

Design and trial of a new questionnaire for occupational health surveys in companies

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In this article we present an example of our method for instrument development. This method is called the Development Cycle. It consists of four main stages: (1) defining the requirements for an instrument; (2) research, design and pilot testing; (3) implementation and (4) evaluation. An application of the Development Cycle was realized within a project for the development of a basic questionnaire about work and health, to be used at periodic health surveys. This questionnaire had to identify work and work-related health problems in employees with divergent occupations and working conditions. The design of the instrument and the results of its trial in 517 employees is presented. The evaluation of the test results and the modification of the questionnaire are discussed. From 1995, the questionnaire has been implemented in the Dutch OHS services quite successfully.

Key words: Instrument development; periodic occupational health survey; questionnaire.

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INTRODUCTION

European Community directives,¹ tailor-made service demanding companies and a competitive European market for occupational health services are incentives for quality assurance of occupational health and safety services (OHS services). Simultaneously, the importance of quality assessment and improvement of instruments used by OHS services is growing rapidly.

In the Netherlands, the number of medical and technical experts involved in assessing health and working conditions and in the consultation of companies had increased considerably by the end of the 1980s. This increase did not automatically give rise to a higher quality of consultancy. There was a general lack of well-defined working methods, measurement procedures and consultation strategies. The few instruments available were based upon traditions, not on quality and effectiveness. Research into quality and effectiveness of OHS services instruments was absent. In response to this need, the Foundation for Quality in Occupational Health Care ('SKB') was founded in 1990 by five large and innovative OHS services with the support of scientific institutes. To date, it has developed into a research and

development centre for all OHS services. Its main task is the development of adequate methods and tools founded on scientific research, with the aim of achieving results which are closely attuned to the practical needs of OHS services, in terms of usability, reliability and validity. The role of the Foundation is initiation, co-ordination and organization of research and development projects. The main projects deal with instrument development, *e.g.*, company-intake surveys, software for the registration and analysis of absenteeism, workplace surveys and working procedures for periodic occupational health surveys.

The Foundation applies a standard development procedure. Development of a product or tool is seen as an ongoing process in which evaluation of the product by the users in the field will contribute to future revision and refinement. So the development process has a cyclic nature.

The four main stages in the Development Cycle were:

1. *Definition of the requirements.* The various parties who were to be involved in the development, use and evaluation of the method or tool were brought together. The first task was to discuss adequate objectives for the project. When the necessary agreements had been reached, a project team was formed with suitable field experts and experts from universities and other research institutions. This team had to define the exact nature of several questions that needed to be answered. What methods were already available? What information needed to be collected by means of the new method?

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2. *Research, design and pilot testing.* Research was directed at the content of the instrument. Necessary decisions were made about essential questions towards employees and management in relation to the validity of the information to be obtained. After research and consultation, a draft version of the tool and associated protocols could be completed and the design was made ready for pilot testing. Testing in a real working environment provides feedback on whether a prototype meets its functional specifications — whether it delivers reliable data of the kind required. The practical qualities of the tool and protocol, *e.g.*, clarity of instructions and questions, but also time and cost aspects, came under scrutiny. Where necessary, revision and repeated tests were conducted.

3. *Implementation.* This included: organizing production and maintenance of the tools; training and support of users of the method/tool in the OHS services; ensuring acceptance through management and employees of the user organizations (*i.e.*, the place of application) and preparation of information processing systems to receive and process the data generated.

4. *Evaluation.* Evaluation was conducted by monitoring the acceptability, functionality and validity of the methods and tools. Initially, formal criteria similar to those used in the pilot test formed the basis of evaluation. In the long-term, it will be possible to evaluate the effectiveness of the instrument, *e.g.*, whether it successfully contributes to reducing absenteeism.

For quality assessment of existing OHS services instruments, a basic scheme has been presented.² It distinguishes four stages of assessment:

1. Definition of measurement object and design of data collection;
2. Technical quality, including aspects like validity, reliability, standardization and precision;
3. Process quality, like acceptability for employees, employers and OHS services' experts. Does the instrument 'fit' easily within the organization and within the OHS service? and
4. Strategic quality: to what extent might the application of an instrument contribute to concrete measures and to a high quality company health policy?

