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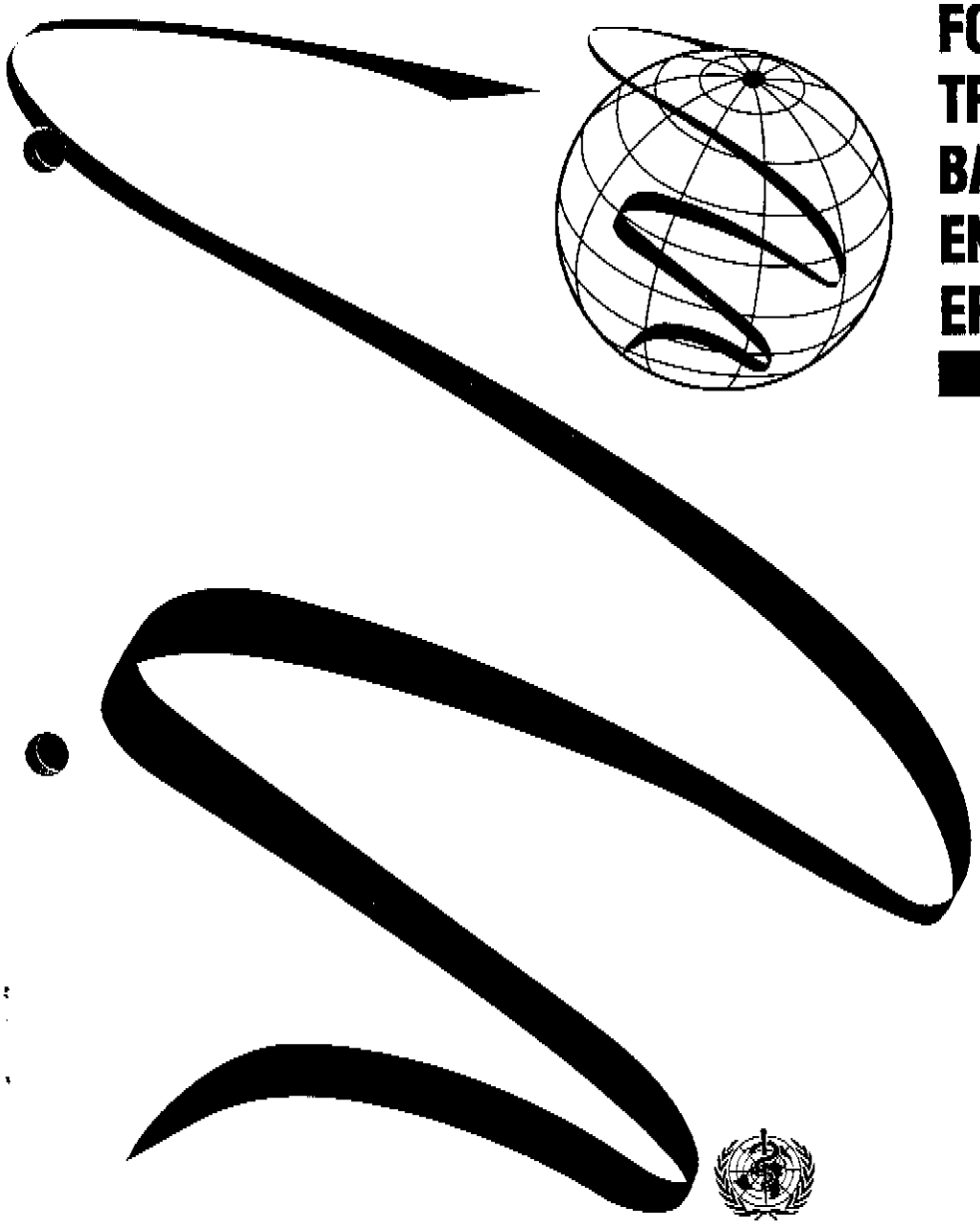
TEACHER'S GUIDE FOR ONE-WEEK TRAINING WORKSHOP: BASIC ENVIRONMENTAL EPIDEMIOLOGY



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TEACHER'S GUIDE

for

ONE-WEEK TRAINING WORKSHOP:

BASIC ENVIRONMENTAL EPIDEMIOLOGY

This guide was prepared with financial support from the Swedish Government and is part of a series of materials produced by the World Health Organization to facilitate and strengthen teaching in environmental epidemiology worldwide.

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PREFACE

This guide has been developed for use by instructors of a one-week workshop *Basic Environmental Epidemiology*. The workshop uses the WHO book *Basic Epidemiology* (Beaglehole et al., 1993) as the core teaching text, supplemented by materials on environmental health issues. The workshop aims to strengthen capacity in environmental epidemiology by:

- consolidating and broadening the participants' knowledge of the basic principles and methods of epidemiology
- consolidating and broadening the participants' knowledge of environmental and occupational hazards and health effects, with an emphasis on assessment, prevention and control activities
- encouraging and facilitating future collaboration among participants to enable them to contribute to the assessment, prevention and control of environmental and occupational health hazards in their own country, and,
- encouraging participants who have teaching responsibilities to apply the knowledge gained from the workshop in local training activities.

The workshop is suitable for public health professionals involved in education, training, research and practice in environmental epidemiology, environmental health, environmental science and environmental management. Typical participants might include:

- public health and medical officers (at national or provincial level)
- environmental protection officers or policy makers
- researchers in environmental health engaged in field studies, and,
- teachers of public health, environmental health or epidemiology.

The workshop combines lectures, case studies and problem-solving exercises, and can be adapted to the needs and interests of particular nations or geographic regions. The guide includes advice for potential conveners and teachers of the workshop regarding teaching methods and organization of suitable facilities and equipment. A proposed timetable and course outline are provided (Section 5), as are examples of how the timetable has been modified for selected national workshops (Appendix II). The course objectives can be evaluated through use of pre- and post-workshop evaluation forms; a sample evaluation questionnaire can be found in Appendix III. References for further reading on both the technical issues and teaching techniques are given in Section 8.

This guide is not intended to restrict local initiatives to a single method for teaching the subject matter. On the contrary, we invite readers to share their ideas and experiences with us so that more effective training materials and methods can be developed. We would therefore welcome comments, reports on workshops, copies of workshop time-tables, local problem-solving teaching examples and other material from those responsible for organizing national or local workshops on environmental epidemiology.

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1. INTRODUCTION

1.1 Purpose of the *Teacher's Guide*

The *Teacher's Guide* is intended to empower environmental epidemiologists to organize and initiate a one-week introductory workshop in environmental epidemiology by providing a framework and suggested teaching approaches. More specifically, the *Guide* aims to encourage the environmental epidemiologist who may be a reluctant or uninitiated teacher to expand her/his horizons. If you have conducted environmental epidemiological studies then you will understand the concepts of environmental epidemiology and have experience in applying them. The challenge is to use this knowledge and experience to teach environmental epidemiology to others.

WHO's Global Environmental Epidemiology Network (GEENET) has devised a series of publications to support environmental epidemiology training. These materials have been used in more than 25 countries since 1987 with considerable success. This *Teacher's Guide* complements the student *Basic Epidemiology* text and has two main aims: to assist the teacher in the initiation, organization, delivery and evaluation of an introductory course in environmental epidemiology for health science students; and to provide teaching resource material, including tables and figures suitable for presentation as overhead transparencies.

The introductory course in environmental epidemiology (which is distinct from the introductory course in basic epidemiology) focuses specifically on the investigation of associations between environmental exposures and adverse health effects. Although both courses use *Basic Epidemiology* as their core text, this course also uses a set of problem-solving examples and a variety of supplementary reading materials (see Section 4.6).

The *Guide* has been prepared on the assumption that most teachers of environmental epidemiology, indeed probably the vast majority of teachers of health science students, have received little instruction in how to develop and teach a successful course. Most teachers learn by doing. In the long term, this may lead to an exciting and well-received course, but in the short term, teachers and students alike will probably be frustrated and disappointed with the instruction given. If you are already an experienced teacher with up-to-date knowledge of effective teaching and learning methods, you may not find much that is new to you in the first sections of this book, but we hope that the chapter resources will be of help. Additional resources for developing learning activities have been included in the reference section (Section 8).

The *Teacher's Guide* provides a general outline of how and what to teach. Inevitably the suggestions it contains will not be universally acceptable or appropriate. Customs and resources may vary, and each course must be tailored to local circumstances.

1.2 How to use the *Teacher's Guide*

The material in this *Teacher's Guide* is designed to be used in conjunction with the text *Basic Epidemiology*. The *Guide* should be read by the course coordinator and teachers well before the beginning of the course, to allow sufficient time for preparation of local examples to illustrate points discussed in the text. Material and ideas in this *Guide* may be of assistance not only to those teachers who are developing a new course but also to those who are

responsible for established courses. We would welcome comments on the *Guide*, descriptions of how it has been used and suggestions as to how it might be improved.

A companion document—not yet produced—will contain resource material which can be made directly into overhead transparencies for group teaching.

This *Guide* can be used in conjunction with more detailed and specialized books on environmental epidemiology and teaching methods. A selection of these books is listed in Chapter 11 of *Basic Epidemiology*. A detailed text on environmental epidemiology (based on the existing WHO *Environmental Health Criteria, No. 27*) is currently being prepared and will be available in 1995. Please note too that a detailed *Inventory of Basic Textbooks in Epidemiology, Occupational and Environmental Health*, together with their tables of contents, is available on request from GEENET, Office of Global and Integrated Environmental Health (EHG), World Health Organization, 1211 Geneva 27, Switzerland.

