ABSTRACT

Background. Human exposure to cold outdoor and indoor temperatures below 10°C may be associated with various cold-related sensations and symptoms. It is not possible to predict a person’s survival ability only by assessing thermal environments; but individual screening is always required for good health care practice with regards to treatment and/or prevention.

Methods. As part of a development project, a health-check questionnaire was developed for the workers exposed to cold. The completion of the development was carried out in the framework of a Nordic collaboration.

Results. This was three-level medical screening protocol for detecting individual cold-related health ailments. "The health-check questionnaire for subjects exposed to cold" comprises the first step of the screening protocol. The medical screening was harmonized with the assessment practices for cold-related health risks in the workplaces.

Conclusion. A "health-check questionnaire for subjects exposed to cold" was developed as the first step of the three-level medical screening for the detection of cold-related health ailments of individuals. The analogical assessment practices for the cold-related health risks in the workplaces were developed in the same project. They both aim towards the establishment of an ISO standard for working in cold environments.

Keywords: Cold questionnaire, health screening, occupational health care
INTRODUCTION

Human exposure to cold outdoor and indoor temperatures below 10°C may be associated with various cold-related sensations and symptoms. In addition, impairment of physical and mental performance, as well as cold-related injuries, may occur more frequently at those temperatures than in thermo-neutral environments. The occurrence and type of cold-related effects are dependent upon the thermal environment, the activity level and performance capacity, anthropology, previous adaptation to cold, the use of cold protective clothing and technical protection, as well as the health of the individual. Subjective cold experiences vary very broadly (1). It is not possible to predict a person’s survival ability only by assessing thermal environments.

We have produced a health questionnaire for identifying individuals with cold-related diseases, complaints, or personal working limitations. The completion of this health-check questionnaire for use by health care professionals was carried out as part of a Nordic co-operation project (2).

METHODS

As part of a development project, a health-check questionnaire was developed for workers exposed to cold. The completion of the development was carried out in the framework of a Nordic collaboration project supported by the European Regional Development Fund (Interreg IIA Programme), during which a model and methods for cold-risk assessment and management for workplaces were also developed (3,4).

RESULTS

We developed a three-step, individual medical screening protocol for the identification of cold-related health risks in the workplace. The first level of the medical screening consists of the health-check questionnaire describing effects related to the thermal environment of the workplace. As a result of the information provided by the
health-check questionnaire, it was possible to separate those individuals having no cold related complaints from those presenting various kinds of cold ailments and who would need further health assessment, or access to individual health care services.

The following questionnaire and table are destined for use by a health care unit to assess the effects of cold exposure on an individual’s health and performance. The possible need for further action is indicated below each table.

The subsequent actions taken by health care personnel depend upon the responses given in the health-check questionnaire above. These actions include a second level of medical screening by a symptom-based interview (table I).

If any cold-related disease, or degradation of performance, has been identified, the third level of medical screening should be undertaken. This will include a specific, more thorough clinical investigation associated, when necessary, with a further assessment of the environmental risk factors (4). If there are still some open questions, a more detailed analysis by expert units, in hospitals or provocation laboratories, may also be needed as part of the third level of medical screening.
HEALTH-CHECK QUESTIONNAIRE FOR SUBJECTS EXPOSED TO COLD

The following questionnaire asks you to assess the effects of cold on your health and performance. Your cooperation assists your doctor/nurse to define their subsequent actions regarding your health and safety.

