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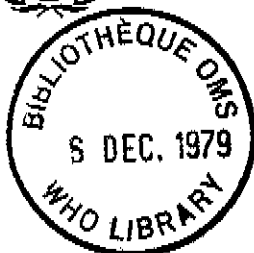
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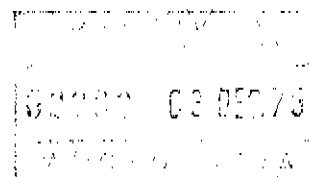
ORGANISATION MONDIALE DE LA SANTÉ
BUREAU RÉGIONAL DE L'EUROPE

ВСЕМИРНАЯ ОРГАНИЗАЦИЯ ЗДРАВООХРАНЕНИЯ
ЕВРОПЕЙСКОЕ РЕГИОНАЛЬНОЕ БЮРО

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EPIDEMIOLOGY OF OCCUPATIONAL HEALTH

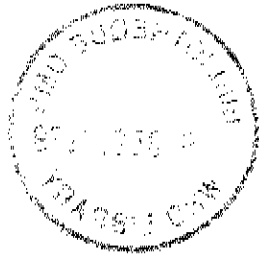
Report on a Consultation Meeting

Copenhagen
10-12 July 1979

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1. Introduction

A consultation meeting was convened by the WHO Regional Office for Europe, in cooperation with WHO headquarters, to discuss epidemiology in occupational health, with special reference to the preparation of an outline for a manual. The meeting was opened by Dr J. Asvall (Director, Programme Management), who referred to resolution WHA 30.47 concerning the evaluation of the effects of chemicals on health and stressed the lack of epidemiological studies in that connexion. In particular, the biological effects of occupational hazards at low level during long periods of exposure call for studies of that nature.

The Regional Office is therefore attempting to stimulate the application of epidemiological methods in occupational health at the regional level, just as headquarters does on a global scale. During 1975-77, courses were held on this subject in three of the working languages of the WHO European Region. In 1978 a Consultation Meeting evaluated the courses and concluded that the further unification of epidemiological methods could be promoted by publications in this field.

The Regional Office, in collaboration with the Office of Occupational Health, WHO headquarters, is therefore planning a methodological publication on occupational health epidemiology. The purpose of this meeting was to discuss the scope of epidemiology in occupational health in order to identify the most important topics which should be included in such a manual on occupational health epidemiology.

Five temporary advisers participated. Professor Karvonen was elected Chairman and Professor Forssman acted as Rapporteur (see Annex).

The Regional Office initiated a study on the epidemiology of industrial intoxication in some European countries in 1970¹. The study showed there is a great need for standardization of methods in order to be able to compare the results of studies in different countries. There is also a great need for more knowledge on the design of epidemiological studies within occupational health. Consequently, the Regional Office organized in 1975-77 three courses in epidemiology, the first two on industrial toxicology and the third on general occupational health. The courses were held in English (in Helsinki, 1975), in Russian (Moscow, 1976), and in French (Paris, 1977). The papers at the French course were edited and published². A Consultation Meeting was organized in 1978 to evaluate these courses.³ The meeting recommended that fellowships should be awarded for studies in this field, that workshops should be organized, that courses for health professionals and for people outside the health sector should be organized, and finally, that WHO should support the development of monographs or manuals to meet the great need for practical literature in this field.

2. Scope and purpose of the meeting

Epidemiological methods are used for the assessment of health risks arising from exposure to occupational hazards. They give valuable information for the evaluation of occupational hazards and for determining permissible levels of chemical and physical factors in the work environment.

In order to further the use of a common methodology and to promote comparability of results in epidemiological studies on occupational exposure, a manual on occupational health epidemiology is to be published by the WHO Regional Office for Europe.

¹WHO Regional Office for Europe. Epidemiology of intoxications in industry; report on a study. Copenhagen, 1971 (document EURO 7901)

²Lazar, P., ed. Pathologie industrielle, Approche épidémiologique

³WHO Regional Office for Europe. The evaluation of courses on epidemiology of intoxications in industry; report on a Consultation Meeting. Copenhagen, 1979 (document ICP/WKH 001)

The purpose of the meeting was to determine the contents of the planned manual and choose the authors.