2. BACKGROUND

2.1 Why teach epidemiology?

Epidemiology involves the study of the distribution and determinants of health-related states or events in specified populations, and the application of its findings for the prevention or control of health problems. As such it is a fundamental component of well-developed health programmes, and the basic quantitative science of public health research and practice. (See Last, 1988; references are listed in Section 8). An epidemiological perspective is therefore relevant to a wide variety of health professionals including clinicians, public health programme administrators and managers, sanitary engineers, environmental health scientists and occupational health engineers.

More specifically, **environmental epidemiology** is concerned with the adverse health effects provoked or exacerbated by environmental factors. Environmental factors can be categorized as biological, chemical, physical or ergonomic. They can occur naturally (such as disasters e.g. volcanos, hurricanes, earthquakes) or as a result of human activities such as agriculture, manufacturing and energy production (WHO, 1983). In addition, environmental factors may reflect psychosocial conditions relating to housing, unemployment, educational level or poverty, or concern cultural mores (values, customs, beliefs, etc), or relate to violence or war (WHO, 1993). (Note that the term **occupational epidemiology** is used to refer to the study of the health effects of workplace exposures). A global perspective of environmental hazards would include issues such as climate change associated with the "greenhouse effect", increases in ultra-violet radiation associated with ozone depletion, as well as the effects of acid rain, urbanization, deforestation and loss of biodiversity.

Environmental epidemiology is multidisciplinary in that it incorporates information from a variety of other specialized scientific disciplines. Biological and physical sciences (such as toxicology, audiology, radiation biology, clinical medicine and chemistry), engineering sciences (such as sanitary engineering, industrial hygiene, hydrology, meteorology, ventilation engineering, and acoustics) and other social sciences (such as demography, economics and sociology), can all contribute to environmental epidemiology investigations.

The ultimate goal of environmental epidemiology is to protect people from unnecessary exposure to environmental hazards, thereby preventing needless mortality, morbidity, disability and suffering. The work of the epidemiologist is therefore incomplete until the study findings are translated into remedial action. The application of epidemiological data to effect social change requires:

- the development and implementation of creative solutions and policies for addressing identified problems
- the promotion of public awareness of environmental health problems
- the ability to locate resources for prevention and control efforts, and,
- active participation in the political process.

In other words, environmental epidemiologists must develop both technical and action-oriented skills.

2.2 Situation analysis

Health is inextricably linked to environmental and social conditions. Therefore, attaining the goal of *Health for All* will require a global strategy to secure environmental conditions that protect and promote environmental and human health. Currently, environmental hazards cause or contribute to the premature death of millions of people and result in the ill health or disablement of hundreds of millions more each year.

Yet the development of national programmes for the prevention and control of environmental hazards has generally not kept pace with the increase in the number and range of environmental health problems arising from population growth, rapid industrialization and urbanization. Additionally, the introduction of new technology and the use of potentially hazardous technologies—in the production of agrochemicals, for example—lead to conflict between the desire and need for technological and economic development, and the preservation of environmental quality (WHO, 1974; WHO, 1992).

This is particularly so in developing countries (WHO, 1985) where proven methods of environmental hazard control are often not applied due to limited national awareness of environmental hazards, or low political priority for health and environment matters, or limited resources, or lack of an appropriate environmental health management system, or any combination of these. The recent report from the WHO Commission on Health and Environment (WHO, 1992) has again highlighted these problems and suggests a number of actions for overcoming them.

Strengthening national programmes for the control of environmental health hazards usually requires:

- improving information exchange
- promoting policy formulation
- improving national institutional capacities, and,
- training at all levels.

Agenda 21, the main report of the United Nations Conference on Environment and Development (UNCED, 1992), listed numerous recommendations for preventing and controlling environmental hazards. Common to all of them is the need for an information base and the ability to interpret environmental health effects, which in turn require capacity in environmental epidemiology. Without this capacity, valid and relevant information regarding the health effects of environmental hazards cannot be interpreted or applied effectively at the national level. It should be emphasized, however, that there is a need not only for training in environmental epidemiology for epidemiologists, but, perhaps even more importantly, for improved knowledge and awareness of epidemiological principles among those involved in environmental management or policy determination.

2.3 WHO strategy and framework for action

In 1987, WHO initiated a new training strategy aimed at improving the local availability of personnel with an understanding of environmental epidemiology and the skills necessary for assessing health risks that may be associated with local environmental hazards. The focus

is on facilitating training and research activities in the field. The individual components of the strategy are:

- Creation of a **Global Environmental Epidemiology Network** (GEENET) of individuals and institutions involved in teaching and research in environmental epidemiology (including university teachers and researchers, major research institution staff, key government officers, etc.). As of December 1993, the Network had 1800 members, in all regions of the world. (Membership application forms can be requested from GEENET, Office of Global and Integrated Environmental Health (EHG), World Health Organization, 1211 Geneva 27, Switzerland.)

- Provision of **information and training materials** for Network members interested in developing new local training activities. (This includes materials already in existence and the development of new materials when required.)

- Preparation of **training kits** (including proposed curriculum, proposed texts, problem-solving case studies and exercises, audiovisual materials when available, and teacher's guides) for selected training workshops and seminars that can be organized locally by Network members.

- Organization of both introductory and advanced **training workshops** on environmental epidemiology to strengthen the technical knowledge of key public health staff and associated professionals, and to promote new local training and research activities.

- Organization of regional **"training-of-trainers"** seminars, in conjunction with new training activities.

The one-week training workshop described in this teacher's guide is envisaged as a primary vehicle of this training strategy.

3. DEVELOPMENT OF THIS WORKSHOP

This *Guide* is intended to provide general advice and guidance for the planning, implementation and evaluation of a one-week introduction to environmental epidemiology workshop. The workshop can be organized at national or local level by teachers and resource people within the country concerned.

3.1 Target groups

It is anticipated that the participants in this workshop will be individuals with detailed knowledge of some area of environmental health (university degree plus practical experience), some understanding of the basic principles of public health investigations, and a willingness to learn the details of environmental epidemiology. Some variation is to be expected in the backgrounds and levels of expertise of the participants, who may include staff with experience not only in communicable disease epidemiology, but also in environmental health science and management. No prior specific training in epidemiology is required, although it would of course be valuable. This workshop may not be suitable for senior officials, who need an overview of environmental epidemiology; a separate shorter curriculum should be developed for them, focusing on the policy and service implications of data derived from environmental epidemiological studies.

All potentially interested groups should be contacted as early as possible so that they can, if appropriate, become involved in the workshop planning. Attention should be paid to how the participants are selected (i.e. on the basis of what criteria). Depending on their potential application of the workshop materials, potential participants or target groups can be divided into four categories:

- public health and medical officers (at national or provincial level)
- environmental protection officers or policy makers
- researchers in environmental health engaged in field studies, and,
- teachers of public health, environmental health or epidemiology.

Experience has shown that this introductory workshop will be more successful if the participants have a similar prior knowledge base of epidemiology and environmental health principles. Within any one country it may therefore be best to hold one workshop for interested participants with prior training in epidemiology (e.g. provincial public health officers with medical degrees or other appropriate university-based health training, i.e. nursing or dentistry) and a separate workshop for those without such training (e.g. environmental science officers or chief sanitary engineers). It is also suggested that the number of participants be limited to a maximum of 30. The group should not be so large that personal interaction between participants and teachers is difficult. Similarly, a too-large group will mean that there is insufficient time to respond to participants' questions. But at the same time, the group must be large enough for team learning.

GEENET's training activities also include more advanced workshops; for these, participants or groups with differing backgrounds can be mixed, provided they have already attended an introductory workshop.

3.2 Goals

The general goal of the workshop is to strengthen education, training, practice and research in the field of environmental epidemiology.

The more specific goals are to:

- consolidate and broaden the participants' knowledge of the basic principles and methods of epidemiology
- consolidate and broaden participants' knowledge of environmental and occupational hazards and health effects, with an emphasis on assessment, prevention and control activities
- encourage and facilitate future collaboration among participants to enable them to contribute to the assessment, prevention and control of environmental and occupational health hazards in their country, and,
- encourage participants who have teaching responsibilities to apply the knowledge gained from the workshop in local training activities.

3.3 Objectives

The depth of learning attained during the workshop will vary for each participant depending on prior knowledge and experience. Nevertheless, the workshop objectives were drawn up with the well-prepared participant in mind and with the intention that by the conclusion of the workshop each participant should:

- understand and be able to apply the basic principles of epidemiology to the field of environmental health
- understand the adverse health effects of various common chemical, physical and biological risk factors
- understand the concept of exposure routes and issues related to measuring environmental exposures
- understand issues related to epidemiological study design
- be able to develop a plan for a descriptive epidemiological study and understand how analytical studies are planned
- be able to design a basic questionnaire (using EPIINFO)
- be able to perform basic analysis of data
- understand basic issues related to exposure and health effects surveillance
- understand how epidemiological data is used to develop prevention and control strategies
- have an appreciation of some of the landmark studies in environmental epidemiology
- be able to critically appraise environmental epidemiology literature
- understand the role of and need for collaboration with other professionals to form multidisciplinary teams (of, for example, epidemiologists, statisticians, industrial hygienists, clinicians (nurses and doctors), toxicologists, environmental control specialists, risk scientists and policy makers) to study and resolve environmental health problems
- understand the basic principles of risk and risk communication

- be aware of the resources available for the provision of technical assistance and support of education, training and research in environmental epidemiology.

Trainers should be prepared to adjust the amounts of time spent on individual topics in workshop sessions in accordance with the prior knowledge of the participants. The curriculum presented here has been designed to be flexible with respect to the needs and experiences of the target group. Some of the teaching sessions are optional so that the curriculum content can be varied.

