PROGRESS IN OCCUPATIONAL EPIDEMIOLOGY

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PREFACE

This proceedings volume is devoted to papers presented at the Sixth Symposium of the Scientific Committee on Epidemiology in Occupational Health of the International Commission on Occupational Health. The Symposium was held at the Foresta Conference Center, Lidingö, Sweden, August 16–18, 1988 and followed by Workshops at the National Institute of Occupational Health, Solna, Sweden, August 19, 1988.

The *International Commission on Occupational Health (ICOH)* is a multidisciplinary organisation to foster scientific progress, knowledge, and development of occupational health and related subjects on an international basis. The commission was founded in 1906 and has presently ca 2,000 elected members from altogether 75 countries. Regular meetings of the *ICOH*, called *International Congress on Occupational Health*, are held every three years.

The activities within the *ICOH* is organized in a number of scientific committees. The *Scientific Committee on Epidemiology in Occupational Health* was formed in 1980 and its 27 members represent altogether 15 countries from several continents. A Symposium is held each year, except for the year of the *ICOH* triennial congress, with the purpose of bringing together active research workers in occupational epidemiology to discuss methodology, findings, and applications of their work. It has become an important forum for exchanging experiences in the field of occupational epidemiology. The previous symposiums were held in Helsinki, Finland (1980), Montreal, Canada (1982), Singapore (1983), Como, Italy (1985), and Los Angeles, USA (1986).

The 1988 Symposium was organized by the National Institute of Occupational Health in Sweden. The Symposium Planning Committee consisted of professor Anders Ahlbom, National Institute of Environmental Medicine, Stockholm, Sweden, professor Irma Åstrand, National Institute of Occupational Health, Solna, Sweden, professor Olav Axelson, University of Linköping, Sweden, professor Sven Hernberg, Institute of Occupational Health, Helsinki, Finland, (president of the *ICOH*), professor Christer Hogstedt, Karolinska Hospital and National Institute of Occupational Health, Solna, Sweden (chairman), doctor Christina Reuterwall, National Institute of Occupational Health, Solna, Sweden (secretary), and professor David Wegman, University of Lowell, USA. The Planning Committee reviewed all originally submitted abstracts and planned the symposium.

We want to express our great appreciation to the planning committee, to the invited lecturers, to the chairmen of the different sessions, and to all the participants who presented papers and contributed in the discussions, for making the Sixth International Symposium on Epidemiology in Occupational Health a scientifically very rewarding meeting. We also want to express our sincere gratitude to the *Swedish Work Environment Fund* and the *Folksam Insurance Group*, for generously supporting the

Symposium financially. Finally, we are indebted to all the authors who undertook the work of preparing manuscripts for this proceedings volume, thereby contributing to a wide covering summary of current occupational epidemiology research, which hopefully will further stimulate the interest for occupational epidemiology.

All authors, whose abstracts were accepted for presentation at the Symposium, were invited to prepare manuscripts for this proceedings volume. In the interest of rapid publication, no editing of these manuscripts has been undertaken. The papers are grouped into the different themes of the Symposium and ordered alphabetically, by the presenting author, within each theme.

Christer Hogstedt **Christina Reuterwall**

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LECTURES

Progress in occupational epidemiology.
C. Hogstedt, C. Reuterwall, editors

EPIDEMIOLOGY IN THE INVESTIGATION OF HEALTH EFFECTS OF MAN-MADE DISASTERS

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HISTORICAL BACKGROUND

Disasters have been a faithful, if unpleasant, companion of man throughout history. Quite soon it became apparent that disasters stemmed not only from unpredictable natural events, but also from man's activities. In our century the principal types of man-made disasters have been caused by wars, transport, and industrial activities. Our focus is on industrial disasters. At first they mainly affected people engaged in specific occupations (e.g.,miners), but later, particularly after World War II, with the rapid growth of the chemical industry and the use of nuclear power, the effects of industrial disasters increasingly affected the general environment. The first disaster of this type for which I have found documentation goes back to the 17th century. The factory in question produced "sublimate". Epidemiology, although at a rudimental stage, even then proved to be the right tool to document the impact of pollution on population's health, the characteristics of illnesses due to exposure, and to indicate the necessary prevention measures. However, the epidemiological data was not deemed sufficient in court and the factory owner won the case which had been instituded by the community (1).

DESCRIPTIVE DATA

Accidents with an off-site impact occurring in recent years have been collected in data bases; in one of these are over 3,000 records concerning 95 countries (2). The frequency distribution of accidents ranks Western countries in first place. The ranking is obviously affected by the availability of information; however, India is in sixth place, and marks the growing problem due to the transfer to developing nations of hazard prone technology, which is banned in developed nations.

