Introduction to basic epidemiology and principles of statistics for tropical diseases control

Part II
Tutor's Guide

World Health Organization
Geneva
2000

Contents

Preface

This module uses a problem-solving approach to facilitate the learning of some basic epidemiological concepts and practices and simple statistics. It is designed for health workers responsible for tropical diseases control. It is considered to be fundamental to the learning of the epidemiological approach to malaria control and for a situation analysis.

The module is designed to stimulate active learning. The structure of the module can be seen from the table of contents. It is divided into two parts: *Learner's Guide* (Part I) and *Tutor's Guide* (Part II). The *Learner's Guide* contains basic information and exercises. The *Tutor's Guide* contains suggestions for using this training module and provides suggested answers to the exercises.

The module can be used in different ways. It is primarily created for group work as one element of a comprehensive training course on basic malariology and planning malaria control. The module can also be used separately for epidemiology or in-service training at appropriate levels of the health services. It can be a useful component of any programme for training in tropical disease control at the district and national levels. The *Learner's Guide* can be used for individual work. The *Tutor's Guide* is intended to supplement the tutor's own knowledge and experience and to guide the facilitators, or, in the case of individual study, to be used as an answer book.

The training using this module is designed to be accomplished in 26 hours including one hour each for the pre and post tests (see page 18 for a proposed timetable).

The module was developed by Dr N. Binkin whilst on assignment to the International Course for Primary Health Care Managers and the Laboratory of Epidemiology and Biostatistics at the *Istituto Superiore di Sanità* in Rome, Italy. At the time of the module's development, Dr Binkin was a WHO staff member of the Division of Strengthening of Health Services, HQ, Geneva. The author wishes to acknowledge the help of Dr P.F. Beales, the late Dr R.L Kouznetsov and Dr F.A. Rio in reviewing the document and reorganizing it into a two-volume training module. The technical editing of the module was undertaken by Dr F.A. Rio of the Training Unit, Division of Control of Tropical Diseases, WHO, Geneva.

The development of this training module was supported by a financial contribution from the World Bank.

Introduction

This *Tutor's Guide* is designed primarily to help those responsible for training health workers and tropical diseases control personnel in basic epidemiology and simple statistics. Some parts of it should be useful even to the most experienced teachers. The style of writing has been kept simple, to avoid misunderstandings and to facilitate translation into local languages.

It is essential that you read the whole of the *Learner's Guide* (Part I of the training module) before planning your training programme, rather than reading only the Unit that relates to your next teaching session.

This introduction will help you understand the role of tutor and facilitator in this training system and explain why the *Learner's Guide* is designed the way it is.

For whom is this training module intended?

The module is intended for health workers who are responsible for planning, managing, implementing, evaluating or teaching the control of tropical diseases, especially (but not only) malaria. It can be used alone for a special course or as one element of a more comprehensive course on disease control.

Educational level of learners

The appropriate educational or entry level of learners will depend upon a number of factors. Experience in many parts of the world has shown that health workers from a wide range of educational backgrounds can be accepted for training in this subject. However, if the entry level is relatively low, the period of training may need to be extended. On average, it should be possible to teach the contents of this module in four days.

Apart from educational requirements, it is equally important that learners:

- be able to read, comprehend and write simple English (or the language into which the module is translated);
- systematically follow a set of written instructions;
- have good hearing and eyesight;
- be sympathetic to the health problems of the community.

This list is not necessarily complete: another requirement might for instance be willingness to work for long periods in rural areas far from home. Often, it will be impossible to interview candidates directly. It then becomes particularly important, when writing to those who will select learners for the course, to indicate the most suitable type of person.

How is the training designed and what are its contents?

The training module is intended to facilitate the teaching of basic epidemiological tasks and the appropriate use of some simple statistics to health workers and disease control personnel. The principal objectives of the training are listed in the Introduction to the *Learner's Guide* (pages 7-10). **Please stop and read these now.**

This training system deals with basic epidemiology and simple statistics in a practical sequence. For example, learners are taught rates, ratios, and proportions before surveillance and surveys. In other words, the learners acquire, step by step, the knowledge and skills they need for the tasks involved in basic epidemiology and simple statistics. This type of training may be referred to as **performance-based** or **competency-based**. When carried out properly, it is highly effective. It is also very economical: training is kept as short as possible, yet participants learn all they need to perform the required tasks competently. This saves time, money and resources.