In this article we present a description of a project in which the above-mentioned concepts were applied: the development of a basic questionnaire about work and health. The aim was the development of a uniform instrument for employees in divergent occupations and working conditions. We first discuss the strong and weak characteristics of questionnaire measurement in general and we then describe the development of the basic questionnaire, based on the Development Cycle. The outcome was assessed using the four stages summarized above. The questionnaire itself is shown in an appendix.

QUESTIONNAIRE MEASUREMENT IN GENERAL

In the literature much criticism is found concerning the use of questionnaires in assessing employees, especially as a method of measuring the psychosocial aspects of the work load.³ The main weakness of the questionnaire method is the fact that it is often doubtful to what extent an employee's subjective perception agrees with objective reality. However, this same circumstance is also a strong advantage. The questionnaire method is especially useful in assessing the people's subjective opinions. Measurement of experiences and emotions, like annoyance and complaints about work and health, can be carried out very well with questionnaires, for the simple reason that only introspection can trace them. In other cases, a problem can be identified by questionnaires in an early stage, before its 'objective' measurement is possible. Objective registrations, when possible, are often more expensive, complicated in practice, and not always more valid than the questionnaire method. Some authors recommend a combination of objective and subjective measurement methods. With regard to psychosocial working load, there is some evidence in a sense that a multitrait-multimethod approach can really improve the quality of a measurement.⁴

The aim of the periodic health surveys in the Netherlands is to obtain a broad picture of the perceived health and working conditions of employees. Not only are physical and psychosocial aspects of an employee's task, work load and working situation dealt with, but also their potential consequences like annoyance, health complaints and medical treatment.⁵

DEVELOPMENT AND TEST OF A BASIC HEALTH AND WORK QUESTIONNAIRE

Project definition

The project dealt with the development of a questionnaire for periodic occupational health surveys (POHS), with the aim of identifying work and work-related health problems. The method had to be applicable to employees in divergent occupations. Aggregation and processing of individual measurements to group data on different levels was an additional requirement.

Materials and methods

As the first step in the Development Cycle, the Foundation invited experts from practice and scientists to elaborate on the requirements for the desired instrument in more detail. In three workshops the experts and scientists came to a full agreement upon the fundamental characteristics of the questionnaire:

Structure of questionnaire. To achieve a more or less complete picture of all important aspects of work and health in any employee, a modular structure was proposed. It consisted of a basic questionnaire and one or more

work-specific additions, called 'modules'. The basic questionnaire was supposed to be used in all surveys. It consisted of a fixed set of questions dealing with work and health which aimed at describing the most important fields in a global way. The work-specific modules were meant to complete the basic questionnaire in a precise manner. For this reason, the basic questionnaire should not to be considered a complete questionnaire on its own, but should always be administered in combination with a work-specific module.

Nature of questions. The questions were to be formulated clearly and concisely. To facilitate the processing of separate questions into group data, a dichotomous answering pattern of only 'yes' and 'no' answers was favoured in the design. For the same reason, conditional questions ('if, so, etc.') were avoided.

Contents of questions. With regard to the health questions, the main aim was not to facilitate a differential medical diagnosis in individual employees, but to identify work-related health complaints in groups of employees. Health complaints are primarily studied as possible effects of risk factors at work. The relationship between work and health complaints was to be revealed more explicitly by a number of selected questions, *e.g.*, those about skin, airways and locomotor apparatus.

The questions about work were designed to deal with a broad spectrum of risk and loading factors and opportunities for employees to influence those factors. Appropriate attention was paid to the load of the locomotor apparatus, especially through working posture and repetitive movements. In psychosocial factors, two main fields were distinguished: the cognitive/perceptive load (*e.g.*, during information and decision-making processes) and the emotional/psychosocial load (*e.g.*, during contact with aggressive clients).

Draft of the test version and the practical test

In the second step of the Development Cycle a draft or test version of the basic questionnaire was constructed, based upon the above-defined requirements and experiences with a diverse number of current questionnaires. The test version contained 114 items: 48 about health and 66 about work and working conditions. All response options were of a dichotomous nature.