Nowadays, the most wide-spread and dangerous type of disaster is due to the release of toxic substances in the environment. This can happen in a sudden, explosive way (e.g., Seveso, Bhopal, Chernobyl) (3,4,5), but also in a diluted way through industrial emissions (Minamata) (6), or waste sites (Love Canal) (7). Current accidents often have a transnational character, whether it be the effects (Schweizerhalle, Chernobyl) or the causes (Bhopal) (8).

OBJECTS OF EPIDEMIOLOGICAL INVESTIGATION

In a disaster setting epidemiology is concerned with 1- descriptive relations of illness occurrence with the accident, and 2- causal occurrence relations. The former enable us to ascertain the impact of the accident on the population's health, to undertake medical surveillance of stricken subjects, to allocate pertinent services, etc. This information can be important also for compensation purposes and can serve for preparedness in case of other similar accidents. Relations of the causal type allow, in addition, responses to more general scientific questions, using the accident and the population struck as a "natural" experimental context. The study of these relations, moreover, furnishes the bases for primary preventive action. The two study objectives are not mutually exclusive, yet they must be kept distinct because each has specific requirements in the study plan. Thus, for example, to bring to light a causal relation, it is necessary to take into account all the potential confounders, whereas it is not necessarily so in the case of descriptive relations.

ASPECTS OF STUDY DESIGN

The plan for an epidemiological investigation of a disaster rests on the careful consideration of the following elements: the two basic components of the relation at issue (illness determinants and outcomes); the population experience (subjects and duration of the observation); the strategy for information acquisition and study conduct.

Illness determinants

Nature of the release. The principle determinants are tied to the nature of

the accident. What was the exposure? The answer is not always simple,even in the case of overt disasters as, for example, in Bhopal (9). The characteristics of the agent are very important, in particular those which determine the environmental fate and the toxic properties for man. The context in which the accident occurred is often much more important than the total quantity of the substance released. Group exposure can be determined with environmental indicators (soil, vegetation, animals, air, water). In regard to individuals, relevant information can derive from place of residence, eating habits (food chain exposure), the presence of early signs or symptoms of contact with toxic agents (e.g., chloracne), etc. The possibility of collecting samples of biological materials (fat, blood, urine, etc.) should also be considered for the identification of specific markers which can be used even at a later time.

Disaster experience. A second set of determinant factors is linked to the disastrous or catastrophic nature of the event as experienced by the population. It has been proposed (10) to incorporate into two categories the risk factors pertaining to the disaster associated stress: objective losses/experience; perception/evaluation of the disaster. Both are present in any type of disaster, although with varying intensity. Industrial disasters often result in a high perceived risk, even though objective losses are little. In Seveso, for instance, five major components of the disaster stressful experience can be single out: uncertainty about the nature of the contaminant and its late-appearing effects; housing and job insecurity; social rejection as if people from the area might carry some mysterious contagion; media siege; cultural pressure regarding hot issues as, for example, abortion.

Response measures. A third set of determinants of post-disaster health sequelae is comprised of the response measures to the disaster. As an example, displacing people from a polluted area has tne obvious merit of precluding further exposure. Yet, such a policy may add further risk determinants to the experience of the population (11).

Health outcomes

Exposure-related. Early effects assessment is relevant not only per se, but also for further action. One first example is illustrated by the Chernobyl experience, where a great deal of attention was devoted to the identification of people who had received massive radiation doses (5). Based on a set of biological indicators and symptoms characteristics they were grouped into four groups of increasing severity of acute radiation syndrome (ARS) which served as guidance for treatment and medical resources allocation, including decisions regarding bone marrow trasplants. A second example relates to the relevance of early health impairment for the study of long-term consequences. Quite instructive was the case of a 1,3-dichloropropene spill which caused rather severe symptoms in nine firemen of the brigades on the scene. Two out of them developed lymphoma almost simultaneously after several years (12). Early effects assessment has, thus, the merit not just of identifying early victims, but also of guiding allocation of resources for their treatment and rehabilitation and of planning long-term surveillance of particular groups.

With regard to long-term effects some results related to the the Seveso incident, which occurred in 1976, are available. The study of all live births and stillbirths born between 1977-82 to women resident in the contaminated area at the date of the accident failed to demonstrate any increased risk of birth defects (13). An investigation concerned with liver function and lipids metabolism in some 1,500 children from the contaminated area, repeatedly tested between 1976 and 1982, showed slight elevations of the values of some tests, which later proved to be reversible (14). The follow-up of 193 chloracne cases and of a control group up to 1985 demonstrated the complete recovery of all cases, but one (15). The mortality study in the ten-year period following the incident provided, instead, suggestive indications of an increased risk owing to cardiovascular deaths, and deaths from some specific cancer sites (including bile duct, soft tissue sarcoma, and lymphopoietic tissue) (16). Such mortality results are only suggestive, but nonetheless important, at least to flag the problem of delayed effects on which follow-up studies should continue (Table I).