The need for further action is indicated by shadow boxes and below each question.

| Question | Options | Instructions |
|----------|---------|--------------|
| **1. How do you generally feel in the cold?** | | |
| | very uncomfortable | uncomfortable | slightly uncomfortable | uncomfortable | comfortable | |
| whole body | 1 | 2 | 3 | 4 | |
| fingers | 1 | 2 | 3 | 4 | |
| toes | 1 | 2 | 3 | 4 | |
| | Interview if, in question 13, the subject also answered that concentration and/or motivation deteriorates because of cooling |
| **2. Do you feel uncomfortable at work because of the cold?** | | |
| 1 | no | |
| 2 | yes | |
| **3. Are you exceptionally sensitive to the cold?** | | |
| 1 | no | |
| 2 | yes | |
| | Interview |
| **4. Do you experience an intense itching of the skin (like nettle-rash) in the cold or after cold exposure??** | | |
| 1 | no | |
| 2 | yes | |
| | Interview |
### DEVELOPMENT RESULTS

**5. Do you experience any of the following?**

| Condition                                           | not at all | in the warm | in the cold | during exercise |
|-----------------------------------------------------|------------|-------------|-------------|-----------------|
| shortness of breath                                 | 1          | 2           | 3           | 4               |
| persistent coughing, or bouts of coughing           | 1          | 2           | 3           | 4               |
| wheezing                                            | 1          | 2           | 3           | 4               |
| increased mucus excretion from the lungs            | 1          | 2           | 3           | 4               |

**Interview**

**6. Do you experience any of these symptoms?**

| Condition                                           | not at all | in the warm | in the cold | during exercise |
|-----------------------------------------------------|------------|-------------|-------------|-----------------|
| Chest pain                                          | 1          | 2           | 3           | 4               |
| Cardiac arrhythmia                                   | 1          | 2           | 3           | 4               |

**Interview**

**7. Do you experience episodes of any of the following?**

| Condition                                           | not at all | in the warm | in the cold |
|-----------------------------------------------------|------------|-------------|-------------|
| Disturbances in peripheral circulation in the hands, or feet | 1          | 2           | 3           |
| Blurred vision                                       | 1          | 2           | 3           |
| Migraine-type headache                               | 1          | 2           | 3           |

**Interview**

**8. Are your fingers exceptionally sensitive to the cold?**

|  | 1 | no  |
|---|---|-----|
| 2 | yes |

**Interview**

**9. Do your fingers episodically change to any of these colours?**

| Colour          | not at all | in the warm | in the cold |
|-----------------|------------|-------------|-------------|
| White           | 1          | 2           | 3           |
| Blue            | 1          | 2           | 3           |
| Red/purple      | 1          | 2           | 3           |

**Interview**
### 10. Do you repeatedly experience any of these?

| Condition                                      | Not at all | Warm | Cold |
|------------------------------------------------|------------|------|------|
| Neck/shoulder, or upper extremity pain         | 1          | 2    | 3    |
| Back, or hip pain                              | 1          | 2    | 3    |
| Pain in the lower extremities                  | 1          | 2    | 3    |

**Interview**

### 11. Do you experience any other serious symptoms?

| Symptom                      | Warm | Cold |
|------------------------------|------|------|
| Yes, what symptom?          | 1    | 2    |
| Yes, what symptom?          | 1    | 2    |

**Interview**

### 12. Have you ever suffered frostbite of blister grade, or worse?

- 1: No
- 2: Once
- 3: Several times

**Interview**

### 13. How does cold affect the following aspects of your performance at work?

| Aspect                        | No Effect | Performance deteriorates because of cooling | Performance deteriorates because of symptoms | Improves |
|-------------------------------|-----------|---------------------------------------------|--------------------------------------------|----------|
| Concentration                 | 1         | 2                                           | 3                                          | 4        |
| Motivation                    | 1         | 2                                           | 3                                          | 4        |
| Manual strength               | 1         | 2                                           | 3                                          | 4        |
| Musculo-skeletal function      | 1         | 2                                           | 3                                          | 4        |
| Some other aspect, what?      | 1         | 2                                           | 3                                          | 4        |

**Interview**
DEVELOPMENT RESULTS

This kind of questionnaire is lacking in the literature. In this development project, the usability of the questionnaire was recognized in many activities of health care. It is a useful instrument for the assessment of the cold-related health status of an individual, by identifying his cold-related sensations, symptoms and performance limitations. This information may be utilised for the treatment and rehabilitation of persons having some cold-provoked sickness. It is also useful for preventive, or follow-up actions for persons persistently working, or spending their leisure time, outdoors in circumpolar countries. The results of the usability testing will be reported in another article.

