

Indoor air related health disorders: experiences of an advisory center for environmental medicine

C Hornberg^{1*}, S Mourheg², GS Siao², HF Neuhaus³, U Ranft⁴, W Dott² and GA Wiesmüller²

¹ Dep. Environ. and Health, Faculty for Public Health, University Bielefeld, Germany

² Inst. of Hygiene and Environ. Medicine, University Hospital Aachen, Germany

³ Clin. for Gastroenterol., Hepatol. and Infectiol., University Hospital Duesseldorf, Germany

⁴ Med. Inst. of Environ. Hygiene at the Heinrich Heine-University Duesseldorf, Germany

ABSTRACT

Since 1987, in Germany advisory centers for environmental medicine were founded. In the present study the relevance of indoor air problems in a patient collective in environmental medicine was investigated. Questionnaire data of 772 patients, who consulted the former Consulting Center of Environmental Medicine (CEM) of the Medical Institute of Environmental Hygiene at the Heinrich Heine-University Duesseldorf because of the suspicion of environment-related health disorders, were retrospectively examined regarding exposures and health effects. Indoor air factors were predominantly reasons to consult the CEM. Health disorders were mainly vegetative symptoms, headache, psychological symptoms, pain, neurological symptoms, and chronic fatigue. In 15 cases the suspicion of sick building syndrome (SBS) led to a consultation of the CEM. In conclusion, indoor air problems are main reasons to consult an advisory center for environmental medicine. Therefore, such centers must provide a competence in the specific field of indoor air exposures.

INDEX TERMS

chemical sensitivity, environment, health effects, SBS

INTRODUCTION

Environmental agents have been suspected as possible causes of health problems such as unspecific and functional health disturbances, disorders of the nervous system and respiratory tract, skin lesions, allergies and malignancies (Wiesmüller et al., 1998/99). For this reason, outpatient units and advisory centers for environmental medicine were established in Germany at the end of the 1980s (Seidel, 2002). Thus, in 1989 the consulting Center for Environmental Medicine (CEM) of the Medical Institute of Environmental Hygiene in Duesseldorf, Germany was founded as second center specialised in environmental medicine at a German university (Neuhaus et al., 1994) following 2 years after the establishment of the outpatient Unit of Environmental Medicine (UEM) of the Institute of Hygiene and Environmental Medicine at the University Hospital Aachen (Brölsch et al., 2001). In 1996 the CEM Duesseldorf was closed, because of a politically and scientifically demanded new orientation.

During about the first decade of the work of the founded environmental units, reports were published on the practical experiences of the outpatient units of environmental medicine (UEM) in Erlangen-Nürnberg (Drexler et al., 1993), Heidelberg (Eis et al., 1995), Aachen (Brölsch et al., 2001; Schulze-Röbbecke et al., 1998/99; Wiesmüller et al., 2002), and Munich (Bornschein et al., 2002) as well as of the advisory centers of environmental medicine (CEM)

* Contact author email: claudia.hornberg@uni-bielefeld.de

in Wiesbaden (Wendel, 1992), Duesseldorf (Neuhann et al., 1994), and Hamburg (Freie und Hansestadt Hamburg, 2000). Actually, the first data of a multi-center study focusing on Multiple Chemical Sensitivity (MCS) give an overview about consulting reasons of still working environmental units in Aachen, Berlin, Bredstedt, Freiburg, Giessen, and Munich (Eis et al., 2003).

Aim of the present study was to investigate the relevance of questions about indoor air problems in the patient collective with environment-related health disorders of the CEM Duesseldorf and to compare the results with reports from other environmental units in Germany.

METHODS

Between 1989 and 1996, consultations of 695 women and 545 men (≥ 13 years) as well as of 33 girls and 44 boys (< 13 years) were documented at the CEM Duesseldorf. The present paper focused on the data of the 1,240 adults. Out of them, gender, birthday and consultation date were documented from 571 women and 415 men. A standardised questionnaire for environmental medicine, which includes information on the patient's history, signs and symptoms (the term symptom(s) will henceforth be used as mean signs and symptoms) as well as possible exposures in the patient's living surroundings, was available from 772 adults. Between 1989 and 1991, the questionnaire data were not electronically archived. Therefore, these questionnaire data were retrospectively electronically assessed using EpiInfo. Since 1991, the questionnaire data were based on a questionnaire-based PC-assisted patient-information-system (Neuhann et al. 1992) as dBASE IV files available.