3.4 Skills and knowledge to be gained

After the workshop, the participants should have a clear understanding of the basic concepts and terms used in environmental epidemiology. They should be able to devise a general plan for a small-scale descriptive epidemiological study of an environmental health problem and to carry-out basic analysis of the data. It is *not* expected that they would be able to carry out a full-scale environmental epidemiology study independently. Complex studies are generally collaborative endeavours, performed by a team of epidemiologists, statisticians and others. But by the end of the workshop students should have improved their ability to critically read published reports and extended their knowledge of information sources (e.g. texts, journals, colleagues, data-bases, etc.). The participants should also have learned about available training materials and training approaches in this field, and acquired some practical experience in evaluating training needs and preparing training modules using local examples.

It should be pointed out that this is a short and condensed workshop. Public health staff who need more detailed knowledge in the planning, supervision and interpretation of environmental epidemiology studies will require additional training. Acquiring an in-depth epidemiology training necessitates work in the field, carrying out all the practical and theoretical components of epidemiological studies under the supervision of an experienced scientist.

A more advanced two-week workshop building on the skills taught in this introductory workshop is being prepared by WHO.

4. TEACHING METHODS AND FACILITIES

4.1 Advance preparation

The course coordinator should ensure that workshop participants receive the following materials in advance:

- the course outline and timetable
- information on where to obtain the course texts (alternatively the texts should be provided)
- photocopies of any other materials that must be read in advance of the workshop.

Each participant should be requested to prepare a report for presentation at the workshop. This report should include a brief description of an environmental health problem of which the participant has knowledge and that might benefit from the application of an epidemiological approach. The report should include a brief summary of any studies already implemented concerning this problem (see Appendix I), the participant's recommendations for additional studies, and the participant's proposed interventions. Participants should be informed of this assignment at least one month ahead of the workshop, so that they have adequate time in which to prepare it.

The participants' reports and any data presented can be used as the basis of practice sessions during the workshop. Similarly, some of the problems and studies can be used by the instructors to illustrate the application of course materials. Participants should each be requested to bring a calculator (and, if possible, a portable computer) to the workshop.

It is important that course instructors and local coordinators communicate with one another at least two months before the start of the workshop. Local input is essential if the course is to be geared to the needs of the participants.

4.2 Workshop structure

The programme is designed on the assumption that there will be two instructors running the entire workshop. They must be highly qualified, i.e. professionals with experience in the teaching and practice of environmental and/or occupational epidemiology.

Workshop materials should be presented in a combined lecture and group discussion format requiring the substantial participation of those attending. There should be frequent use of case study and problem-solving examples during the sessions, either by the entire class or within sub-groups. It is suggested that discussion groups should contain no more than 6 people. The small groups for Days 1 and 2 should be composed of a different set of members than the groups that will analyse problem examples in depth in the latter part of the week. In this way, the opportunity for each participant to exchange ideas with other participants will be maximized.

If appropriate, epidemiological calculation exercises can be completed by students individually and then reviewed in small groups. These can be supplemented with demonstrations of software packages on personal computers. Ideally, the computers should be available during all break times and during sessions devoted to individual or group

preparation of materials, so that students have plenty of opportunity to familiarize themselves with available hardware and software.

4.3 Lectures

In this workshop, lectures or technical presentations are used to convey a basic body of information. However, they should be brief and combined with participatory exercises which allow the students to work with and apply the information that has been presented. A few pointers to keep in mind are:

- begin with an overview of what the lecture will cover and its practical relevance, and conclude with a similar summary (i.e. tell the class what you will present, make the presentation, then summarize what you have presented)
- make lectures relevant by drawing on examples from participants' experience
- make lectures interesting by using good visual aids
- increase active participation by inviting questions from the group and by posing questions which require participants to apply the information presented to their own work situations.

However, the main guideline for lecturing is to keep presentations short since people have a relatively brief attention span. Moreover, during this workshop, it is essential that as much time as possible is used for skill-building and analytic exercises.

4.4 Small group exercises

One of the main techniques used in this workshop is problem-solving in small groups, either with group worksheets or case studies. The purpose of the small groups is to maximize participation and allow people to use their own experiences and apply new information to answer questions. A group worksheet is a questionnaire which can be used as a catalyst for introducing concepts that will form the basis of a lecture. For example, a questionnaire is distributed that covers the main points of a lecture. During the first five minutes of the session, students would answer the questions by themselves or in pairs or small groups. The participant's answers form the basis of discussion, thereby fostering group involvement. A sample worksheet is presented in Appendix IV. With case studies, participants are presented with a situation and asked to analyse it in small groups. Sample case studies are presented in the curriculum for Day 4 as a way of teaching how to apply some analytic techniques.

Another teaching technique uses "buzz groups". The class is split into pairs for a short period to come up with ideas on an issue. A similar procedure is the "brainstorm" in which students in the whole group are asked to come up with as many ideas as possible on a given issue. With "role-play", a problem situation is acted out rather than just described and analysed. Following the role play, the instructor leads a discussion that focuses on salient points. Role plays are especially effective for exploring attitudes and developing interpersonal communication skills.

It is important that the small group exercises are well administered. To ensure active participation, groups should consist of no more than four to six people. During the week's training, the composition of the groups should be varied to encourage the widest sharing of

experience and to prevent dominant individuals from establishing control over any one group. Instruct groups to select a chairperson and a rapporteur for small group activities, and brief the groups clearly on the role of these two people. The chairperson should ensure that discussion is relevant to the issue in hand and that each part of the exercise or assignment is completed within the time allocated, and enable each individual in the group to make his/her contribution. The rapporteur should note the salient points of the group's discussions and summarize the group's conclusions for presentation to the rest of the workshop.

4.5 Audiovisuals

Various audiovisual aids are suggested for use in the workshop. These include a blackboard or large pieces of paper (flip-chart), overhead transparencies, and slides. The more varied the way in which the information is provided (visual, audio, print), the more likely it is that it will be retained. Videos may also be useful for introducing participants to key environmental health issues. Note that Part II of this *Guide* will provide a set of tables and graphs that can be easily converted into a set of transparencies.

4.6 Course texts and case study materials

World Health Organization. *Basic epidemiology*. Geneva, 1993.

World Health Organization. *Our planet, our health*. Report of the WHO Commission on Health and Environment. Geneva, 1992 (available in English and French).

World Health Organization. *Problem-based training exercises for environmental epidemiology*. Geneva, 1992 (unpublished document WHO/PEP/92.05B; available in English and French).

World Health Organization. *Major poisoning episodes from environmental chemicals*. Geneva, WHO and London, Monitoring and Assessment Research Centre, 1992 (unpublished document WHO/PEP/92.19).

World Health Organization. *Investigating environmental disease outbreaks. A training manual*. Geneva, 1991 (unpublished document WHO/PEP/91.35; available in English, French and Spanish).

4.7 Equipment, facilities and recommended activities

The following are suggestions regarding equipment and facilities:

- The teaching room should be large enough to seat all participants, preferably in an arrangement around a table which makes it possible for all participants to face each other.

- Ideally, two or three smaller rooms for group work should also be available.

- A typewriter (or word-processor) and copying machine will be required to prepare material during the workshop for distribution to participants .

- An overhead projector and/or flip-chart are/is essential for demonstrating key concepts and results of group work. Make sure that the teaching room can be darkened sufficiently for easy viewing of overheads and slides.

- At least one IBM-compatible microcomputer is required for the demonstration of computer software and to give participants an opportunity to practice using programmes. A "Kodak data-show" or similar equipment to show the computer screens to the whole group would be a useful adjunct. A CD-ROM reader for the microcomputer is also useful for demonstrating modern information systems. (A session on this topic can be held in an adjacent library if it has a CD-ROM reader.)

- Name signs in large letters at seats and a name badge for each participant will enable instructors and participants to address each other by name, thus fostering familiarization and group connectedness. A list of participants, including addresses and affiliations, should also be distributed at the start of the workshop.

- A social activity at an early stage (for instance during the second evening) will also help participants and instructors to get acquainted.

- A class picture will foster future contact and collaboration.

- A certificate of attendance, preferably prepared with an attractive design, should be issued to each participant who completes the training course.

- Select (or elect) class representative(s) to meet with the instructors each morning to provide feedback and discuss and plan the teaching schedule.

- A small collection of relevant environmental health and environmental epidemiology books and journal papers should be made available to form an ad hoc library for the more advanced or interested students. Similarly, advanced computer-based exercises can be made available for the student who is already familiar with EPIINFO software.

5. PROPOSED TIMETABLE

5.1 Participants' timetable

The proposed timetable is shown on the next page. Depending on local requirements, the timetable can be modified to give more emphasis to certain parts of the curriculum. Additional examples of timetables are given in Appendix II.

