



Self-reported rhinitis of students from different universities in the Netherlands and its association with their home environment



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ABSTRACT

Background: While the indoor environmental quality of student homes is a potential issue since it may affect the wellbeing of the students, the relations are still poorly studied. This study aimed to investigate the relations between home building characteristics and rhinitis in students.

Material and methods: A questionnaire was distributed among four groups of students from three different universities in The Netherlands. Self-reported characteristics of 396 students and their homes were linked to self-reported rhinitis. Logistic regression modelling was applied to explore relations between building characteristics and rhinitis.

Results: Among the students studied, 33% declared to suffer from rhinitis in the last 12 months. After full adjustment, the regression model revealed that having relatives with rhinitis was positively associated with rhinitis (OR:5.27, CI: 3.02–9.21) as well as the presence of less than one-year old furniture made of MDF in the bedroom (OR:2.26, CI: 1.17–4.37). Both working out and having no pets was negatively linked to rhinitis (respectively OR:0.50, CI: 0.25–0.99 and OR: 0.37, CI: 0.18–0.74). Opening the window in the bedroom more than once a week also reduced the risk for rhinitis (OR: 0.55, CI: 0.31–0.98).

Conclusions: The study shows that biological pollutants (caused by pets), chemical pollutants (caused by MDF in bedroom), ventilation (opening window in bedroom) and workout, were associated with rhinitis in students. Further studies are needed to investigate the underlying causes to prevent rhinitis in young adults.

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1. Introduction

There is an increasing concern about the quality of the indoor environment in homes and the rising prevalence of allergic and respiratory diseases. The indoor residential risk factors of primary interest for asthma, allergies and respiratory health, include allergens (e.g. dust-mites, cockroaches and pet dander), moisture, mould and endotoxin, combustion products from appliances, tobacco or other combustion sources (e.g. traffic), and indoor chemical emissions or emission-related materials or activities (e.g. formaldehyde or particleboard, phthalates or plastic materials, and volatile organic compounds or recent painting), renovation and cleaning activities, new furniture, carpets or textile wallpaper (e.g. reviews in Refs. [1–3]), and several building factors (building location, type of construction and design of the heating, cooling and ventilation systems applied, furnishings and furniture) (e.g.

Refs. [4,5]). Besides the environmental risk factors, potential risk factors for asthma, allergies and respiratory health are personal factors (e.g. sex, age, genetics, educational level), lifestyle-related behaviours (e.g. smoking, alcohol use, physical activity, sedentary behaviour) and psychosocial factors (e.g. mood).

Up to now, very few studies have investigated simultaneously the impact of environmental and individual factors on health, while it is important to consider physical, physiological, psychological and social factors to explain the responses of people [6]. Moreover, indoor environmental studies in homes mainly involve children (e.g. Refs. [7–11]). However, indoor environmental quality may also affect the well-being of students [12,13]. Studies involving this population have focussed mainly on their school environment, but not their home environment. Therefore, a survey was performed among students from different universities in the Netherlands [14]. In this survey, rhinitis was reported to be the most prevalent health condition. Rhinitis is a worldwide health problem with negative impacts on quality of life [15]. There exist several forms of rhinitis: allergic rhinitis, caused by an immune response against allergens

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(e.g. indoor allergens such as dust mites, moulds, insects -cockroaches- and animal dander) and non-allergic rhinitis, caused by non-allergic conditions resulting in similar symptoms (e.g. infections, emotional, physical and chemical factors, and use of certain drugs) [4]. The relations between environmental factors, individual factors and rhinitis are not clearly understood.

In this context, using the large database from the survey conducted in Dutch universities, this study aimed to explore the associations between the indoor environment of the students' homes and rhinitis, taking into account all potential confounders, as a first important step towards unravelling the indoor environmental causes of rhinitis in students.

2. Methods

2.1. Study design

In the spring of 2015, four groups of students from three different universities in the Netherlands were recruited for a survey on their health and comfort in relation to their homes: the universities were the Delft University of Technology (TUD) (including two groups: bachelor and master students), Wageningen University (WUR) (bachelor students), and the Technical University of Technology (TU/e) (master students), located in the West, East and South of the Netherlands, respectively.