The final diagnoses were taken from the doctor's report. These diagnoses were accepted as an adequate medical opinion after verifying their plausibility. When symptoms characteristic of a certain environmental agent exposure occurred in a post-exposure period typical for this agent, a cause-and-effect relationship was considered likely. When symptoms could partly be explained by exposure to a certain environmental agent, a cause-and-effect relationship was deemed possible. When symptoms were typical manifestations of other diseases and not of the environmental agent(s), a relationship was deemed unlikely.

Data management and descriptive statistical analyses were performed using Microsoft® Excel 5.0 and SPSS® for Windows 10.0.

RESULTS

Most patients consulted the CEM Duesseldorf because of unspecific health disorders (61.8%) followed by questions about possible relationships between an existing disease and environmental factors (17.6%). Concerning the last question recurrent infections (10%) and atopy (8.6%) were the most relevant diseases. Cardiovascular, gastrointestinal, and respiratory diseases were the most relevant current diseases (figure 1).

The patients suffered from vegetative symptoms ($n=184$), headache ($n=165$), psychological symptoms ($n=157$), pain ($n=130$), neurological symptoms ($n=120$), and chronic fatigue ($n=118$) (figure 2).

Indoor air factors were predominantly suspected by the patients and/or their referring physicians as causative exposures, especially wood preservatives ($n=184$), volatile organic compounds ($n=130$), and formaldehyde ($n=64$) (figure 3).

Out of 2,094 biomonitoring measurements (696 patients (65.47%), 1 - 12 measurements per patient) 173 exceeded the relevant reference values. Out of 422 ambient monitoring measurements (96 patients (11.7%)., 1 - 29 measurements per patient) 13 exceeded the relevant reference values.

In 73.1%, environmental factors were excluded as a cause of health disorders. In 8.4% an increased exposure with unclear clinical relevance was determined. A cause-effect-

relationship could not be excluded in 7.9%. In 9.2% it could not be sufficiently judged. Among those were suspected: 15 cases of SBS, 15 cases of Fibromyalgia, 11 cases of Chronic Fatigue Syndrome (CFS), and 6 cases of MCS.

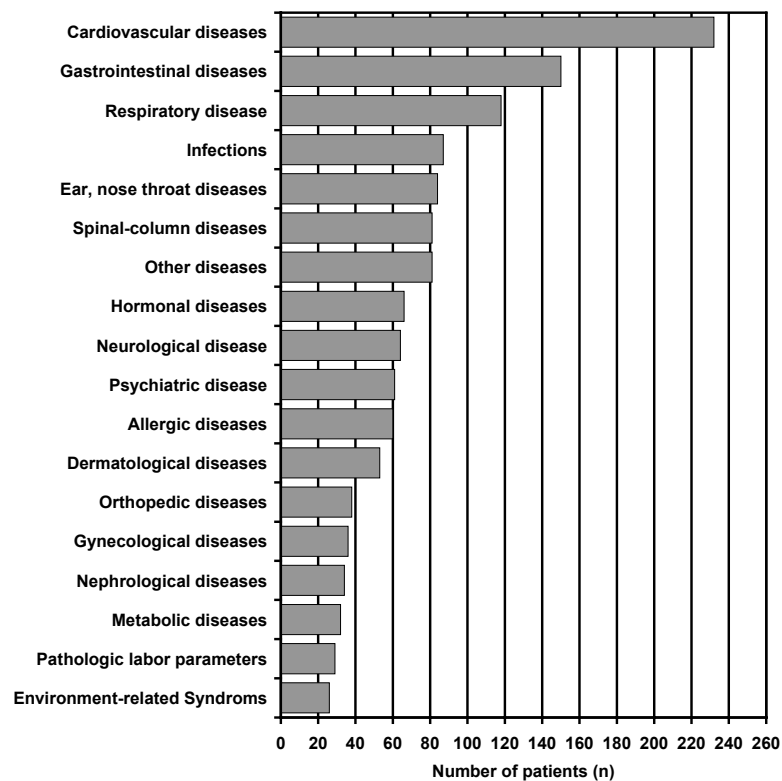


Figure 1. Current diseases in 772 patients (multiple answers possible). Only advice: 3, missing: 134.