A list of training objectives appears at the beginning of each Learning Unit in the *Learner's Guide*. Learning objectives summarize the knowledge, skills and attitudes that each learner should have acquired by the end of that Unit. The Tutor and Facilitators must satisfy themselves that each learner has achieved the stated objectives before proceeding to the next Learning Unit. (Methods of evaluating progress are described later).

While it is more convenient to have all the learners working together or in small groups on each Learning Unit, this programme allows for slower learners to work through each Unit at their own pace. However, careful planning is essential if the brighter participants are not to become bored.

Who runs the course?

The are responsible for organizing and running the course. The *Learner's Guide* and *Tutor's Guide* will help you, but the final results will depend upon the efforts of the Tutor and Facilitators. For some, this may be the first time they organize and run such a course; others may be experienced in these courses. In either case, it is important to use the *Learner's Guide* and the *Tutor's Guide* together whilst proceeding through the Learning Units.

Who helps in the course?

The Tutor's job will be easier, and teaching more effective, if one or more persons help. These assistants, who should have working experience in the subject, are called **Facilitators**. Learners can thus be divided into small groups of perhaps five, allocating one facilitator to each group. The greater interaction this allows between the learners and the facilitators results in improved learning and understanding.

As overall manager of the training programme, the Tutor will be responsible for designing the timetable, explaining the learning tasks to the learners and facilitators, and giving learners and facilitators whatever help they need. Facilitators need not necessarily be trained as teachers: their task is to explain or demonstrate a particular activity and to watch the learners perform it. They must also be able to admit to learners when there is something that they do not know and be prepared to refer the question or problem to you. Tutor and Facilitators must keep in mind the fact that no one person can be expected to know everything about a particular subject. There is no shame in saying " I do not know, but I will find out for you".

Many problems can be avoided by giving facilitators plenty of time to read the *Learner's Guide* and discuss with the Tutor any part of it that may need clarification. It would be a good idea for the Tutor and Facilitators to go through the module together; testing their knowledge through appropriate questions.

There are many approaches to epidemiology and statistics. This training module describes and attempts to standardize well-tried methods already used in many parts of the world.

Why provide a *Learner's guide*?

Providing learners with a full set of notes ensures that:

- all learners have exactly the same set of notes, and thus avoid unnecessary note-taking during lessons;
- tutor and Facilitators can refer to any part of the *Learner's Guide* knowing that all learners can find the right page quickly;
- learners can spend more time reading the notes, and therefore have a greater chance of understanding them, because there is no need to write up notes taken during class;
- there is no chance of learners making errors in note-taking;
- after the course, each learner can take home a copy of this Learner's Guide and the *Tutor's Guide* as a helpful reference in his or her daily work and perhaps also to use in teaching others.

How is the course run?

This subject is dealt with on pages 8-10 of the *Learner's Guide*: **please stop and read these now.**

As stated in the *Learner's Guide*, classroom presentations should be kept to a minimum. The use of examples, individual and group exercises and discussion groups are all more effective ways of teaching.

Learners who are actively involved learn more, and better, than those who simply sit and listen to someone talking for long periods of time.

Use of the *Tutor's Guide* and *Learner's Guide*

The *Tutor's Guide* and the *Learner's Guide* may be used together for basic group training and for in-service training. The *Learner's Guide* may be used alone for refresher training, or by individuals for reference.

The way in which Tutor and Facilitators should make use of the Guides and the audiovisual aids will become apparent when working through the training module.

Learners will follow the group training activities using the *Learner's Guide* plus whatever other materials you provide them with.

Training facilities

Basic facilities and equipment must be organized before training can begin. In some countries these are readily available but in others it may be necessary to improvise or to modify existing equipment. It must be borne in mind that there may be long intervals between ordering supplies and getting them delivered, but training should not be delayed unnecessarily because equipment is imperfect or scanty.

Ideally, one large room should be available for training. The room can be used for group discussions, presentations, and for the overhead and slide projectors (it is also an advantage if smaller rooms are also available for small-group work, but this is not essential, see *Arrangement of the meeting room* hereafter). Chairs and small tables or desks will be needed. Whatever the conditions, learners should be as comfortable as is possible in the circumstances: surprisingly much may be achieved even with limited facilities.