3. The application of epidemiology in occupational health

Epidemiology is becoming more and more important for the assessment of occupational exposure to hazards. Epidemiological analyses provide valuable information on the inter-relationships between occupational hazards and their effects on the human organism.

The biological effects of exposure to occupational hazards at low levels and over a long period of time, and the maximum concentrations at which harmful substances or other factors cause no damage, even over a long period of time, are the main requirements in assessing the health risks of occupational exposure. Accordingly, a determination of the effects of long-term exposure to low-intensity occupational hazards will call for the application of modern epidemiological methodology. Knowledge from epidemiological studies is also necessary in order to define or revise permissible occupational exposure limits and to control occupational hazards in working places.

The quality of the epidemiological studies recently performed varies considerably. The most serious shortcomings are usually in the study design, poor sampling, poor standardization of methods, etc. Lack of comparability and of standardization of epidemiological methods may yield contradictory results.

Epidemiology can be used within occupational health in different ways, for instance, to detect early deviations from health, to ascertain occupational health hazards, to evaluate occupational health services and to define factors at work or in the work environment that promote health and wellbeing. The records of occupational health services can be used for epidemiological studies, for instance, changes in morbidity or sickness absence may reveal unknown occupational health factors. Such studies may contribute to the better planning of preventive measures.

4. Provisional outlines of the manual on epidemiology in occupational health

There is a great need for a manual on epidemiology in occupational health which will provide practical information on designing studies and evaluating results. The planning of this manual is being coordinated with the programme of WHO headquarters¹, which is preparing a monograph on epidemiological methods for environmental health studies. Concerning basic concepts of general epidemiology, the reader will be referred to the usual text books on epidemiology as well as the above-mentioned monograph. This manual will therefore not deal with general epidemiology but will concentrate on the special problems of the application of epidemiology in occupational health.

The aim of the manual is to develop knowledge and experience in this field, especially among staff of occupational health services, to promote preventive work within occupational health services, to assess health problems at places of work, to assist in evaluating the need for preventive measures and to establish priorities. The manual will also be of value to scientific institutes in their attempts to evaluate standards of occupational health. As for the staff of occupational health services, it will increase their understanding of the principles of epidemiology and make it possible for them to use their own data in a more efficient way by means of epidemiological studies.

In the following, an outline for a nine-chapter manual on occupational health epidemiology is presented. After an introduction, the nature and classification of occupational health factors and the sources of data are described. The different methods for epidemiological studies are then presented and for each method the following aspects are considered:

¹WHO/HQ CEP 76.2 Epidemiological Methods for the Assessment of the effects of Environmental Agents on Human Health with special reference to environmental health criteria, Geneva, 7-13 October 1975

- (a) aims and tasks
- (b) design of study
- (c) standardization of methods
- (d) plan of the study, implementation of the study, strategy
- (e) evaluation of results
- (f) practical examples.

Chapter I - Introduction

The purpose of this manual is to provide information on epidemiological methods applied to occupational health and to be used mainly by occupational health services.

The general definition of epidemiology should be explained.

The scope of epidemiology in occupational health will be not only to define occupational health hazards and to detect occupational diseases and deviations from health related to work or the work environment, but also to detect and prevent accidents and to identify factors promoting health.

Specific characteristics of occupational health epidemiology

It is possible to define health risks, to determine causes of diseases, and to describe the relationship between occupational exposure and its effects. It is also possible to evaluate the efficiency of preventive methods and of occupational health services as a whole.

Needs and present situation of epidemiology in occupational health

Epidemiology will be of value in detecting, defining and controlling occupational health hazards, detecting impairments of health related to the work environment and also in detecting the effects of health factors.

The present situation of epidemiology in occupational health is that a great deal of material is available from health examinations as well as from industrial hygiene surveys, measurements of exposure to dust, gas, noise, vibration etc., but is often not used properly.

The application of epidemiology should promote preventive activities within occupational health services.

