ENERGY EFFICIENT DOMESTIC VENTILATION SYSTEMS FOR ACHIEVING ACCEPTABLE INDOOR AIR QUALITY

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A METHOD TO ASSESS THE HEALTH AND COMFORT CHANGES AMONG TENANTS AFTER DRAUGHT PROOFING OF THEIR FLATS

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INTRODUCTION

The aim of the present study is to measure the possible health effects among tenants after certain characteristic energy conservation measures had been taken in their dwellings. In addition to health effects, changes in sensation of comfort/discomfort related to indoor climate exposure in accordance with the WHO-definition[1] are also included.

The study is part of the number of projects, which the Department of Energy, Copenhagen has given the Institute of Hygiene, University of Aarhus, comprising indoor pollutant source control[2] as well as changes in house dust mite populations related to moisture changes in retrofitted dwellings[3].

The concept of combining different methodological studies like this is based on the experience from other fields of environmental health studies in that they generally should include both field measurements and observational health studies, as well as controlled exposure studies, to be conclusive. This presentation should be regarded as interim information concerning a particular study in progress. The final report is not due until 1st February 1983.

BACKGROUND

The specific Danish background of the health studies is the so-called Energy Plan 76, which claims that from 1975 to 1985 the gross energy consumption for building climatization should be reduced by approximately 25% in the existing building stock.

This goal could be achieved in three possible ways:

1. More efficient heat production,

2. alternative energy supply (solar heat, heating pumps, etc.),

   and last and most important in a climate having about 3000 degree days in the officially designated 227 days heating season,

3. reduced heat consumption in buildings by improved insulation and reduced uncontrolled air infiltration.

This has been described in more detail in a 371 page publication[4] in which 4½ pages describe the possible adverse effects of energy saving measures in buildings on the building itself, such as damage from frost action, boiler corrosion, noise and vibration from installations, increased danger in case of fire, dampness and condensation and related risk of mould and fungus growth. Another 1½ pages in this book describe the possible adverse effects to the indoor climate under the following headings:

- indoor air humidity
- irritating gases
- static electricity
- aero-allergens

The conclusions were, however, that more had to be known about the possible negative or positive affects on human beings caused by those changes in the building following energy conservation measures.

It is already known that the indoor climate factors are very closely interacting, but we know very little about the effects resulting from moderate exposure conditions such as those occurring in the domestic environment as distinct from those effects related to occupational exposure. Therefore, this study was designed on the basis of collecting written information from single individuals about their sensation of health, comfort and physical wellbeing related to the indoor environment. The idea was to obtain this information both before and several times after energy conservation measures had taken place.

The study was designed as an observational investigation with two groups; a study group and a corresponding control group not exposed to environment changes in their homes other than those which normally occur throughout the seasons of the year. This is what is called a concurrent prospective study in epidemiology.

The general concept of the prospective study is relatively simple. A sample of the normal population is selected and information is obtained to determine which persons either have or have not a particular characteristic, e.g. energy conservation measures carried out, that is believed to be related to changes in health and comfort, both positive and negative. These individuals are followed for a period of time to observe who developed changes and to what degree they occur.

In this case, the necessary data for assessing these developments have been obtained from the tenants by monthly questionnaires, four times in all, once before changes took place and three times after changes had been carried out; more precisely - August 1981, December 1981, January 1982 and February 1982. In the control group, similar questionnaires were answered at the same time but, as mentioned, previously no building changes took place there.

However, the main problem to consider has been how to measure changes in health in a specially exposed population within a relatively short period of time and compare the findings with those of the normal population.

Our study population has been specially exposed to a supposed environment change in their homes caused by energy conservation measures which, in this particular case, were replacement of single glass windows with double glass windows and sealing of joints aiming to improve insulation and to reduce uncontrolled air infiltration.

The health of the population is normally measured on the basis of some well-defined and well-recorded input data, such as death rates and prevalence of specific diseases related to certain demographic characteristics like age, sex, race or ethic group. We could not expect to make any use of this kind of data with regard to the expected acute or sub-acute health effect of indoor climate changes.

Our target has, for that reason, been the field of health between diagnosed and medically treated illness and feelings of non-optimal health condition as reflected by certain typical symptoms such as pains, cough, irritation

in mucous membranes and eyes and the evidence of some normally not medically treated diseases, such as the common cold and certain other virus infections.

We know from a more general health survey carried out in a suburban city population outside Copenhagen[5] some years ago, that about 55% of the 40-year old population are faced with, or feel, some kind of health problem during the year with an increased percentage in higher age groups. The basic problem in the study has been to make it large enough in scale to be sure that no random effects among a small study population would lead to fallacy in the conclusions.

Each questionnaire had a total of 41 questions distributed within the following main groups:

a. Personal characteristics (age, sex, years of residency, smoking habits).

b. Flat characteristics (window types).

c. Occupancy and use of flat (number of residents and age, average occupancy hours, smoking, washing, cooking, window opening, domestic animals).

d. Sensation of comfort or discomfort related to partly thermal, atmospheric and acoustic environment.

e. Somatic symptoms (pain or illness without medical treatment).

f. Chronic diseases or illness with medical treatment.

g. Physical indications (observation of fungi, mould or condensation).

With an estimated maximum of 3000 respondents and 4 surveys, it was realised that both mailing procedures and data handling would be facilitated if an optical character recognition (OCR) procedure was adopted to read the questionnaires directly to the database.

CONCLUDING REMARKS

The preliminary results of this study show that it would be desirable to conduct similar studies under different climatic conditions and for other types of building, but with the same methodology so that the studies would be comparable.

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