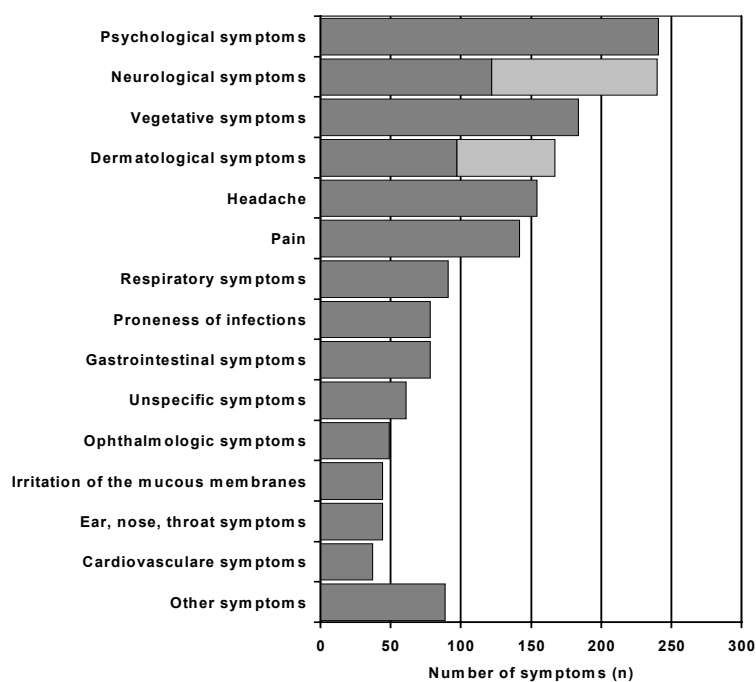
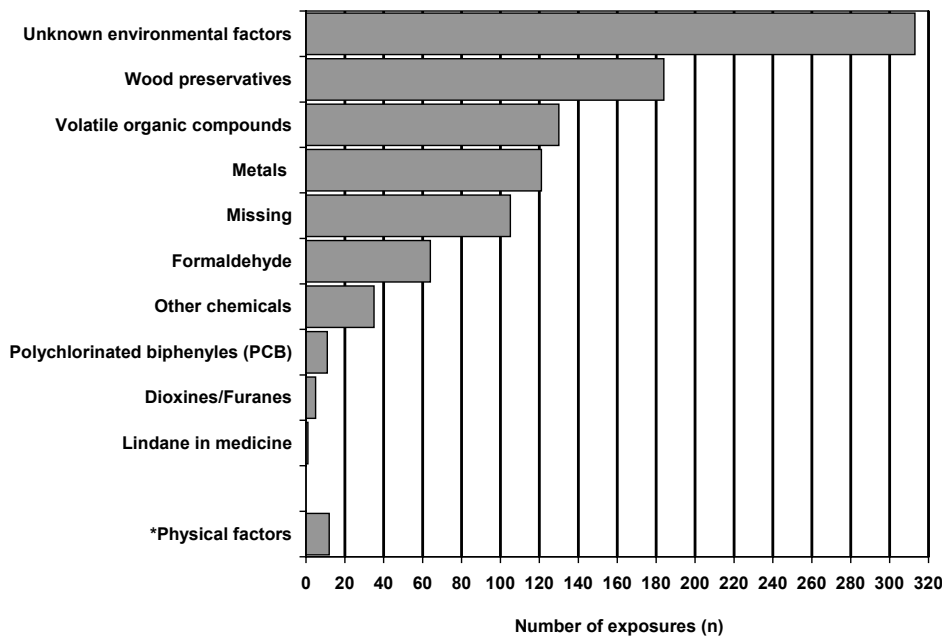


Figure 2. Health disorders in 772 patients (multiple answers possible). Only advice: 3, no symptoms: 11, missing: 134.