Multifactorial causes

The combined effects of many factors related to work and the work environment should be emphasized. The mental and physical workload as well as exposure to environmental factors may cause or contribute to diseases. Early detection may be possible if epidemiological methods are applied.

Definition of different types of epidemiology

The various types of epidemiology include;

- descriptive epidemiology
- case-control study
- cohort study
- cross-sectional and cross-longitudinal study.

The different health effects from work include occupational diseases, work-related diseases and accidents. There are, however, also the positive aspects of work in promoting physical and mental health.

Chapter II

Nature and classification of occupational health factors

It is essential to have a broad concept of occupational health, covering all health factors at work and considering the total health of the workers. Monitoring of health and exposure levels should be carried out.

Occupational health hazards or factors may be divided into physical, chemical, biological and psychosocial factors. In addition, the safety factor should be considered. All these factors can be measured in respect of their concentration, intensity and period of exposure.

The exposure-response-effect relationship can be established. It is important to quantify the risks and to establish the levels of exposure at which adverse health effects will occur and the levels at which there are no adverse effects.

As the degree of exposure is being reduced in many countries by the introduction of preventive measures, improvements in the work environment and job adjustment, the personal factors determining individual resistance will gradually become more important.

The effects of work in promoting health through increased physical working capacity, work performance, and job satisfaction should be considered.

There are many negative and positive health factors at work that may interact. The interaction and the combined effects should be described. Either the effect on individuals or the group response may be studied with the aid of epidemiology.

Chapter III

Sources of data

Many data collected for other purposes are available and can be used for epidemiological studies. They include:

- (1) official statistics on mortality, morbidity and occupational diseases;
- (2) trade union records or other records concerning occupational groups;
- (3) records of firms or other places of employment;
- (4) records of occupational health services.

There are many records on pre-employment and periodic health examinations, on treatment and on sickness absence, as well as records on exposure to dust, gases, noise etc., which are usually not used for epidemiological surveys but which could be used and be of great value. The types of records to be kept by occupational health services should be described. Routine record-keeping of health and exposure should be promoted.

Chapter IV

Methods to detect adverse effects of occupational health factors

1. Descriptive epidemiology

The methods aimed at describing situations relating to health morbidity, sickness absence, job adjustment, etc., at different places, at different times and for different groups of persons. The advantages and limitations of the descriptive methods should be emphasized.

Descriptive epidemiology is the basic activity of epidemiology within occupational health. This is usually the first stage, which can then be developed into a cross-sectional case-control or cohort study or an experimental epidemiological study.

2. Cross-sectional studies

2.1 Aims and tasks

A critical review of the studies should be given and reference made to their positive and negative aspects, advantages and limitations.

2.2 Design of study

2.3 Standardization of methods

2.4 Implementation of the study, and strategy, with practical examples

2.5 Evaluation of results

3. Case-control studies

3.1 Aim and tasks

The aim is to carry out tests and form hypotheses on the etiology of specific occupational or work-related diseases.

3.2 Design of study

It is normal to start with a number of cases as the basis for hypotheses. The collected cases should be matched with controls. The usual way is to find matched pairs according to sex, age, smoking habits, etc.

A high lapse-rate should be avoided. The investigator should not know who are the subjects and who are controls when he puts the questions to them.

3.3 Standardization of methods

The same questions should be put to both patients and controls.

3.4 Implementation of the study

3.5 Evaluation of results

This method is useful for studying a well differentiated disease that is rare among the general population; examples are the studies on mesothelioma and asbestos, or angiosarcoma and vinyl chloride. It may be useful to study two factors at the same time, such as asbestos and smoking. Case-control studies are useful for detecting long-term effects, e.g. with regard to carcinogenicity and mutagenicity.

4. Cohort studies

4.1 Aims and tasks

4.2 Design of study

4.3 Standardization of methods

4.4 Implementation of the study, and strategy, with practical examples

4.5 Evaluation of results

The principle is to study an occupational group exposed to a risk factor and compare it with the general population not exposed to this risk factor. The study will usually take several years and is useful for studying long-term effects.