It may be valuable to periodically repeat the medical screening for those who have a cold-related disease, or health or performance limitations. The content of the repeated evaluation depends on the type of ailment, or limitation, identified during the first screening. The detailed rules and routines for the medical services vary between the different countries.

The persons having cold-related health limitations need appropriate advice to protect themselves by means of both clothing and technical preventive measures. This type of information is available in, for example, Nordic guides for cold work (5-7). In other countries, a variety of relevant written information is produced for military purposes.

**Table I.** Types of second level interviews and clinical investigations, and their actors, for health assessment in cold work.

| Results from the health-check questionnaire | Nature of the second level action | Type of health care professional to undertake the action |
|--------------------------------------------|----------------------------------|--------------------------------------------------------|
| Nature of second level action               | Results from the health-check questionnaire |
| Interview of working ability                | Interview of working ability |
| Interview-vasocompression-atopia-allergy    | Interview-vasocompression-atopia-allergy |
| Disease-focused interview                   | Disease-focused interview |
| Further-work analysis                       | Further-work analysis |
| X                                          | X |
| X                                          | X |
| nurse                                      | nurse |
| Symptom of some disease in cold             | Symptom of some disease in cold |
| nurse and physician                        | nurse and physician |

DISCUSSION

It may be valuable to periodically repeat the medical screening for those who have a cold-related disease, or health or performance limitations. The content of the repeated evaluation depends on the type of ailment, or limitation, identified during the first screening. The detailed rules and routines for the medical services vary between the different countries.

The persons having cold-related health limitations need appropriate advice to protect themselves by means of both clothing and technical preventive measures. This type of information is available in, for example, Nordic guides for cold work (5-7). In other countries, a variety of relevant written information is produced for military purposes.
REFERENCES

1. Hassi J, Juopperi K, Remes J, Rintamäki H, Näyhä S. Cold exposure and cold related symptoms in adult Finns. Second International Conference on Human Environment System; 1998 Nov 30 - Dec 4; Yokohama, Japan.

2. Mäkinen TM, Hassi J, Päsche A, Abeysekera J, Holmer I. Project for developing a cold risk assessment and management strategy for workplaces in the Barents region. Int J Circumpolar Health 2002; 61(2): 136-141.

3. Risikko T, Mäkinen TM, Päsche A, Toivonen L, Hassi J. A model for managing cold-related health and safety risks at workplaces. Int J Circumpolar Health 2003; 62(2): 204-215.

4. Mäkinen TM, Hassi J. Usability of ISO thermal standards for cold risk assessment in the workplace. Int J Circumpolar Health 2002; 61(2):142-153.

5. Hassi J, Mäkinen TM, Holmér I, Päsche A, Risikko T, Toivonen L, Hurme M (eds.) (2002) Opas Kylmätyöön. Työterveyslaitos, Arbetslivsinstitutet, THELMA AS. 111 p.

6. Hassi J, Mäkinen TM, Holmér I, Päsche A, Risikko T, Toivonen L, Hurme M (eds.) (2002) Handbok för Arbete I Kyla. Työterveyslaitos, Arbetslivsinstitutet, THELMA AS. 111 p.

7. Hassi J, Mäkinen TM, Holmér I, Päsche A, Risikko T, Toivonen L, Hurme M (eds.) (2002) Håndbok for Arbeide I Kulde. Työterveyslaitos, Arbetslivsinstitutet, THELMA AS. 111 p.

Juhani Hassi,
Centre for Arctic Medicine, Thule Institute
P.O. Box 5000
FIN-90014 University of Oulu
Finland
Email: juhani.hassi@oulu.fi