5.2 Activity chart for instructors

Day	Session	Time	Activity
1	1	09:00–10:20	Introduce self; ask participants to do the same. Distribute pre-course questionnaire. Describe course.
	2	10:40–12:00	Lecture and questions.
	3	13:00–14:20	Collect completed pre-course questionnaires. Briefly present exercise, go through the different steps of exercise discussing them with participants.
	4	14:40–17:00	Lecture by local resource person. Distribute study abstracts for Day 2 and format for individual reports.
	5	Evening	Available to advise participants.
2	6	09:00–10:20	Lecture and questions.
	7	10:40–12:00	Lecture and questions. Lead discussion of study designs (and population selection) from abstracts previously distributed.
	8	13:00–16:00	Chair participants' presentations and lead discussion of presentations and methodological issues.
	9	16:00–17:00	Lead discussion of preparation for field trip.
	10	Evening	Plan a suitable social get-together in collaboration with local organizers.
3	11)	09:00–10:20	Lecture and examples.
	12)	10:40–12:00	Lecture and examples.
	13)	13:00–17:00	Travel with participants to field study area.
	14)	15	Free time

4	16	09:00–10:20	Lecture and microcomputer demonstration (EPIINFO and/or other software packages and examples)
	17	10:40–12:00	Lecture and examples.
	18) 19) 20)	13:00–17:00 evening	Available to small groups.
5	21	09:00–10:20	Chair participants' presentations and discussion.
	22	10:40–12:00	Lecture and discussion.
	23	13:00–14:20	Facilitate role-play exercise.
	24	14:40–17:00	Lead discussion; distribute post-course questionnaires.
	25	evening	Collect completed questionnaires; available to participants.
6	26	09:00–10:20	Chair participants' presentations and discussion.
	27	10:40–12:00	Lecture; report results of pre-workshop and post-workshop questionnaires; lead discussion.
	28) 29)	13:00–17:00	Available to participants.

Proposed Course Timetable

	Early morning (e.g. 09.00–10.20)	Late morning (e.g. 10.40–12.00)	Early afternoon (e.g. 13.00–14.20)	Late afternoon (e.g. 14.40–17.00)	Evening (e.g. 19.00–21.00)
DAY 1	1. Opening; introduction; administrative matters	2. Summary of health effects of environmental hazards	3. Problem-based exercises and demonstration	4. Review of national and environmental health problems	5. Preparation of individual reports
DAY 2	6. Basic concepts; terminology; sources of data on exposure and effects	7. Study design	8. Individual reports by participants	9. Preparation for field trip	10. Social get-together
DAY 3	11. Bias, confounding and interaction	12. Data analysis	13. Field trip	14. Field trip	15. Free time
DAY 4	16. Data presentation, interpretation of statistics	17. Causal inference and risk assessment	18. Problem-based exercises in groups	19. Problem-based exercises in groups	20. Problem-based exercises in groups
DAY 5	21. Report back and plenary discussion of problem-based exercises	22. Prevention strategies; policy implementation; risk communication	23. Role play on local environmental health problems	24. Group discussion of training and research priorities	25. Individual preparation of follow-up action plans
DAY 6	26. Plenary discussion of training and research priorities and follow-up	27. Teaching approaches; evaluation of workshop; closing	28. Optional individual tutoring	29. Optional individual tutoring	

6. COURSE OUTLINE

DAY 1

Objectives:

- to introduce the basic epidemiological approach
- to give participants an opportunity to share their own experiences in this field and to learn (more) about priority environmental health problems in their country
- to enable participants to develop an understanding of the role of epidemiology with respect to assessing reports of perceived or alleged health problems, or environmental exposures which appear to exceed normal background levels.

Teaching methods:

Combined lecture, general discussion group and case study format, with substantial participation.

Teaching materials:

Basic Epidemiology: chapters 1, 2, and 9.
Our Planet, Our Health: all (assigned pages should be read in advance of the workshop).

Session 1

Opening; welcome & introductions; administrative matters

- get to know one another and create a comfortable learning atmosphere for the week
- instructors describe their teaching experience and research interests
- overview of the workshop, its goals, schedule, etc.
- participants introduce themselves (i.e. give their name, title, expectations of the workshop, and subject of his/her particular study problem)
- distribution of pre-workshop questionnaire which asks participants about their knowledge of epidemiology and environmental health hazards, and their expectations of the workshop.

Session 2

Summary of health effects of environmental hazards

- introduction to the subject of exposure and effects including the concepts of exposure routes, dose-response and risk
- brief review of some major environmental/occupational factors (including biological, chemical, physical, ergonomic (including safety) and psychosocial

factors) that can have negative health effects; for each type of factor, examples of the measurement of exposure and health effects will be given
- discussion of some landmark environmental episodes, including, for example, the London Smog episode of 1952, and exposure to tobacco smoke and asbestos dust
- the concept of latency and incubation period for chronic diseases should be introduced.

Session 3

Problem-based teaching example

The instructor will present a prepared study problem for group discussion. This may take one of several forms. For example, it could be based on an accidental release of a chemical from a factory (e.g. with potential acute and latent effects), or a sudden discovery of a long-standing pollution situation, or of an apparent cluster of disease cases. The initial discussion should focus on the development of a clear "problem definition" and the aims of any proposed epidemiological studies. The following questions can then be discussed:

- How will the investigator establish whether or not there is an "environmental epidemic"?
- How will the investigator determine whether the morbidity/mortality excess is related to the contaminant source and the number of people potentially affected?

There will also be a brief discussion of how to organize an epidemiological study and of the need for collaboration with other professionals and the appropriate authorities, and for communication with the local community. Ethical questions concerning informed consent, confidentiality and funding constraints will also be discussed, and the likelihood of the study providing suitable solutions to the problem considered.

Session 4

Review of national environmental health problems

Each country has its own range of environmental and occupational health problems. It is useful if an individual with a good knowledge of the local and national situation can present an overview of these problems at an early stage in the workshop. This session is usually given by a key staff member of a public health agency. A discussion of possible barriers to improved environmental conditions could include reference to the potential conflict between different economic priorities, or between rapid development and the need to protect the public's health.

Session 5 (evening)

Individual preparation/revision of reports

Participants will revise their prepared problem statements in light of the material presented during the day. For example, a review of the available data concerning disease outcomes or exposure (and their reliability) that could be used by the investigator might be considered.

Individuals may work alone or in pairs. The instructors will be available, in a common meeting room, for discussion and assistance. Ideally, word processing equipment will be available in the same area, so that the revised drafts can be printed out for distribution to the group on the following day.

DAY 2

Objectives:

- to review basic epidemiological concepts and terminology
- to lecture on the relationship between disease and exposure
- to provide an overview of data sources and an introduction to study design and the concept of the study base.

Teaching methods:

Combined lecture and group discussion using case study material. The problem definition from Day 1 (Session 3) will be used as the basis of a proposed study, for which the group will suggest potential study populations and outcome measures. Participant presentations (individually or in pairs during Session 8) will be followed by group discussion as time permits. Selected student cases may be used during the remainder of the week to illustrate the course material.

Teaching materials:

Basic Epidemiology: chapters 3, 4, and 5.

Session 6

Basic concepts

The terminology used by epidemiologists for measures of disease occurrence and other basic concepts will be discussed, with emphasis on the importance of explicit operational definitions. The discussion will aim for standardization of terms during the workshop, including risk versus hazard; exposure versus dose; effects versus response; prevalence, incidence density, and cumulative incidence; and rate versus ratio. The concepts of morbidity and mortality excess should be covered and the idea of relative and attributable risk introduced.

With regard to measures of exposure, it should be made clear that there is a wide range of indices and proxies—ranging from direct measurements of environmental contaminants, to indirect measures and exposure inferred from interviews. The former are generally continuous and quantitative data, while the latter are more likely to consist of qualitative and discrete data.

concepts may take some time to comprehend and that an-indepth understanding of them is likely to require years of additional study and experience.

The data analysis and statistical material will be presented in lecture form. (A hand-out with all the necessary formulae and tables needed to perform the calculations discussed during the day should be distributed.) Exercise sessions, interspersed with the lectures, will use real or hypothetical data pertaining to selected cases presented by participants on Day 2. A personal computer will be used to demonstrate one or more statistical packages that compute epidemiological measures.

A half-day field experience will be followed by general group discussion. Note that if a field trip cannot be arranged, the time can be used for the problem-based exercises involving more in-depth teaching on environmental/occupational hazards.

Teaching materials:

Basic Epidemiology: chapter 11.

Session 11

Bias, confounding, effect modification, misclassification and age-adjustment

This section includes a lecture on the types of error that may be inadvertently introduced into observational studies, including selection bias, observation (information) bias, and confounding. The issues of random and systematic errors should be discussed as well as how to minimize their occurrence. (Selection bias occurs when the definition of study population, or the implementation of study enrollment procedures, is not representative with respect to the exposure-effect relationship being studied. Observation bias occurs when the accuracy of information on study endpoint(s), or the procedures for obtaining that information, are not random with respect to membership in the study population. For example, in a case-referent study of pregnancy outcome, postnatal interviews regarding prenatal exposure may be biased by differential recall by mothers with adverse outcomes. The "healthy worker effect" should be discussed as an example of selection bias. Confounding is an undetected mixing of effects that occurs when there are unmeasured or inadequately measured risk factor(s) for the disease being studied, other than the exposure of interest, which are also associated with that exposure.) The concepts of misclassification and age-adjustment procedures can be introduced at this stage.

The concept of interaction may best be introduced by using lung cancer associated with the individual and combined effects of asbestos exposure and cigarette smoking as an example.

Session 12

Data analysis

This session should include a review of the measures of disease frequency and risk that can be computed from cohort and cross-sectional studies: i.e. prevalence, cumulative incidence, and incidence rate (density); and of absolute and relative measures of risk (rate differences and rate ratios). The 2 x 2 table is presented as an easy tool for basic analysis of study results.

Some of the methods for analysing data from cohort studies can also be applied to case-referent studies. However, unless the study is a population-based case-referent study, it will not be possible to compute actual rates and rate differences. Instead, the relative risk can be estimated by calculating the cross-product or odds ratio.

Sessions 13-14

Field trip

In order to focus the participants' attention on some common local environmental /occupational problems and the need to study these using epidemiological methods, a field trip to local factories, polluted areas or other sites of interest could be organized. A WHO environmental epidemiology workshop in Ethiopia, for example, included a field trip to a small rural community to gather information about the extent of indoor air pollution from biomass fuel. The participants were particularly interested to see a biogas fuel demonstration in one of the village homes.