Teaching equipment

For teaching sessions and group discussions, the following items should ideally be available:

- Overhead projector.
- Screen for slide projection (a white sheet is an adequate substitute, but the white-board is unsuitable because it will reflect projected light).
- Flipcharts—one for each small group of learners. Supplies of "butcher's paper" or "newsprint" are usually cheap and readily available.
- Large blackboard or white-board.
- Chalks for blackboard or marker pens for white-board, in a selection of colours.
- Acetate sheets for overhead projector.
- Coloured marker pens for acetate sheets (including some permanent markers for diagrams you may wish to keep).

Learners' equipment

Each learner should receive the equipment listed below. Where supplies have to be ordered, this should be done well in advance of the course; since many items are difficult to obtain at short notice.

- *Learner's Guide.*
- Notebook. This should be used only for occasional notes or instructions; as explained earlier, there should normally be no need for notes to be taken during training sessions.
- Arithmetic (squared) paper
- Semi-log paper
- Ballpoint pen.
- Set of pencils (medium-hard graphite, plus red, blue, brown and black) for drawing charts and graphs during practical sessions.
- Pencil sharpener.
- Eraser.
- Ruler.
- A simple hand held calculator.

Syllabus and timetable

The syllabus

The contents list of the *Learner's Guide* represents the syllabus—the list of subjects to be covered—for the training course. Planning the course is made easier by the division of each Learning Unit into a number of subunits or main topics. It is necessary for the Tutor to go through each of the Learning Units in turn; and to decide for each subunit the amount of time needed and the most suitable kind of training activity. For example, Learning Unit 1 – Introduction to epidemiology – has six learning objectives and is divided into four main sections. This unit can be dealt with through presentations and through questions and answers. On the other hand, Learning Unit 2 – Rates, ratios and proportions – has five learning objectives and five main sections. This unit needs to be dealt with through presentation, numerous examples, individual and group exercises involving the Facilitators and the Tutor.

The following is a list of the various learning activities that can be used:

- *Group discussion*

Once participants get used to group discussions, the two-way exchange of information between them and the Facilitators makes this a very effective learning activity. People share their knowledge and experiences with the rest of the group and stimulate each other's thoughts on the subject in hand.

- *Practical exercises*

Practical exercises may be undertaken individually or in groups in the classroom. Their purpose is to give learners the opportunity to practise the procedures involved. The more practice learners have, the more competence they will acquire.

- *Demonstrations, examples*

These are designed to reinforce the learning process. Clear examples help to clarify concepts and concretize principles of epidemiology and statistical calculations and methods.

Evaluation

Judging whether or not the course was a good one is difficult and involves answering the following questions:

How well did the group learn?

This may be determined by evaluating the learners' performance as they work through the Learning Units and again, at the end of the training, by evaluating the level of **skill, competence**, and **knowledge** that learners have achieved in this subject. This may be done by the use of pre-and post-tests; examples of questions to that purpose are to be found in Annex 1. More details on evaluation are given later and in the *Learner's Guide*. A further evaluation of how well the learners have retained their knowledge, skills and competence may be required 10-12 months after the end of the course.

How did the learners view the training?

Learners' answers to this question will yield valuable information on how useful they find this type of training (a suitable questionnaire is provided in Annex 3). Allowing learners to answer anonymously will encourage frankness.

Feedback provided during the course helps assess how well the training is being received and to make any improvements needed. Feedback received at the end of the course helps improve future programmes. If the course has been carefully prepared, feedback is likely to be favourable, which is rewarding both for the Tutor and for the Facilitators.

Whatever the government policy may be regarding the award of a certificate of competence, some record of attendance and level of competence reached by each learner should be kept so that details may be checked later.

Whether this module is used for group training or for individual learning, it is essential, both for the learners and for the Tutor and facilitators, to assess progress made by the learners in gaining skills and competence in the subject matter. This can be accomplished by means of a pre-test given before the learner reads the *Learner's Guide*. To be valid, this test must be the learner's own work. Annex 2 provides suggestions for pre- and post-test questions together with the answers. The post-test should be administered only after all the learning units have been completed. Since the answers to the evaluation questions, and to the exercises, are included in the *Tutor's Guide*, it is essential that learners do not have access to this Guide until after the training activity has been completed.

The results of the pre-test can be used in two ways. The Tutor may use it to ascertain the general level of knowledge on the subject among the group, and to obtain an indication of weak areas that need emphasis and areas of general knowledge that can be de-emphasized. The results may also be used to identify individuals who might be used as Facilitators for certain subject areas. The other major use of the pre-test is as an individual base-line comparator to measure gains in knowledge, skills and competence at the end of the training as revealed by the post-test.