Six OHS services participated in the trial. Each of them selected a pilot employee group. These six pilot groups were: 37 train ticket sellers, 81 hospital cooks, 44 truck drivers, 27 operators in the chemical industry, 83 software engineers and 206 high school teachers. All of them were administered the test version of the basic questionnaire and additional group-specific questions, in the context of a health survey. Data collection and health examination were carried out by the OHS service in accordance with a test protocol.

The questionnaire data and a number of selected personal and work variables were stored in the computer by means of a special data entry program. The OHS services sent the data on disk to the Foundation.

Immediately after the data collection phase, nine experts from the six participating OHS services were interviewed: seven physicians and two nurses. The interviews were recorded on tape.

Test results

We studied four categories of results, which could offer considerations for modification of the questionnaire: (1) prevalences of positive signals per item; (2) prevalences of missing answers per item; (3) opinions and comments from the employees and (4) opinions and comments of the experts from the OHS services.

Prevalences of positive signals per item. Two criteria were stated for the selection of items with a low yield:

- A prevalence of positive signals in the whole test group less than 5%.
- A prevalence of positive signals less than 5% in at least four out of six employee groups.

Consequently, many items dealing with medical treatment in the past five years were selected by these criteria, including the item about cutaneous allergic reactions from specific materials. These items were omitted in the definitive version.

Prevalences of missing answers per item. According to the test protocol, questions not answered by the employee had to be marked by the OHS service personnel, and presented to the employee a second time. This rule was followed in five out of six participating OHS services. The prevalences of several types of missing answers are presented in Table 1.

The work questions were less likely to be answered than the health questions. This was also seen after the second presentation to the employee. Apparently some employees did not believe that their complaints about work would receive confidential treatment. In particular, questions about management, organization and job certainty were often unanswered.

Unanswered questions were not automatically considered as negative answers (*i.e.*, no signal function). However, in most questions, the low proportions of missing answers did not have a significant influence on the prevalences of positive answers (signals). Nevertheless, the amount of unanswered questions can be reduced considerably by means of a second presentation to the employee.

Opinions and comments about the questionnaire from the employees. The test version of the basic questionnaire proved to be a practicable and acceptable instrument in this project. Almost 98% of the questions were answered at the first presentation to the employees and 95% of the employees understood the questions. Nevertheless, the choice between a 'no' and a 'yes' answer was difficult for many people. This problem could be solved *via* suitable instructions.

Table 1. Numbers and percentages of missing answers; data from 272 questionnaires from five OHS services

	Health questions	Work questions	Total
1. Number of questions	13,056	17,952	31,008
2. Primarily not answered (% of 1)	200 (1.5%)	517 (2.9%)	717 (2.3%)
3. Noticed (% of 2)	146 (73%)	404 (78%)	550 (77%)
4. Answered later (% of 3)	128 (88%)	290 (72%)	418 (76%)
5. Signalling (% of 4)	44 (34%)	133 (46%)	177 (42%)

Notes: From the total number of questions (1), a small part (2) had not been answered after the first presentation of the questionnaire to the employee. Most unanswered questions (3) were noticed by OHS personnel. The large majority (4) of those noticed unanswered questions were completed at a second presentation to the employee. (5) Indicates the number (proportion) of those later answered questions that proved to be signalling.

Opinions and comments about the questionnaire of experts in OHS services. The experts were also generally satisfied, especially as far as work questions were concerned. In the health questions, some issues are missed. Most of the experts intend to use the basic questionnaire for their own practical work.

Redesign

Decisions about maintenance, skipping or changing items were made on the basis of the results and the importance of individual items.

The prevalence of missing answers was generally very low. No questions were skipped merely because of a high prevalence of missing answers.

The following types of recommendations were formulated:

- maintaining a question;
- skipping a question;
- reformulating a question;
- adding one or more questions;
- changing the instruction for completion;
- changing the layout of the questionnaire and
- other recommendations (combining questions, changing the order of the questions, etc.).

Comparison of test version and modified version

The test version contained 114 questions (48 about health and 66 about work). The redesigned version contains 122 questions (53 about health including four 'open' questions, and 69 about work including two 'open' questions). The 'open' questions have been included as an alternative for those employees having problems with

the dichotomous answering structure. Some questions have been removed from the test version and some questions have been added in the working version, *e.g.*, questions about undesired (sexual) approaches by colleagues at the workplace.