The participants should be divided into sub-groups of 5-6 persons. Each sub-group should be given observation tasks, such as:

- At the sites observed, identify the exposures that may cause health effects.
- Identify potential methods for exposure measurement.
- Consider potential methods for effects measurement.
- Consider problems in defining study populations.
- Discuss prevention and control strategies.

The field trip enables the participants to get to know one other further, and also provides first-hand experience, which can serve as a basis for subsequent workshop sessions.

At the end of the field trip the whole group should be brought together for 30 to 60 minutes to discuss the sub-group observations and the implications for epidemiological studies of the problems observed.

If possible, the transport for the field trip should be arranged in one vehicle for the whole group, so that delays in bringing the whole group together for comments and

discussion of observations are minimal. An instructor should be assigned to each sub-group during actual observations, to facilitate discussion. Each sub-group should have a rapporteur who keeps a record of the observations so that these can be presented at the general discussion at the end of the field trip.

DAY 4

Day 4 should be used to provide more detailed descriptions of key issues in epidemiological methodology and to give participants an opportunity—through problem-based exercises—to apply the methods learned.

Objectives:

- to continue discussions on basic data analysis techniques
- to discuss basic statistical analysis
- to discuss risk assessment and describe how a rudimentary assessment can be accomplished
- to discuss issues related to causal inference.

Teaching methods:

The material on data presentation will be covered by lecture and demonstration of computer software; this will be a relatively short didactic session of about 30 minutes. It will be followed by a presentation on risk assessment, using problem-based exercises as an illustration. After this presentation, the small groups will be asked to perform a risk assessment on hypothetical cases and to select the most appropriate intervention strategy(ies). The assessments will be based on estimates of health risk and the cost of the various intervention strategies and likely reductions in risk. Post-intervention data will be presented and the participants requested to assess the impact of the intervention(s).

For the small groups (not more than 6 students each), a written case study of a real environmental health hazard will be assigned at the beginning of the session. The cases presented will bridge the gap between the basic principles and analytic methods presented, and the practical considerations involved in intervention strategies. An instructor will participate in each group; s/he will provide assistance and ensure that the main issues to be raised by each case study are actually covered.

The participants will be guided through the exercise by a work sheet that will ask questions about study design. It will also request participants to undertake certain calculations, and to interpret the results. (Some personal computers will be available to each group, but participants will learn how to perform basic analyses with hand-held calculators.) Issues involved in intervention decisions and evaluation will be tied directly into the problem-based exercises. A short set of reporting back questions on a separate work sheet will be used by the rapporteur of each group to prepare for reporting to the plenary session.

Three examples of different types of problem-based exercises are given below:

Case 1: a study of a continuous measure of the body burden of a pollutant such as a heavy metal, with major exposure via drinking water. Two cross-sectional studies, one before and one after an intervention, could be presented. The students will calculate a t-test for the difference in two mean levels, and will learn about the differences between two cross-sectional studies in a dynamic population and a follow-up study of a cohort.

Case 2: a small study, perhaps of a short latency cancer (e.g. benzene and leukaemia in shoe workers). Data could be provided to analyze either a cohort study (with very rough population data and a very small numerator) or a case-referent study. Participants could also be asked to calculate the etiologic fraction and then to consider its implications for intervention. In the afternoon the participants could be asked to consider the case once more, with additional data provided on the costs of alternative prevention strategies (e.g. substitution versus ventilation in the benzene example).

Case 3: an acute episode of air pollution causing respiratory disease or death. The participants could calculate excess deaths from the incident, based on very small numbers, and learn about the situation of a large relative risk with even larger confidence intervals, and about the difference between relative risk and risk difference.

Combined lecture and group discussion using problem-based study material is suggested for presenting issues related to causality. It is suggested that Hill's paper be distributed the day before this session so that students have a chance to familiarize themselves with the concepts (Hill, 1965). Sample case studies can serve as the basis for demonstrating the application of Hill's guidelines.

Teaching materials:

Basic Epidemiology: chapters 8 & 10.

Session 16

Data presentation; interpretation of statistics

The presentation of data in tabulated or graphic form can be a useful means of conveying information to the scientific community and/or the interested public. Various options should be discussed; but should include reference to pitfalls such as misleading scales and intervals that have been pre-defined by software packages.

Examples of data and results will be presented for one or more of the cases from Day 2 (either the problem originally presented on Day 1, or the participants' presentations). The discussion should focus less on the mechanics of computation than on interpretation of results, e.g. how to evaluate the potential contribution of systematic error to the results observed; the relation between p-values and confidence intervals. The distinction between statistical and public health significance should be dealt with in this session.

Session 17

Causal inference and risk assessment

There should be some discussion of the principles of causal inference including a review of Hill's guidelines. The concept of necessary and sufficient cause should be presented with case studies as examples. The basic principles of risk assessment should be presented. (The basic principles of risk assessment involve some effort to quantify the occurrence of health effects in a specific population with a certain predicted or measured exposure situation. Statistical measures that are often computed include etiologic fraction and attributable risk. The results of risk assessment may lead to various strategies for intervention, based on estimates of health risk, the cost of the various intervention strategies and likely reductions in risk.)

Session 18-20

Small group preparation of problem-based exercises

Participants will work in small groups on a selection of problem-based exercises. Methods of investigating environmental disease outbreaks would be an appropriate exercise at this point.

DAY 5

Day 5 focuses on the future application of epidemiology to local environmental health problems and the role of each individual participant.

Objectives:

- to discuss a variety of questions that may arise when conducting epidemiological studies, such as:
  - How can epidemiological data contribute to the decision as to when to intervene?
  - How should priorities for intervention be determined?
  - What are the limits of statistical power, and what can be concluded from weak data?
- to consider the practical implications of conducting an epidemiological study, e.g. seeking the cooperation of the community, reporting results to the study subjects, the community, etc.
- to define training and research needs for the country, and to develop individual plans for follow-up action to meet these needs.

Teaching methods:

During the first session the rapporteurs will report on the conclusions of their sub-group concerning the problem-based exercises. The short set of reporting back questions will be used in the rapporteurs' reports.

The second morning session will comprise a combination of lecture and group discussion, using the case studies as examples. The next session will use role-play techniques to further illustrate the issues.

The afternoon discussion groups will be the same as those formed for the problem-based exercises. Tutors should be available to answer questions.

Teaching materials:

Basic Epidemiology: chapters 6 and 7.

Session 21

Report back and plenary discussion of problem-based exercises

Participants' presentations will summarize the environmental health problem under consideration, the choice of study design and justification, and methods of data analysis, and results. Emphasis will be placed on the interpretation of findings and recommendations for control measures, if any.

Session 22

Interpretation and prevention strategies; policy implications; risk communication

This session will underscore the need to report back to the study subjects and interested community regarding the results of the study, basic risk assessment, and recommended prevention measures (if any). Emphasis will be placed on ways of simplifying technical material for the layperson's understanding, but without avoiding discussion of ambiguities or uncertainties in the data. There will also be discussion of the political implications of, for example standard-setting, banning of substances, and long-term planning to avoid recurrence. Other actions—including the creation of registries, or carrying out of community or worker-initiated studies—could be discussed, as could some of the common ethical dilemmas that arise during or as a result of epidemiological studies.

Session 23

Role play

One small group from Day 4 will be selected for role play of the issues covered in the first session regarding communication with the affected community and interested public. Roles might include plant owner, journalist, rank-and-file worker, and parent of a sick child living near the plant.

Session 24

Group discussion of training and research priorities

Participants will meet in small groups to discuss future activities for teaching the material in this curriculum upon return to their own locality, and to assist each individual to plan appropriately. Specific considerations should include the target population (e.g. municipal officials, environmental engineers) and the expected applications (e.g. improved communication with epidemiologists in the national health service, incorporation of risk assessment into priority-setting for environmental control measures). Participants should be asked to identify the major obstacles they expect to encounter, whether these be logistic, scientific, or political, and the resources that they can draw on to overcome them. The groups should also consider research needs in their country or locality. Each group will propose recommendations for consideration by the whole group on Day 6. The post-workshop evaluation questionnaire should be distributed at the end of this session.

Session 25

Individual preparation of follow-up action plans

Each participant is asked to write a 2-3 page summary of activities they plan to carry out after the workshop in the field of environmental/occupational epidemiology. These could be a continuation of work already under way or a new initiative inspired by the workshop. The aim here is to focus the participants' attention on the need to make personal commitments for further work after the workshop.

During the evening the completed post-workshop questionnaires are collected.

DAY 6

Objectives:

- to present and discuss training and research needs
- to evaluate the workshop in terms of whether or not it has provided participants with new skills to assist in meeting these needs.

Teaching methods:

The morning session will consist of reports from each group, and discussions. The final session will consist of a brief lecture and a discussion of the local applicability of the different teaching methods; the discussion will also cover whether or not the workshop provided sufficient technical and strategic tools to enable participants to expand and improve their own teaching and research work.

The afternoon session will be an optional period during which students can meet with one another for further discussions, or work with the instructor(s) on any of the technical material presented during the workshop. The computer work stations will be available to participants

for use of software packages and biostatistical tutorials, or for word processing of revised teaching proposals.

Session 26

Plenary discussion of training and research priorities and follow-up.

Full group discussion of the recommendations proposed by the sub-groups on Day 5.

Participants could also make brief reports concerning the individual follow-up activities that they have proposed.

Session 27

Teaching approaches; evaluation of the workshop; closing session

There are a variety of approaches to adult education that may be applied to teach environmental epidemiology. An inventory of teaching materials will be presented and demonstrated, for example, self-teaching packages such as biostatistical tutorials on personal computer, and the use and analysis of pre-course knowledge questionnaires. Suggestions should be provided regarding additional readings in textbooks or journals for the interested student.