To be valid, the questions in the post-test should be of the same difficulty as the questions in the pre-test and both tests should be given under the same conditions and the same length of time. The only sure way of knowing that the questions in the post-test are of equal difficulty to those in the pre-test is to give the same questions but in a different order (and, in the case of multiple choice questions, with the answers also in a different order). It is thus essential that the pre-test papers be collected up and retained (not handed back to the participants). In any event, it is not necessary for the participant to know the results of the pre-test until the end of the training, when these results are used to determine progress.

The Tutor is encouraged to develop a bank of questions that can be used for pre- and post-testing in subsequent training sessions. The answers to sample pre- and post-test questions are provided separately in this *Tutor's Guide* to allow easy reproduction of question papers. The answers are scored equally because each question is considered, in this instance, to be of equal value. The

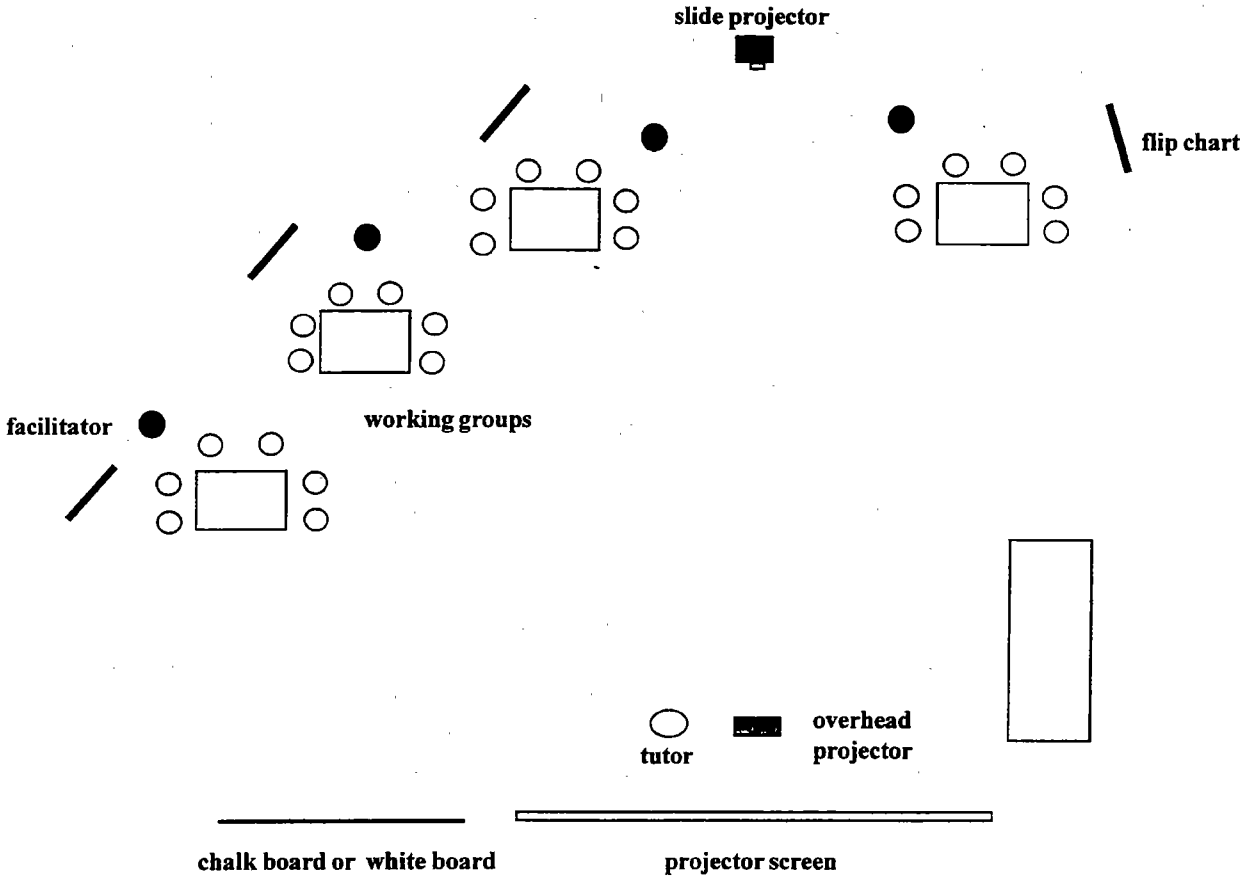
preferred answers have been provided, but in some instances alternative responses are acceptable, and these have been noted.