*Physical factors: artificial light (1), dampness (1), noise (1), radon (1), electrosmog (4), fibres (4)

Figure 3. Suspected exposures (685 environmental exposures, 87 workplace exposures) of 772 patients (multiple answers possible). Only advice: 3, missing: 134.

DISCUSSION

Our results and the experiences of other environmental units in Germany are summarized in table 1. It shows that indoor air problems were main reasons for the consultation of an advisory center for environmental medicine.

That wood preservatives were the most relevant indoor air factors suspected by the patients and/or their referring physicians as causative exposure may be explained historically by the public discussion about the harmfulness of pentachlorophenol (PCP) in the process of the so-called PCP-prohibition-decree, which was introduced in Germany on 23rd December, 1989. This decree prohibits the production, the circulation and the usage of PCP, including imported products (Bundesgesetzblatt, 1989). Additionally, this process stimulated the discussion about the harmfulness of other wood preservatives, like lindane and pyrethroids.

Brölsch et al. 2000 reported that at the UEM Aachen the consultations concerning PCP showed a peak in 1990 and then declined over the following years. In the general population, the exposure to PCP decreased over the last decade (Straff et al., 2002) yielding in a diminish of the PCP reference value (Ewers et al., 1999). In this process, at advisory centers for environmental medicine the consultation frequency concerning wood preservatives dropped, too (Wiesmüller et al., 2002).

But indoor air problems are still the main reason for people to consult an environmental unit. This fact may be explained that humans spent most of their day time indoors (Ranft et al., 1996; Samet et al., 1987). Indoor air quality problems may be caused by ventilation problems, building products, building usage conditions, e.g. the use of odorants as air refresher. Own experiences show, that our patients increasingly pick out unspecific factors (e.g. the dwelling, a room, odor, the environment) as a central theme in the face of causative exposure (Wiesmüller et al., 2002).

However, our examination showed that advisory centers for environmental medicine must provide a special competence in the specific field of indoor air exposures.

Table 1. Synopsis of patient number, most relevant place of exposure, and most relevant exposure of environmental units in Germany as well as the result of the present paper.

environmental unit	number of patients	place of exposure	exposure	references
CEM Wiesbaden	20 patients	indoor air	PCP	Wendel L, 1991
UEM Erlangen-Nürnberg	no detail	indoor air	wood preservatives	Drexler et al., 1993
CEM Duesseldorf	158 patients	indoor air	pentachlorophenol (PCP)	Neuhann et al., 1994
UEM Heidelberg	49 patients	indoor air	wood preservatives	Eis et al., 1995
UEM Aachen	50 patients	unspecific	solvents	Schulze-Röbbecke et al., 1998/99
UEM Aachen	682 patients	indoor air	wood preservatives	Brölsch et al., 2000
CEM Hamburg	853 patients	indoor air	wood preservatives	Freie und Hansestadt Hamburg, 2000
UEM Munich	264 patients	no detail	amalgam and other metals	Bornschein et al., 2002
UEM Aachen	69 patients	indoor air	solvents	Wiesmüller et al., 2002
MCS multi-center study	93 patients with self-reported MCS and 141 patients with other environment-related health disorders	indoor air	harmful substances	Eis et al., 2003
<i>CEM Duesseldorf</i>	<i>772 patients</i>	<i>indoor air</i>	<i>wood preservatives</i>	<i>present paper</i>

CONCLUSION AND IMPLICATIONS

It is concluded that our results and a related literature review show that indoor air problems are main reasons for the consultation of an advisory center for environmental medicine in Germany. Therefore, such centers must provide a competence in the specific field of indoor air exposures.

ACKNOWLEDGEMENTS

Funding: Partly supported by former MAGS NRW Germany.

REFERENCES

- Bornschein S, Hausteiner C, Zilker T, *et al.* 2002. Psychiatric and somatic disorders and multiple chemical sensitivity (MCS) in 264 “environmental patients”. *Psychol Med* 32, pp 1387-1394.
- Brölsch O, Schulze-Röbbecke R, Weishoff-Houben M, *et al.* 2000. Environmental medicine: eight-year experience from the Outpatients’ Unit of Environmental Medicine at the University Hospital Aachen. *Allergologie* 24, pp 237-252.