DISCUSSION

The prevalences of positive answers in particular and — to a lesser extent — the opinions of OHS services' experts were the reasons for recommendations other than maintenance. We then assessed the quality of the redesigned working version of the basic questionnaire by means of a four-stage quality assessment.

Definition of measurement object and design of data collection

This stage was completed as well as possible for a broad spectrum instrument. A protocol for the application of the basic questionnaire and the work-specific modules was also available for OHS services.

Technical quality, including aspects like validity, reliability, standardization and precision

Much work remains to be done on these areas. The protocol was supposed to contribute to standardization in OHS service practice. Most aspects will only be able to be assessed in the coming years, after implementation of the instrument on a large scale.

Process quality (acceptability for employees, employers and OHS services' experts)

Does the instrument 'fit' within the organization, and also within the OHS services using it? The answer to this question is 'probably yes', judging by the opinions of employees and experts during the test.

Strategic quality

To what extent can the application of an instrument contribute to high quality company measures and health policy? This question into the potential contribution of the instrument towards efficacy depends upon the goals set for POHS in general, and also upon socio-economic circumstances. It also demands that a time structure during which efficacy is measured be clearly defined. Follow-up studies into the process of policy adaptation, actions and interventions within companies based upon outcomes of signalling instruments like the basic questionnaire and the work-specific modules are of utmost importance.

FOLLOW-UP

Since 1995, the redesigned basic questionnaire has been implemented in Dutch OHS service practice: the third

step of the Development Cycle. More than 150,000 basic questionnaires have been filled in by Dutch employees in the last three years. In this stage, information processing systems are brought within the scope of the OHS services. A form of centrally organized service for data processing and analysis has been realized. The policy of the Foundation is to maintain the current version in an unchanged format for about three years. This period is long enough to collect field experience with the instrument, and to carry out a validation study. After this period, an evaluation (the fourth step of the Development Cycle) will be possible, giving rise to an update based on experiences from practice, the results of the validation study and the stage of development of the work-specific modules.

REFERENCES

1. Council of the European Communities. Council Directive. Publications of the European Communities No. L 183, 1989. (89/391/EEG).
2. Dijk FJH van, Kort WLAM de, Verbeek JHAM. Quality assessment of occupational health services instruments. *Occup Med* 1993; 43(Suppl 1): S28-S33.
3. Kasl SV. Epidemiological contributions to the study of work stress. In: Cooper CL, Payne R, eds. *Stress at Work*. New York, NY (USA): Wiley, 1978.
4. Zapf D. *Selbst- und Fremdbeobachtung in der psychologischen Arbeitsanalyse*. Göttingen: Dr C. J. Hogrefe — Verlag für Psychologie, 1989.
5. Broersen JPJ, Dijk FJH van, Weel ANH, Verbeek JHAM. The atlas of health and working conditions by occupation. 1. Occupational ranking lists and occupational profiles from periodical occupational health survey data. *Int Arch Occup Environ Health* 1995; 67: 325-335.

APPENDIX. OCCUPATIONAL HEALTH QUESTIONNAIRE/BASICS

Questions about your health situation

General

Are you often tired?

Are you often sleepy or listless?

Do you sleep badly?

Do you often feel you can't cope?

Do you suffer from nerves?

Do you regularly suffer from headaches?

Do you regularly have problems concentrating?

Do you regularly have difficulty remembering things?

Do you regularly have stomach or digestive problems?

Do you sometimes have aches and pains or a tight feeling in the chest or around the heart?

Do you have problems with your vision (even when wearing contact lenses or glasses)?

Do you regularly suffer from tired or irritated eyes?

Do you have difficulty hearing?

Are you often hoarse?

Do you regularly suffer from nose complaints (blocked nose, runny nose or sneezing fits)?

Do you regularly suffer from respiratory problems (coughing, wheezing, or breathing difficulties)?

Do you usually suffer from being out of breath when making physical efforts?

Do you regularly suffer from dry skin or from skin rashes?

Is your skin over-sensitive to certain substances or materials?

Posture and movement

Do you regularly have pain, or do you feel stiff:

- in your shoulder, arm or hand;
- in your hip, leg or foot;
- in your neck;

- at the small of your back;
- either in the middle or top of your back

Do you have any other symptoms which are not covered by these questions?