A questionnaire to be completed at the end of the course by the participants (Annex 3) can be used to evaluate the educational activity. Another questionnaire may be completed by learners at the end of each learning unit. Examples can be obtained from the WHO Training Unit, Division of Control of Tropical Diseases, HQ, 1211 Geneva 27, Switzerland.

Arrangement of the meeting room

The number of working groups should be decided upon in advance. Groups of 6 to 8 are best. This will depend upon the number of learners and number of facilitators available. The room should be arranged in such a way that participants sit in groups, in more or less a semi-circle as in the diagram. Everyone must have a clear view of the blackboard and projector screen.

The composition of each group can be changed occasionally or left the same throughout the course. For the pre- and post-test evaluations, however, participants must be seated apart from one another under examination conditions. However, the group activities can all take place in the same room and time is saved by not having to change places.


slide projector
flip chart
facilitator
working groups
tutor
overhead projector
chalk board or white board
projector screen

Introduction to the course

The very first session with the learners in the meeting room should be preferably with the seating in a semicircular arrangement as indicated in the diagram. If the chairs do not have fixed supports for notebooks, it would be helpful to have small desks or tables available.

The Tutor should first introduce himself or herself and write his or her name on the board or flipchart, telling the learners a little about his or her background and job. Each of the facilitators is then asked to do the same thing.

The learners introduce themselves next. It might be helpful to divide the learners into pairs and ask them to exchange names, information about jobs, home towns, etc. Each learner can then introduce his or her partner to the whole group. This method often has the effect of reducing tension, and a relaxed atmosphere is a good learning atmosphere.

The learners will have been given their copies of the *Learner's Guide.* After 10 minutes or so to read through its Introduction, the Tutor shall briefly deal with the various topics covered, explaining, for instance, that working in small groups with facilitators should make learning easier, and that there should be little need to take notes during the course. It must be stressed that the course will involve a great deal of exercises, since this is the best way to acquire the necessary skills. The objectives of the various Learning Units must be discussed so that the learners understand exactly what they should have achieved by the end of the course. One important point is that the learners should keep these objectives in mind throughout the course and always ask for help if they feel uncertain of having achieved them. Each learner is likely to be more aware than the facilitators of how well he or she has understood a particular topic or has mastered a particular skill—it is the job of the facilitators to make the learning process as effective as possible.

The learners should at that time be encourage the to discuss the training programme - what they expect of it, what aspects of it are worrying them, and so forth. The Tutor should explain that both Tutor and Facilitators will welcome feedback throughout the course—constructive criticism from the learners will help you improve the training programme. Other questions should be dealt with at this time.

The Tutor should finally explain that evaluation will be a continuous process throughout the training course, stressing that pre and post-tests are part of the learning experience and should be enjoyed rather than feared. Their purpose is to allow an assessment of the learners' starting level, to correct mistakes and clarify misunderstandings. It must be emphasized that learners must read all the questions (and any supplementary instructions) very carefully. Everyone will learn at different speeds and that you and the facilitators will make as much allowance for this as possible.

Timetable

Once you the amount of time that needs to be spent on each subunit has been calculated, the various learning activities must be fitted into the framework of the training programme. The duration of the programme may be something over which there is little control: shortage of funds may for instance limit the programme to 3 days, even though it should ideally be spread over 4 days. The Tutor and Facilitators will then need to spend time reorganizing the timetable so that all the learning activities can be fitted into the time available.

The timetable must allow time for evaluation both during and after the course, and for "hidden" activities, such as getting settled into group work, delays in transportation to training facility and so on. A suggested timetable for a 4 day training course is shown in Figure 1, but again is provided only as a guide. It is based on a 7-hour working day—four hours in the morning and three in the afternoon; this may not always be suitable may have to be adapted. A certain amount of time is unallocated, especially in the morning sessions, to provide for further discussion on some topics. These activities can be fitted into the "free" periods and a discussion session on the afternoon of the last day can also be used in a flexible manner.