In all cases, the procedure was similar. At least three weeks before the lecture, the students of the specific courses received an invitation by e-mail with a link to the digital on-line questionnaire. In the e-mail the purpose and the procedure of the survey were explained and the deadline for completing the questionnaire was given (in general one week before the lecture). All students who were registered to the course received an invitation. It was estimated that the questionnaire would take about 30 min to complete and respondents could save the survey at any time and resume it later.

2.2. Data collection

The electronic-based questionnaire was voluntary, anonymous and in English. It was based on the OFFICAIR questionnaire [16], while also including the International Positive and Negative Affect Schedule Short Form, I-PANAS-SF [17], the Emocards tool to assess the self-reported emotional status at the moment of filling in the questionnaire [18], the dwelling questionnaire [19], and the HOPE checklist for homes [20]. In total, the questionnaire included 125 questions at the most (without skip-logic questions) and one optional question about the respondents' interest in the questionnaire and ease of filling it in. It included questions to collect sociodemographic data about the respondent (e.g. gender, age, marital status, educational level), life-style information (e.g. time spent inside the home, workout, smoking status, and alcohol habits), psycho-social aspects (e.g. mood via Emocards, recent positive and negative events - such as birth, wedding, death, accident, severe illness -, and general positive and negative affects via I-PANAS-SF), health and medical history (e.g. personal medical history, family medical history, health at home), and comfort data (e.g. overall comfort, indoor comfort perception). Additionally, the questionnaire included a checklist to collect information about different types of occupants of the home environment (e.g. people, pets and pests), the systems and activities (e.g. heating, cooling and cooking, do-it-yourself activities, cleaning activities, consumer products), the presence of materials, coverings and furniture (e.g. asbestos, lead, floor and wall coverings, ceiling surface, painting, new carpeting, particle board, open shelves), the ventilation type and window characteristics (e.g. natural ventilation, mechanical

ventilation, maintenance, window frame, window opening), and humidity problems (e.g. humidity signs, condensation, washer and/or drying).

The I-PANAS-SF is composed of 5-item positive affect subscales (alert, inspired, determined, attentive and active) and 5-item negative affect subscales (upset, hostile, ashamed, nervous, and afraid). Each item is rated from 1 'never' to 5 'always'. The Emocards tool includes eight cards with facial expressions for distinct emotional expressions varying on the basis of the dimensions 'pleasantness' and 'arousal' (physical state of activation). The cards are presented with a female or a male cartoon character, appropriately for both female and male participants [18].

Concerning health data, the following question was asked for a number of diseases, including allergic rhinitis: 'Have you suffered from *disease/disorder*?' The following options were the possible answers: 'Never', 'Yes, in the last 12 months', 'Yes, but not in the last 12 months'. To identify health symptoms that the students suffered from, the following was asked: 'In the past 3 months, how often have you suffered from *Health symptom* while you have been in your home (on average)?' The possible answers were: 'every day', '3–4 days a week', '1–2 days a week', 'once every 2–3 weeks', 'less often or never'. If the answer was 'once every 2–3 weeks' or more often, the following additional question was asked: 'Do you think that this is because of your indoor environment?' with possible answers: 'yes', 'no', 'partly'.

2.3. Ethical aspects

The students were asked to give an informed consent to start the survey. Participants were able to skip any question that they were not comfortable answering. To decrease involuntary missing answers, an automatic check of completeness was performed, and missing answers were pointed out to the participant at the end of each page of the questionnaire.

2.4. Data management

All data were digitally completed and stored in Collector[®] (an online questionnaire tool).

Data were prepared by removing incomplete questionnaires (e.g. 7 from TUE who answered only the first ten questions), a questionnaire of a non-student (teacher from TUD BSc) and one respondent from TUD MSc, who answered the questions in a non-serious way.

2.5. Statistical analysis

2.5.1. Descriptive analysis

Descriptive statistics such as percentages, range (minimum–maximum), or arithmetic mean with standard deviation (SD) were used to summarize the characteristics of the students and their homes. Since there was no overall difference between the different student groups, data were pooled for further analyses.

2.6. Associations between building characteristics and rhinitis

The relations between building characteristics and rhinitis ('yes in the last 12 months' equalled yes; while 'yes, but not in the last 12 months' and 'never' equalled 'no') were examined using unconditional logistic regression modelling.

Potential personal factors were: gender, parental history of rhinitis, smoking status (yes versus no), alcohol consumption (yes versus no), and psychological aspects (PANAS negative and positive). Age was not considered because the standard deviation was small.

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