- Bundesgesetzblatt, 1989. Pentachlorphenolverbotsverordnung (PCP-V). *Bundesgesetzblatt I* 59, p 2235.
- Drexler H, Weber A, Letzel S, *et al.* 1993. Umweltmedizinische Erfahrungen aus der Poliklinik für Berufskrankheiten der Universität Erlangen-Nürnberg. In *Dokumentationsband über die 33. Jahrestagung der Deutschen Gesellschaft für Arbeitsmedizin und Umweltmedizin*, Triebig G, and Stelzer O, eds. Stuttgart: Genter Verlag, pp 89-92.
- Eis D, Geisel U, and Sonntag HG, 1995. Experiences with an Ambulance for Environmental Medicine at the University of Heidelberg/Germany. *Zbl Hyg Umweltmed* 197, pp 212-221.
- Eis D, Mühlinghaus T, Birkner N, *et al.* 2003. Multicenter Study on MCS. Study design and first results. *Umweltmed Forsch Prax* 8, pp 133-145.
- Ewers U, Krause C, Schulz C, *et al.* 1999. Reference values and human biological monitoring values for environmental toxins. Report on the work and recommendations of the Commission on Human Biological Monitoring of the German Federal Environmental Agency. *Int Arch Occup Environ Health* 72, pp 255-260.
- Freie und Hansestadt Hamburg - Behörde für Arbeit, Gesundheit und Soziales, 2000. *Bericht aus der Umweltmedizinischen Beratungsstelle Hamburg 1991 - 1998*. Hamburg: Eigenverlag.
- Kommission "Human-Biomonitoring" des Umweltbundesamtes, 1999. Aktualisierung der Referenzwerte für Pentachlorphenol im Serum und im Urin. *Bundesgesundheitsblatt* 42, pp 599-600.
- Neuhann HF, Prätör K, Szemkus M, *et al.* 1992. PATIS – A Questionnaire-Based PC-Assisted Patient-Information-System in Environmental Medicine. *Zbl Hyg* 193, pp 350-363.
- Neuhann HF, Henne A, Kleinstaub B, *et al.* 1994. Evaluation of the Use of an Environmental Medicine Consulting Centre. *Zbl Hyg Umweltmed* 195, pp 342-356.
- Ranft U, Wiesmüller GA, and Dolgner R., 1996. The diary as an instrument in air pollution exposure assessment for children. In *Proceedings of an International Symposium*. Bremen: Bremen Institute for Prevention Research and Social Medicine (BIPS), Germany, pp 340-351.
- Samet JM, Marbury MC, and Spengler JD, 1987. Health effects and sources of indoor air pollution. Part I. *Am Rev Respir Dis* 136, pp. 1486-1508.
- Schulze-Röbbecke R, Bodewig S, Dickel H, *et al.* 1998/99. Interdisciplinary clinical assessment of patients with illness attributed to environmental factors. *Zbl Hyg Umweltmed* 202, pp 165-178.
- Seidel HJ. 2002. Environmental medicine in Germany – a review. *Environ Health Perspect* 110 suppl 1, 113-118.
- Straff W, Möller M, Jakobi N, *et al.* 2002. Predictive value of human biomonitoring in environmental medicine: Experiences at the outpatient unit of environmental medicine (UEM) of the University Hospital Aachen, Germany. *Int J Hyg Environ Health* 2002; 205: 337-346.
- Wendel L. 1991. Environmental Medicine Consulting Office at the Public Health Services Bureau in Wiesbaden – Concept and Initial Experiences. *Öff Gesundheitswes* 53: pp 587-590.
- Wiesmüller GA, Ebel H, Schulze-Röbbecke R, *et al.* 1998/99. Editorial: 1st Aachen Symposium "Environment and Psyche". *Zbl Hyg Umweltmed* 202, pp 79-84.
- Wiesmüller GA, Dott W, Erdmann S, *et al.* 2002. Diagnostic algorithm for patients with environment-related health disorders. *Allergologie* 25, pp 513-521.