Figure 1 : Suggested timetable

Period	Day 1	Day 2	Day 3	Day 4
A.M.	Introduction to the course and how it will function (40 minutes) Pre-test (60 minutes) Introduction to epidemiology (40 minutes) BREAK (20 minutes) Exercises: Rates, ratios and proportions, (80 minutes)	Measures of central tendency – mean, median, mode (40 minutes) Exercises: Measures of central tendency (40 minutes) Measures of variability (40 minutes) BREAK (20 minutes) Exercises: Measures of variability (40 minutes) Exercises: Group presentation, data presentation (60 minutes)	Survey: overview of methods and steps (40 minutes) Exercises: Survey (20 minutes) BREAK (20 minutes) Survey: sampling (60 minutes) Exercise: Survey – sampling (90 minutes)	Survey: Analysis (75 minutes) Exercises: Survey – Analysis (75 minutes) Sensitivity and specificity (60 minutes 10 minutes) BREAK (20 minutes) Sensitivity and specificity (80 minutes)
P.M.	Principles of surveillance and the evaluation of surveillance systems (40 minutes) Evaluation of exercises on surveillance (40 minutes BREAK (15 minutes) Data presentation - tables, graphs, and charts (40 minutes) Exercises: Data presentation (45 minutes)	Health facility-based studies (60 minutes) BREAK (15 minutes) Exercises: Health facility-based studies (105 minutes)	Survey: questionnaire design (45 minutes) BREAK (15 minutes) Exercises: Survey – questionnaire (80 minutes)	Exercises Sensitivity and specificity (75 minutes) BREAK (15 minutes) General discussion on basic epidemiology and simple statistics (30 minutes) Post-test (60 minutes)

LEARNING UNIT 1

Introduction to epidemiology

As the learning objectives state, this Unit is intended to help learners achieve the following :

- provide a definition of epidemiology
- provide a definition of surveillance
- outline the purpose of descriptive studies
- describe the major types of descriptive studies and their primary uses
- outline the purpose of analytic studies
- describe the major types of analytic studies

The learner's guide provides a definition of epidemiology and briefly describes the purpose of various descriptive and analytic studies, but you should be particularly careful to check that learners have understood the role of these studies for tropical diseases control. Stimulate discussion; be particularly careful to explain any items that might be misunderstood, so that misconceptions are eliminated from the outset.

Remind learners that they should take the time to read Learning Unit 2 of the Learner's Guide in preparation for the next session.

LEARNING UNIT 2

Rates, ratios, and proportions

As the learning objectives state, this Unit is intended to help learners achieve the following :

- define the terms rate, ratio and proportion
- outline the difference between incidence rate and prevalence rate and give examples of their uses.
- explain how to differentiate point prevalence from period prevalence
- explain how to determine the correct denominator for the calculation of each of these terms
- provide examples for calculations of rates, ratios, and proportions using appropriate numerators, denominators, and constants
- apply the concepts of rate ratios and rate differences.

Describe briefly the terms mentioned above, the purposes for which these measurements are used and their primary users. Illustrate your presentation with simple examples.

Exercises on rates, ratios, and proportions

For conducting the exercise session it is best to have the learners in your class work individually, although if some are particularly weak in mathematics, you may wish to have them work in pairs with those who are more comfortable with numbers. You and the facilitators may wish to circulate around the room as they are working to help anyone who is having difficulties. For some of the calculations, the learners may write their results in a slightly different way than expressed here. For example, 9/100 can also be expressed as 90/1000. In general, one should either follow convention (infant mortality is always

expressed per 1000 live births for example) or use the figure that leaves one digit to the left of the decimal point for the smallest rate in a series.

Exercise 1

(a) The number of cases has increased steadily, and in 1994 there were more than twice as many cases as in 1990.

(b) The rate per 100 is calculated by taking the number of cases divided by the population and multiplying by 100.

YEAR	RATE / 100
1990	6.3
1991	6.2
1992	6.2
1993	6.3
1994	6.6

The rate has been relatively stable over the five-year period, although it appears to be increasing in 1993 and 1994.

(c) While the number of cases has increased very rapidly, so has the population. The rate, therefore, has remained relatively stable.

(d) The rate, because it takes into account the changes in population size, provides a more realistic idea of the amount of disease in the population.

Exercise 2

(a) The rate in province Z is 9.0/100, much higher than the rate of 6.6/100 seen in province X.