The advantages of this method are that one can study a well-defined risk factor, or several risk factors at the same time, and that one observes the same individuals over a long period. This method is especially useful for occupational health as the cohort, the working population under observation by the occupational health services, is already available. This method is useful for studying occupational diseases as well as work-related diseases. As an example the study on air traffic controllers and hypertension can be mentioned.

The disadvantages of this method are that it is not possible to study rare symptoms or rare diseases, that the study will take a long time and that it is expensive.

5. Experimental epidemiology

5.1 Aims and tasks

The role of experiments in biological research should be considered, together with their advantages and limitations, especially with regard to experiments with humans. The aims of these studies are to prevent diseases, to study etiology for preventive purposes and to assess the efficiency of preventive measures.

5.2 Design of study

There is usually a need for pilot studies. Intervention may be directed to the human being (the worker), the work involved or to the interaction between work and man. One should use "natural" experiments such as major changes in production for studies on experimental epidemiology.

5.3 Standardization of methods

This is a kind of cohort study. The population under observation may change during the observation time as some older workers will leave the group. It may be necessary to use dynamic cohorts. The exposure should be evaluated. Ways in which the work environment has been improved through intervention should be studied; the results should be studied in relation to a series of end-points.

5.4 Implementation of the study

The effect of an intervention should be determined by means of measurements before and after it takes place. Baselines should therefore be established for exposure and workload on the one hand and health and physiological functions on the other.

5.5 Evaluation of results

The effects on health after intervention should be studied, e.g. the effects on morbidity or sickness absence; there should be an interdisciplinary approach to this study.

By way of examples, one may mention the study on the effect of respirable or total cotton dust, or the use of occupational health services to study public health problems such as the effect of influenza vaccinations on an industrial population or the application of preventive measures against cardiovascular diseases in an industrial population.

Chapter V

Evaluation of long-term effects

It is important to use epidemiological methods to study specific long-term effects such as cancerogenic, teratogenic and mutagenic effects.

1. Evaluation of the carcinogenic effect of occupational hazards
2. Evaluation of the effects of occupational hazards on reproduction
 - 2.1 Genetic effects of occupational hazards
 - 2.2 Evaluation of the gonadotoxic effect of occupational hazards
 - 2.3 Evaluation of the embryo toxic effect of occupational hazards
 - 2.4 Evaluation of the effect of occupational hazards on development in succeeding generations

Chapter VI

Accident epidemiology

Occupational accidents are important effects of occupational hazards. Epidemiological methods can be used to detect multifactorial causes of accidents and to improve preventive measures.

Chapter VII

Nine ways of using epidemiology in occupational health

Experience has shown that epidemiology can be used in studying at least nine different fields within occupational health:

- (1) identification of risks
- (2) determining etiological factors of disease
- (3) establishing and revising threshold limit values (TLVs)
- (4) evaluating preventive measures
- (5) establishing priorities
- (6) determining normal values
- (7) identifying health-promoting factors
- (8) evaluating health services in work places
- (9) studying community health problems.

Practical examples of all nine ways should be given.

Chapter VIII

Work as a health-promoting factor

The aim should be to verify the hypothesis that health-promoting factors, not only negative factors, are involved in work.

There are very few studies on the subject, mainly due to the absence of methods for measuring positive health. There are, however, many methods for measuring deviation from health, such as studies on mortality, morbidity, incidence of symptoms, sickness, biological effects of exposure, etc. It is therefore important to develop new methods for measuring the positive aspects of work on health.

As examples of factors at work promoting health, mention could be made of the use of work for the rehabilitation of temporarily or permanently disabled persons. It may also be possible to study individuals who have a low rate of sickness absence. It would also be of interest to study motivations and incentives for work, job satisfaction, situations where retired workers stay on voluntarily at work full-time or part-time and when interventions in the work setting reduce sickness absence and labour turnover and increase job satisfaction and performance, e.g. when ergonomics is applied. It should, however, be emphasized that there are many possibilities of error when studying subjective feelings towards work such as job satisfaction or motivation.

It is possible to use cohort studies or experimental epidemiological studies for this purpose.

Chapter IX

Conclusions.

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