Identifying specific competencies through problem identification, determination of resulting staff needs and competencies to address the problem, and evaluation of competency at the conclusion, should also be discussed. These issues will be elucidated by questioning participants on the major environmental problem in their jurisdiction, the resources and personnel available for dealing with it, and competing public health priorities.

The responses to the pre-workshop and post-workshop questionnaires will be used to illustrate one method of evaluating teaching effectiveness and to stimulate discussion regarding whether the goals of this workshop were achieved.

To sustain the level of interest and collaboration among participants it is suggested that development of a local or national environmental epidemiology network be recommended with one person or group of people taking responsibility for organizing and maintaining it. Analogy to the global network can be made with expectation of possible further collaboration. In addition, to provide further encouragement and motivation, copies of EPIINFO might be distributed to active participants in the workshop.

Sessions 28, 29

Teachers available for additional tutoring.

7. EVALUATION OF WORKSHOP

An evaluation of a training programme should always be carried out during the programme itself—particularly when the purpose of the training is to encourage the participants to use the new knowledge in their own teaching. An evaluation session also provides an opportunity to discuss teaching methods and suggest modifications.

This workshop is designed to encourage the learning of epidemiological concepts, and to enable participants to develop the ability to critically evaluate the strengths and weaknesses of different study designs, and to apply different study designs to specific problems. The course emphasizes problem solving, rather than rote learning of facts. Formal examination of the participants may therefore be neither easy nor suitable, particularly since the time available is limited. The assessment of whether or not the objectives of the workshop have been achieved must be carried out by the participants themselves, in terms of their personal judgement of the value of the workshop to them.

A questionnaire can be used to record the opinions of the participants. A questionnaire with two parts—pre-workshop and post-workshop (Appendix III)—has been developed specifically for use in conjunction with this workshop. The pre-workshop questionnaire includes questions about the individual objectives of the participants, their preparation for the workshop, and their confidence in teaching certain subjects. The post-workshop questionnaire evaluates the teaching and the facilities, and asks whether the objectives were achieved. The questions concerning confidence in teaching are repeated, which provides an opportunity to ascertain whether any modification or improvement in the curriculum or teaching methods, is required. The questionnaire is a means of measuring the changes (before, during and after the course) in participants' knowledge, skills and abilities.

The questionnaire was developed with the EPIINFO software for microcomputers and the replies can be entered into a data file (this takes 30 seconds per questionnaire) in order to demonstrate the software during the feedback of results. (The software is available from WHO's Division of Environmental Health.)

In addition, a more informal assessment of whether the course objectives were achieved is carried out through a group evaluation discussion period.

A follow-up evaluation, implemented one year after the training workshop, would be appropriate for determining the impact of the workshop on the ability of individual participants to use their knowledge in their work.

8. REFERENCES AND SUPPLEMENTARY READINGS FOR STUDENTS AND TEACHERS

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World Health Organization. *Problem-based training exercises for environmental epidemiology*. Geneva, 1992 (unpublished document WHO/PEP/92.05-B; available in English and French).

World Health Organization. *WHO global strategy for health and environment*. Geneva, 1993 (unpublished document WHO/EHE/93.2).

Materials for illustrating local environmental epidemiology problems can often be found in national publications, especially those produced by ministries of health or national statistics centres. Similarly, national and international medical, public health and epidemiology journals may serve as a source for examples.

APPENDIX I

CHECKLIST FOR PARTICIPANTS' REPORTS ON ENVIRONMENTAL HEALTH PROBLEM AND ASSOCIATED EPIDEMIOLOGICAL STUDY APPROACHES

1. Brief summary of the health problem(s) and the environmental hazard(s) that may cause this problem ("problem statement").

2. Description of the exposure situation and the type and size of the population exposed.

3. Description of the health problems that have been recorded or suspected and the type and size of the population affected.

4. List of the different study approaches that have already been used to investigate this problem.

5. Recommendation(s) for additional studies.

   Select one study design and include the following aspects (optional):

   Problem definition
   Hypothesis formulation
   Selection of study population (including referents)
   Data collection and editing
   Data analysis and statistical evaluation
   Interpretation, conclusions and recommendations.

6. Description of potential follow-up action for prevention that may be indicated.

APPENDIX II

ADDITIONAL TIMETABLE EXAMPLES

Workshops should be planned according to local and national requirements. Thus, for example:

A six-day workshop in the People's Republic of China in 1989 substituted the field investigation with sessions focused on issues related to data-analysis and risk assessment. There were also small group presentations by participants on study approaches.

A five-day workshop in Gambia in 1991 limited the field investigation to one half-day, added sessions on questionnaire design and also included small group presentations of research proposals.

A six-day workshop in the Philippines in 1992 replaced the field trip with extended sessions on study design, teaching approaches, and statistical methods, and sessions on infectious disease epidemiology and disaster epidemiology.

A six-day workshop in Vietnam in 1992 replaced the field investigation with sessions on data reporting techniques, and presentations by workshop participants of study proposals concerning local exposure issues.

A six-day workshop in Nicaragua in 1993 replaced the field investigation with sessions on contemporary issues in environmental epidemiology including surveillance, biological monitoring, screening, decision-making, statistical power and sample size, hazardous waste and disaster epidemiology.

The timetables on the next pages are drawn from past workshops and illustrate further how this particular workshop can be adapted to meet specific needs.

Sample Course Timetable A

	Early morning (e.g. 09.00–10.20)	Late morning (e.g. 10.40–12.00)	Early afternoon (e.g. 13.00–14.20)	Late afternoon (e.g. 14.40–17.00)	Evening (e.g. 19.00–21.00)
DAY 1	1. Opening; introduction; administrative matters; pre-course questionnaire	2. Basic concepts of environmental health; principles and methods of environmental epidemiology	3. Measuring health and disease	4. Presentation of area reports, participants' study problems/experience; rates and ratios	5. Socializing
DAY 2	6. Exercises; discussion; study design I; observational studies	7. Study design II; experimental studies	8. Presentation of area reports, participants' problems/experiences	9. Study design issues; field examples; exercise: study design; issues in participants' problem areas	10. Reporting of exercises
DAY 3	11. Basic statistics I (distribution and summary measures; estimation; data presentation)	12. Basic statistics II (statistical inference; relation between two variables; summary)	13. Exposure and dose (general concepts)	14. Dose and effect relationships; dose and response relationships; exercises (statistics; exposure/dose/effect/ response)	15. Free time
DAY 4	16. Feedback; reading journals; environmental and health services and policies	17. Case study introduction	18. Small group discussion	19. Preparation of case studies; presentation of group reports	20. Free time
DAY 5	21. Communicable disease epidemiology; disaster epidemiology	22. Teaching approaches; post-course questionnaire	23. Demonstration of teaching approaches	24. Workshop planning of action programme: teaching/training, research	25. Free time
DAY 6	26. Regional report on proposed action programme	27. Evaluation of workshop; WHO presentation of Network on Environmental Epidemiology	28. EPIINFO; closing session: closing remarks; award certificates		

Sample Course Timetable B

	Early morning (e.g. 09.00—10.20)	Late morning (e.g. 10.40—12.00)	Early afternoon (e.g. 13.00—14.20)	Late afternoon (e.g. 14.40—17.00)	Evening (e.g. 19.00—21.00)
DAY 1	1. Opening; introduction; administrative matters; pre-course questionnaire	2. Goals and methods; scope of environmental epidemiology	3. Demonstration of problem-based exercise	4. Initial development of research proposal	5. Pre-reading of glossary terms and definitions
DAY 2	6. Basic concepts; terminology (rates; ratios; risks); data sources (health statistics: morbidity; mortality; uses of census data, health centre data)	7. Study design (non-experimental observational studies—descriptive, ecological, analytic)	8. Group project work (determination of research question, key measurements, study design)	9. Group research reports in plenary (hypothesis, study design, data collection)	10. Further work on group project
DAY 3	11. Data quality I & II	12. Data presentation	13. Field trip	14. Field trip	15. Free time or preparatory reading for problem-based exercises
DAY 4	16. Group projects	17. Problem-based exercise	18. Problem-based exercise	19. Experimental studies (randomized trials, field studies); final preparation of group projects	20. Free time
DAY 5	21. Final reports of group projects	22. Environmental health issues of that country; plenary discussion of field trip; post-course evaluation	23. Protocols for investigation of diseases in that country	24. Evaluation of workshop; approaches to environmental health; workshop closure	
DAY 6	26. Plenary discussion of training and research priorities and follow-up	27. Teaching approaches; evaluation of workshop; closing	28. Optional individual tutoring	29. Optional individual tutoring	

Sample Course Timetable C

	Early morning (e.g. 09.00–10.20)	Late morning (e.g. 10.40–12.00)	Early afternoon (e.g. 13.00–14.20)	Late afternoon (e.g. 14.40–17.00)	Evening (e.g. 19.00–21.00)
DAY 1	1. Opening; introduction; administrative matters; overview of environmental & occupational epi in that country	2. Basic principles	3. Group work: review envir & occup health problems in that country; list areas for action and research; list own investig and research experience	4. Feedback; steps in investigations; questions and discussion	5. Free time
DAY 2	6. Exposure, with example	7. Group work: exposure issues—write report; feedback	8. Effects and study design; example to demonstrate effects and issues	9. Study design in outbreak investigation; list types of study design performed in that country	10. Feedback
DAY 3	11. Plenary review of first two days	12. Implementation of studies, data editing, data presentation and analysis	13. Plenary: feedback	14. Dose & effect relationships; dose response; exercises	15. Free time
DAY 4	16. Review first three days; planning a study	17. Group work: preparing a study design	18. Plenary: feedback	19. Uses of epidemiology	20. Plenary: discussion
DAY 5	21. Group work on study design	22. Discussion of participants own studies	23. Feedback and discussion with local tutors	24. Evaluation form and short knowledge test; workshop closure	25. Free time
DAY 6	26. Feedback from groups on study design	27. Discuss course evaluation forms and knowledge test	28. Closure		

