi/in_english.html> Viewed 21 Nov 2018.

Homepakolaiset ry, n.d. *Terveyshaitat.,* <https://homepakolaiset.fi/sisailma-ja-terveys/terveyshaitat/> Viewed 21 Nov *2018.*

Johnson, B. & Turner, L. A., 2010. Data Collection Strategies In Mixed Methods Research. In: *SAGE Handbook of Mixed Methods In Social & Behavioural Research.* California: Sage Publications, pp. 297-309.

Komulainen, H., 2007. The opinion on risk assessment on indoor air quality by SCHER. <https://www.isiaq.org/docs/Keynote papers/Tu9K2.pdf> Viewed 12 Oct 2018.

Lampi, J & Pekkanen, J. 2017, *Terve ihminen terveissä tiloissa,* Kansallinen sisäilma ja terveys -ohjelma THL. <https://thl.fi/documents/98567/1586976/Kansallinen_sisÃ¤ilma_ja_terveys_ohjelma_Luonnos.pdf/a3b390ba-ac92-49e3-a03e-2e6067b2f8c7> Viewed 6 Feb 2019.

Leung, L., 2015. Validity, reliability, and generalizability in qualitative research. *Journal of Family Medicine and Primary Care*, 4(3), pp.324–327.<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4535087/> Viewed Jan 4 2019.

References

National Advisory Board on Research Ethics TENK, 2009. *Ethical principles of research in the humanities and social and behavioural sciences and proposals for ethical review,* <http://www.tenk.fi/sites/tenk.fi/files/ethicalprinciples.pdf>. Viewed Oct 10 2018.

Ohje koulun ja päiväkodin olosuhdevalvontaan, terveyshaitan ennaltaehkäisemiseen sekä selvittämiseen, 2018. Valvira. <https://www.valvira.fi/documents/14444/261239/Koulu_ja_paivakotiohje.pdf/f334041d-c6f3-fe0a-daa5-78a76ae6a216> Viewed Jan 7 2019.

Parahoo, K., 2014. *Nursing Research.* Third edition ed. Hampshire: Palgrave Macmillan.

Pitarma, R., Marques, G. & Caetano, F., 2016. Monitoring Indoor Air Quality to Improve Occupational Health. *New Advances in Information Systems and Technologies Advances in Intelligent Systems and Computing*, pp.13–21.<http://web.b.ebscohost.com.ezproxy.metropolia.fi> Viewed Oct 10 2018.

Sisäilmasta oireilevat ja sairastavat 2019, Hengitysliitto. <https://www.hengitysliitto.fi/fi/hengityssairaudet/sisailmasta-oireilevat-ja-sairastavat> Viewed 7 Jan 2019.

Terveysvaikutukset 2008, Sisäilmayhdistys ry. <http://www.sisailmayhdistys.fi/Terveelliset-tilat/Terveysvaikutukset> Viewed 7 Feb 19.

The National Building Code of Finland 2018, Ministry of the Environment. < http://www.ym.fi/en-US/Land_use_and_building/Legislation_and_instructions/The_National_Building_Code_of_Finland> Viewed 6 Feb 19.

YMPÄRISTÖTERVEYS 2018, THLhttps://thl.fi/fi/web/ymparistoterveys/sisailma/sisailmatutkimus-thl-ssa> Viewed 6 Feb 2019

Information of the Study and Informed Consent

Dear participant,
We are nursing students from the University of Applied Sciences Metropolia. The purpose of this questionnaire is to gather information on the experiences of individuals who have experienced symptoms from poor indoor air quality.
We are gathering information via an open- questionnaire.
By participating in this questionnaire, you are giving consent for your answers to be used as part of our Bachelor's Thesis for BS in Nursing.

There are laws on confidentiality when publishing a thesis in Finland (L621/1999). In this thesis the participant's confidentiality will be respected. The names, ages, gender or any factor which may risk the participants being recognised will not be mentioned. This questionnaire will be anonymous and only we will analyse the answers. However, the public has the opportunity to view our thesis via the internet and also from libraries.
At the end of this research, the gathered information will be discarded completely after publication.

We kindly ask that only individuals who have had personal experiences with poor indoor air quality participate in this questionnaire. We would also appreciate that you answer all questions in much detail as possible.

Thank you for your interest in our research study and for your participation. For any inquiries please do not hesitate to contact us via email.

Best wishes,
Sini Kivelä; Sini.kivela@metropolia.fi
Nadra Adam; nadra.adam@metropolia.fi

Questionnaire

1. What symptoms did you notice early on related to poor indoor air quality?

2. Describe your experience in regards to poor indoor air quality in the early stages.

Results table

Table 1. Formation of categories from the data collected

Original expression	Sub category	Main category
'Väsymys ja uneliaisuus'	• Fatigue • Sleepiness	Neurological symptoms
'Lihasväsymys'	• Muscle fatigue	
'Jatkuvat poskiontelontulehdukset, jatkuva lämpö ilman flunssaoireita'	• Recurring sinusitis • Recurring fever	
'Päänsärky'	• Headache	
'Jatkuva flunssa'	• Recurring flu	Respiratory symptoms
'Nenän tukkoisuus, jatkuva niistäminen, liman erittyminen kurkkuun'	• Blocked nose • Mucous secreation in the throat	
'Astman paheneminen, hengenahdistus'	• Asthma • Shortness of breath	
'Ihon punoitus ja kutina' 'Silmien kutina'	• Redness of the skin • Itchiness in the eyes	Allergic Symptoms
'Silmäoireet'	• Eye symptoms	
'Äänen väsyminen 'Äänen käheys'	• Vocal fatigue • Hoarsness of the voice	Other symptoms
'Korvien oireilua'	• Ear symptoms	
'Huono olo'	• Nausea	
' Kurkku tuntui kuivalta'	• Dry throat	