If so, which?

Are the symptoms you have indicated possibly due to your work?

If so, are these symptoms caused or made worse by your work?

If so, which symptoms?

Do these symptoms trouble you while you are working?

If so, which symptoms?

Treatments

Have you been treated during the last five years for one or more of the following illnesses or ailments (*e.g.*, medication, operations, diet, prescribed rest, radiation treatment, massage or changing your lifestyle)?

- Diabetes
- High blood pressure
- Cardiovascular disease
- Nervous tension
- Epilepsy
- Insomnia
- Skin diseases
- Bronchitis (or asthma)
- Muscular problems or those of the joints
- Long-term neck or back complaints
- Stomach complaints
- Industrial accident(s)
- Serious accident(s) other than industrial accident(s)

What ailments are you currently being treated for?

Do you sometimes use medication (not including birth control pills)?

Lifestyle

Do you, in your leisure time, regularly play sports which require you to make a physical effort?

Do you limit your intake of fats in your diet?

Do you usually take your time eating?

Do you smoke?

Do you smoke more than 20 cigarettes or roll-ups or cigars per day?

Do you drink alcohol?

Do you drink more than 25 glasses of alcohol per week?

Questions about your work

Physical strain

Do you think that your work is highly physical?

During your work, do you experience inconvenience by:

- Lengthy sitting
- Lengthy standing
- Lifting or carrying
- Lengthy periods of working in the same physical position
- Bending down regularly
- Reaching up high regularly
- Lengthy periods of repetitive movements

Psychological stress

Do you think that your work requires a lot of thinking?

Do you often think your work is too difficult?

Do you need to spend a lot of time at work being alert?

Do you think your work is an emotional strain, for example due to working with patients, customers or pupils?

Do you regularly have to work with a deadline?

Does your work regularly pile up?

Job content

Do you usually find your work as engrossing?

Do you have enough variation in your work?

Do you usually think that your work is too simple?

Do you have work which suits you?

Do you usually enjoy your work?

Do you often have to do something which isn't really part of your job?

Do you know what is and what isn't your responsibility at work?

Factors at the workplace

During work, do you suffer from too much noise?

Do you regularly have to raise your voice at work in order to be heard?

Do you suffer from the effects of (mechanical) vibrations or shocks during working hours?

Do you suffer a lot during work from:

- the cold
- the heat
- changes of temperature
- draught
- dry air
- damp air
- lack of fresh air
- light and/or lighting
- stench
- dust
- smoke
- vapour, gas, emissions

Safety

In your department, are there sometimes accidents or near misses? (*e.g.*, cuts, burns, slipping or stumbling over loose objects?)

In your department, is enough attention paid to preventing accidents?

Have sufficient measures been taken to prevent and extinguish fires or deal with other calamities?

Management and colleagues

Is work usually well organized?

Do you work under good, direct supervision?

Do your supervisors have sufficient consideration for what you say?

Are you frequently irritated by others at work?

Do you think that the atmosphere at work is good?

Are you able to meet with colleagues on a frequent enough basis to discuss your work?

Are you kept well-informed about the goals and the results of your work?

Do you have sufficient contact with colleagues as part of your work?

Is your work made more difficult due to other people being absent?

Do you regularly suffer at work as a result of someone not doing their job properly?

Work relations

Do you sometimes feel threatened at work in contacts with customers, patients or pupils?

Do you sometimes feel threatened by remarks or the behaviour of colleagues or management?

Are you sometimes irritated at work by the way in which women or men are being touched?

Are you sometimes irritated by intimidating comments in your department?

Other questions

Does this job offer you sufficient security?

Do you have good prospects with this employer?

Do you feel sufficiently appreciated in this company?

Do you think that your wages are commensurate with your work?

Do you have fixed working hours?

Do you have fixed breaks during working hours?

Can you usually manage to get a day off easily?

Can you take a break when you need to?

Can you determine your own working methods?

Do you have sufficient opportunities at work to expand your knowledge and your experience?

Are there sufficient opportunities to gain further training?

Does your private life suffer due to irregular working hours (shifts, nights, or overtime)?

Do you suffer from anything in your work situation which has not been covered above?

If so, what?

Do you think that your work or working conditions need to be improved?

If so, which suggestions would you like to make?