Sample Course Timetable D

	Early morning (e.g. 09.00–10.20)	Late morning (e.g. 10.40–12.00)	Early afternoon (e.g. 13.00–14.20)	Late afternoon (e.g. 14.40–17.00)	Evening (e.g. 19.00–21.00)
DAY 1	1. Introduction and opening ceremony	2. Definition of terminology; quality of data available for disease and exposure	3. Study design; population definition	4. Problem-based exercise	5. Free time
DAY 2	6. Bias and	7. .... confounding (cont'd)	8. Examples from participants' experiences for discussion on study	9. .... design, population definition, bias & confounding potential, etc.	10. Feedback
DAY 3	11. Data analysis: cross-sectional	12. .... and cohort	13. Data analysis	14. .... case-control	15. Free time
DAY 4	16. Small groups preparation—first half	17. Presentation by small groups of first half	18. ....: concerning issues in	19. .... study design	20. Free time
DAY 5	21. Data interpretation—risk assessment	22. Small groups preparation—second half	23. Presentation by small groups of second	24. .... half: concerning data analysis issues	25. Free time
DAY 6	26. Finalization of small group presentations	27. Strategies for preventive action (use examples from Day 2)	28. Summary of workshop; open discussion	29. .... of whether goals have been met	

Workshop Programme

	Morning (e.g. 08.30–12.30)	Afternoon (e.g. 14.00–18.00)
DAY 1	1. Opening 2. Sources and types of environmental pollution 3. Toxicokinetics and toxicodynamics	4. Exposure and types of information on exposure 5. Basic concepts and terms 6. Exercise 1: Elements of the environment, agent and populations that determine the exposure
DAY 2	7. Exercise: Elements of the environment, agent and populations that determine the exposure (cont.) 8. Risk approach 9. Study population and type of epidemiological design	10. Exercise 2: Pesticide poisoning 11. Presentation of studies based on the participants' experience 12. Adverse health effects
DAY 3	13. Exercise 3: Fatalities due to sulfurylfluoride exposure 14. Environmental monitoring and exposure limits 15. Biological monitoring, biological exposure indicators and limits	16. Exercise 4: Assessment of the exposure to methylmercury 17. Screening 18. The decision-making process and the opportunity for intervention 19. Bias and confounding factors
DAY 4	20. Causes in environmental health 21. Integration of statistics into epidemiological research 22. Exercise 5: Design studies of exposure populations 23. Statistical power and sample size	24. Data analysis in cohort and in case-control studies 25. Exercise 6: Type of epidemiological studies and risk estimation 26. Exercise 7: Stratified analysis
DAY 5	27. Environmental epidemiological surveillance 28. Environmental health situation in Nicaragua 29. Exercise 8: Risk assessment, and prevention and control strategies 30. Information on the collaborating network in environmental epidemiology in Nicaragua	31. Exercise 9: Main methodological and operating problems in environmental epidemiology in Nicaragua 32. Pesticides and their health effects. Situation in Nicaragua 33. Industrial wastes, water sources contamination, liquid wastes, among others. Situation in Nicaragua 34. Epidemiology in disasters
DAY 6	35. Strategies to increase the practice of environmental epidemiology and training activities 36. Exercise 10: Proposal on training, education, community participation, research and other intervention actions in environmental epidemiology in Nicaragua 37. Evaluation of the workshop 38. Closing	

APPENDIX III

EVALUATION QUESTIONNAIRE

Pre- and Post Workshop

World Health Organization
One-week workshop on
Environmental Epidemiology

EVALUATION QUESTIONNAIRE
Before workshop

1. Code : _____

2. Country : _____

3. The stated overall objectives for this workshop are:

   * to reinforce and extend the participants' knowledge of basic principles and methods of epidemiology and environmental health

   * to encourage participants to use the materials and new knowledge from the workshop in local or national training activities.

   Do you have additional specific individual objectives and goals in attending this workshop? Please list:

   a. _____

   b. _____

   c. _____

4. Did you receive any of the training materials in advance of the workshop? _ Yes [ ] No [ ]

   * If yes,

   How much of the materials did you read? _ All 5 [ ] Some 4 [ ] 3 [ ] 2 [ ] None 1 [ ]

   Were they sent out sufficiently in advance? _ Yes [ ] No [ ]

Was the language easy to understand?		Easy 5	4	3	2	Hard 1
	_	[ ]	[ ]	[ ]	[ ]	[ ]
Was the level of difficulty correct?		Too easy 5	4	Just right 3	2	Too hard 1
	_	[ ]	[ ]	[ ]	[ ]	[ ]
Was the information new or old for you?		All old 5	4	3	All new 2	1
	_	[ ]	[ ]	[ ]	[ ]	[ ]
Was the length of the materials appropriate?		Too short 5	4	3	Too long 2	1
	_	[ ]	[ ]	[ ]	[ ]	[ ]

* Other comments on these materials :

_____

_____

5. Please rate your ability to explain each of the following epidemiological concepts or distinctions to a group of students:

		very confident 5	4	3	2	very unsure 1
a. prevalence vs incidence	_	[ ]	[ ]	[ ]	[ ]	[ ]
b. rate difference vs rate ratio	_	[ ]	[ ]	[ ]	[ ]	[ ]
c. cross-sectional vs cohort study design	_	[ ]	[ ]	[ ]	[ ]	[ ]
d. odds ratio	_	[ ]	[ ]	[ ]	[ ]	[ ]
e. dose-response relationship	_	[ ]	[ ]	[ ]	[ ]	[ ]
f. confounding vs interaction	_	[ ]	[ ]	[ ]	[ ]	[ ]
g. selection bias vs information bias	_	[ ]	[ ]	[ ]	[ ]	[ ]
h. healthy worker effect	_	[ ]	[ ]	[ ]	[ ]	[ ]
i. p-value vs confidence interval	_	[ ]	[ ]	[ ]	[ ]	[ ]
k. age-adjustment of rates	_	[ ]	[ ]	[ ]	[ ]	[ ]

6. Please rate your ability to explain the following environmental/occupational health concepts issues to a group of students:

		very confident 5	4	3	2	very unsure 1
a. local effects vs. systemic effects	_	[ ]	[ ]	[ ]	[ ]	[ ]
b. biological half-time	_	[ ]	[ ]	[ ]	[ ]	[ ]
c. indicators of exposure	_	[ ]	[ ]	[ ]	[ ]	[ ]
d. biological monitoring	_	[ ]	[ ]	[ ]	[ ]	[ ]
e. risk assessment vs risk management	_	[ ]	[ ]	[ ]	[ ]	[ ]
f. the major biomass fuel indoor air pollutants	_	[ ]	[ ]	[ ]	[ ]	[ ]
g. respirable fraction of airborne dust	_	[ ]	[ ]	[ ]	[ ]	[ ]
h. accumulation in the food chain	_	[ ]	[ ]	[ ]	[ ]	[ ]
i. external vs. internal dose	_	[ ]	[ ]	[ ]	[ ]	[ ]
k. the major natural hazardous trace						

elements in drinking water _ [ ] [ ] [ ] [ ] [ ]

7. For each of the following questions, please indicate whether you have previously had the specified type of experience in epidemiology:

a. formal training in epidemiology? _ Yes [ ] No [ ]
If yes, please specify (type,length):

b. carrying out epidemiologic research? _ [ ] [ ]
If yes, please specify:

c. teaching epidemiology? _ [ ] [ ]
If yes, please specify:

d. using epidemiologic findings and/or approaches in day-to-day public health work? (for example, to propose public policy or intervention measures)? _ [ ] [ ]
If yes, please specify:

e. communicating the implications of an epidemiologic study to the general public? If yes, please specify: _ Yes [ ] No [ ]

8. a. What is your current position of employment?

_____

b. Do you have in this position responsibilities that relate to environmental health or epidemiology? _ Yes [ ] No [ ]

If yes, please list:

_____

_____

9. Have you participated in other WHO courses workshops or meetings in the last five years ? _ Yes [ ] No [ ]

If yes, how many ?: _

Which topics ?:

10. Teaching processes.

		Definitely Yes				No, not at all
		5	4	3	2	1
a. Were you satisfied with the presentations and explanations by the teachers ?	_	[ ]	[ ]	[ ]	[ ]	[ ]
If no, please explain:						
b. Were you satisfied with the discussion						
at the plenary sessions ?	_	[ ]	[ ]	[ ]	[ ]	[ ]
at the group sessions ?	_	[ ]	[ ]	[ ]	[ ]	[ ]
If no, please explain:						

		Yes	No
c. Were there any topics for which more time should have been allotted ?	_	[ ]	[ ]

If yes, which topics ? _____

		Yes	No
d. Were there any topics for which less time should have been allotted ?	_	[ ]	[ ]

If yes, which topics ? _____

		Definitely Yes				No, not at all
		5	4	3	2	1
e. Were you able to express your ideas or problems during the sessions ?	_	[ ]	[ ]	[ ]	[ ]	[ ]
If no, please explain:						
f. Was there enough opportunity to exchange knowledge and experience with other participants ?	_	[ ]	[ ]	[ ]	[ ]	[ ]
If no, please explain:						

11. Teaching materials.

Were the handout materials received during the workshop		Definitely Yes 5	4	3	2	No, not at all 1
a. Satisfactory ?	_	[ ]	[ ]	[ ]	[ ]	[ ]
b. Understandable language ?	_	[ ]	[ ]	[ ]	[ ]	[ ]
c. Too difficult ?	_	[ ]	[ ]	[ ]	[ ]	[ ]
d. Too long ?	_	[ ]	[ ]	[ ]	[ ]	[ ]

12. Organization of the workshop.

Were the duration and scheduling of different activities (lectures, group work, etc.) satisfactory ?		Definitely Yes 5	4	3	2	No, not at all 1
	_	[ ]	[ ]	[ ]	[ ]	[ ]

If no, please explain:

13. Facilities.

		Definitely Yes 5	4	3	2	No, not at all 1
a. Were the library and information facilities satisfactory ?	_	[ ]	[ ]	[ ]	[ ]	[ ]
b. Were the secreterial facilities adequate?	_	[ ]	[ ]	[ ]	[ ]	[ ]
c. Was the meeting room adequate ?	_	[ ]	[ ]	[ ]	[ ]	[ ]

14. Administrative aspects (if relevant).

Were the arrangements for travel, accommodation, per diem, etc. satisfactory ?		Definitely Yes 5	4	3	2	No, not at all 1
	_	[ ]	[ ]	[ ]	[ ]	[ ]

If no, please explain:

15. Educational gains.

a. Were the stated objectives met:		Definitely Yes 5	4	3	2	No, not at all 1
to reinforce and extend the participants' knowledge of basic principles and methods of epidemiology and environmental health"	_	[ ]	[ ]	[ ]	[ ]	[ ]
to encourage participants to use the materials and new knowledge from the workshop in local or national training activities "	_	[ ]	[ ]	[ ]	[ ]	[ ]
any individual objectives you had ?	_	[ ]	[ ]	[ ]	[ ]	[ ]

If no, please explain:

b. Did you learn new skills or concepts ? _ [ ] [ ] [ ] [ ] [ ]

c. Can these skills be applied in your work ? _ [ ] [ ] [ ] [ ] [ ]

Please, explain:

16. Please rate your ability to explain each of the following concepts or distinctions to a group of students:

		very confident 5	4	3	2	very unsure 1
a. prevalence vs incidence	_	[ ]	[ ]	[ ]	[ ]	[ ]
b. rate difference vs rate ratio	_	[ ]	[ ]	[ ]	[ ]	[ ]
c. cross-sectional vs cohort study design	_	[ ]	[ ]	[ ]	[ ]	[ ]
d. odds ratio	_	[ ]	[ ]	[ ]	[ ]	[ ]
e. dose-response relationship	_	[ ]	[ ]	[ ]	[ ]	[ ]
f. confounding vs interaction	_	[ ]	[ ]	[ ]	[ ]	[ ]
g. selection bias vs information bias	_	[ ]	[ ]	[ ]	[ ]	[ ]
h. healthy worker effect	_	[ ]	[ ]	[ ]	[ ]	[ ]
i. p-value vs confidence interval	_	[ ]	[ ]	[ ]	[ ]	[ ]
k. age-adjustment of rates	_	[ ]	[ ]	[ ]	[ ]	[ ]

17. Please rate your ability to explain the following environmental/occupational health concepts issues to a group of students:

		very confident 5	4	3	2	very unsure 1
a. local effects vs. systemic effects	_	[ ]	[ ]	[ ]	[ ]	[ ]
b. biological half-time	_	[ ]	[ ]	[ ]	[ ]	[ ]
c. indicators of exposure	_	[ ]	[ ]	[ ]	[ ]	[ ]
d. biological monitoring	_	[ ]	[ ]	[ ]	[ ]	[ ]
e. risk assessment vs risk management	_	[ ]	[ ]	[ ]	[ ]	[ ]
f. the major biomass fuel indoor air pollutants	_	[ ]	[ ]	[ ]	[ ]	[ ]
g. respirable fraction of airborne dust	_	[ ]	[ ]	[ ]	[ ]	[ ]
h. accumulation in the food chain	_	[ ]	[ ]	[ ]	[ ]	[ ]
i. exposure vs. dose	_	[ ]	[ ]	[ ]	[ ]	[ ]
k. the major natural hazardous trace elements in drinking water	_	[ ]	[ ]	[ ]	[ ]	[ ]

18. Overall conclusion.

Do you feel that -		Definitely Yes 5	4	3	2	No, not at all 1
a. such workshops should be held regularly ?	_	[ ]	[ ]	[ ]	[ ]	[ ]
b. your attendance was worthwhile for you personally ?	_	[ ]	[ ]	[ ]	[ ]	[ ]
c. your attendance was worthwhile for the institution where you work ?	_	[ ]	[ ]	[ ]	[ ]	[ ]

Please explain your answers:

19. Follow-up.

		Definitely Yes				No, not at all
		5	4	3	2	1
a. As an outcome of this workshop are you planning any new or expanded activities in environmental epidemiology ?	_	[ ]	[ ]	[ ]	[ ]	[ ]

If yes, please explain:

b. Would you like continued cooperation with WHO to develop such activities ?	_	[ ]	[ ]	[ ]	[ ]	[ ]

If yes, in which way can we best cooperate ?:

20. Any other comments or suggestions for this type of workshop:

APPENDIX IV

SAMPLE WORKSHEET QUESTIONNAIRE

Risk

Instructions:

Please respond to the following questions in the space provided.

1. **Why do some people become sick when others don't?**

2. **Give two examples each of "risk factors related to person, place and time".**

3. **Name four important occupational and environmental health risk factors.**

4. **What is the difference between hazard and risk?**

5. **In Mexico, which population groups are more likely to be at risk of exposure to motor vehicle air pollution?**

6. **In Mexico City, which population groups are more susceptible to developing respiratory problems due to exposure to motor vehicle air pollution?**

7. **You would like to estimate the risk of lead poisoning developing among workers in a lead battery plant. What information would you need in order to measure their level of risk?**

Possible Answers to Worksheet Questionnaire on Risk

1. Why do some people become sick when others don't?

It may appear that some people develop cancer or heart disease without rhyme or reason. For example, in a hospital you see patients who are old, young, rich and poor. But if you study populations and look at patterns of disease occurrence you find that there are factors that are more likely to be associated with the probability of developing or not developing specific diseases. For example, alcoholics are more likely to suffer from liver disease, the obese are more likely to suffer from heart disease, asbestos workers are more likely to suffer from lung cancer, Hiroshima survivors are more likely to suffer from leukaemia. Generally, these factors are related to characteristics of person, place and time.

2. Give two examples each of "risk factors related to person, place and time".

Person: genetics, socio-economic status, occupation, race, sex, age, etc.

Place: residence, north-south (e.g. climatic difference and susceptibility to skin cancer), hazardous waste, air and water pollution

Time: night-time driving, summer heat stroke, time during which fields sprayed with pesticides, winter hypothermia

3. Name four important occupational and environmental health risk factors.

There are various ways of categorizing occupational and environmental risk factors:

a. based on media: air, water, food, soil pollution
b. based on type: chemical, physical, biological, psychosocial
c. based on substance: lead, asbestos, pesticides, sulfur dioxide

4. What is the difference between hazard and risk?

Hazard: a factor or exposure that may adversely affect health.

Risk: if exposed to a hazard, the likelihood of developing adverse health effects.

For example, asbestos is a hazard, but may not pose a risk in all forms, e.g., in a jar (i.e. there is no risk if the asbestos is contained to prevent exposure).

5. In Mexico, which population groups are more likely to be at risk of exposure to motor vehicle air pollution?

Distinguish the general population from sub-populations who are more likely to be at risk of adverse outcome: city dwellers (versus rural), mechanics/gas station workers, toll takers, traffic police, bus and taxi drivers.

6. **In Mexico City, which population groups are more susceptible to developing respiratory problems due to exposure to motor vehicle air pollution?**

Among the exposed population, there may be personal characteristics that render some people more susceptible to the development of disease than others ("hyper-susceptibility"). E.g. genetics (cystic fibrosis), age (infants and young), pre-existing health conditions (asthma, chronic obstructive lung disease, heart disease), or other personal factors (e.g. tobacco use, occupational exposures).

7. **You would like to estimate the risk of lead poisoning developing among workers in a lead battery plant. What information would you need in order to measure their level of risk?**

Emphasize the need to first define a case definition to know exactly what is being measured. Then emphasize the need to define a time period, distinguish prevalence from incidence, distinguish overall from specific sub-group risks (e.g. age, sex, job-title), and the need to carefully define the population at risk.

a. Prevalence: Here you will be looking at all workers—what percent have lead poisoning? You will need time period, number of existing cases, number of workers.
b. Cumulative incidence: Here you will be looking at new cases over a particular time period. You will need the time period, number of new cases, number of workers.
c. Job-specific incidence: Here you will be looking at new cases among particular job categories. You will need the time period, number of new cases for each job category, number of workers in each job category.

THE GLOBAL ENVIRONMENTAL EPIDEMIOLOGY NETWORK

G E E N E T

GEENET

The Network was established in 1987 as a means for the World Health Organization to strengthen education, training and research in institutions involved in epidemiological teaching and research on the health effects of environmental hazards, and other epidemiological applications in environmental and occupational health.

The Network aims at improved communication and collaboration between institutions in this field in developed and developing countries. A series of documents with information of value for training and research developement is prepared for the Network and lists of Network members are distributed on a regular basis. Training and research promotion workshops are organized in collaboration with national and international agencies.

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