(b) Although the disease rate is much higher in Province Z, this province has a much smaller population. A decision on allocation of funds will depend on a variety of factors. If the goal of the malaria programme is to prevent as many cases of malaria as possible, funds may be better spent in Province X, where the rate is somewhat lower but the population and total number of malaria cases is much larger. We should also find out if the rate in Province Z is stable or is changing rapidly.

Exercise 3

(a) 47%.

(b) A prevalence rate since it measures all cases of parasitaemia at the time of the survey, some of which may have just occurred and some of which are likely to have been going on for some period of time.

Exercise 4

(a) Ratio = 49 140:23 250 = 2.1:1 (division of each figure by 23 250)

(b) % males = [49 140/(49 140 + 23 250)] = 0.679 = 67.9%
% females = [23 250/(49 140 + 23 250)] = 0.321 = 32.1% or
1-0.679 = 0.321 = 32.1%

Exercise 5

(a) The ∃15 year age group.

(b) The 1-4 year age group.

(c) The ∃15 year age-group accounts for half the cases, but also for over half the population. The group at greatest risk of getting disease is not the >15 year olds, but the 1-4 year olds.
If you are planning hospital beds or ordering antimalarial drugs, the percentage value may be more useful to you.
If you are deciding who is at risk for purposes of an intervention programme, the age-specific incidence rate will be more useful.

Exercise 6

(a) The relative risk is the ratio of the 2 rates:

10/1000 divided by 2/1000 = 5

(b) Gem miners are 5 times more likely to get malaria than farmers living in the same villages.

(c) The risk difference is obtained by subtracting the 2 rates:

10/1000 - 2/1000 = 8/1000

(d) 8/1000 of the 10/1000 cases among gem miners can presumably be attributed to going into the forest; if you could convince them to stop going into the forest, their disease rate would drop by 8/1000 to 2/1000.

Remind learners that they should take the time to read Learning Unit 3 of the Learner's Guide in preparation for the next session.

LEARNING UNIT 3

Data presentation: tables, graphs and charts

As the learning objectives state, this Unit is intended to help the learners achieve the following :

- Explain the differences between graphs and charts
- List the features of good tables, graphs and charts
- Correctly plot and correctly label a series of graphs and charts from raw data
- List the uses for semi-logarithmic paper presentation

Explain clearly the importance of good data presentation. Go through each of the methods in detail using examples to clearly illustrate them. Allow time for questions.

Exercises on data presentation - Part I

These exercises are best performed in groups of 6-8 learners. The first three exercises should be done one at a time with the whole class. Allow them a couple of minutes to think about the answer, and then get the answers from the class. Do not spend more than 5-10 minutes on these exercises, since the graphing exercise will take a lot of time. Instructions for organizing the group for actual graphing are given at the beginning of exercises 4 and 5 in this unit.

Exercise 1

Advantages

- Readily available
- Usually collected from many different types of health facilities (health stations, clinics, hospitals, etc. and therefore may be more representative than data abstracted from individual clinics or hospitals.

Disadvantages

- Changes over time may reflect changing reporting practices, changes in case definition, etc. rather than actual disease trends.
- The information available is often not highly detailed.
- Useful for looking at trends, but may not give an accurate picture of the relative frequency of the diseases compared to each other, since this may be influenced by the accuracy of diagnosis, or the likelihood that someone with this disease will seek medical care, etc.

Other sources:

- Hospital discharge data. This provides more information on who has the disease, but hospitalized cases may represent only a small fraction of the total cases and may not be representative of all the cases of a disease.
- Data from surveys of health status. These are more representative than either of the above sources and can provide more information on who has the disease, but do not allow the assessment of trends, unless more than one survey has been performed over time.

Exercise 2

The DMO also needs the number of children in the district each year so that she can calculate disease rates. This is particularly important in areas with rapid population growth or significant in- or out-migration.

Exercise 3

Knowing the population of under-fives in 1987 and the rate of natural increase in the population allows the DMO to estimate the population for each year.

Example: *The 1987 population in this age-group was 56 650. The rate of natural increase for the population is 3.3% per year. The 1988 population can thus be estimated at*
56 650 + (56 650)(0.033) = 58 520, and the 1989 population as
58 520 + (58 520)(0.033) = 60 451, etc.

Exercises 4 & 5

These exercises are best done with three groups of two people each; if there are more people in a group, assign the two pairs to perform the same task independently (i.e. if there are 8 people, have two pairs independently do the graph for question 4a; have one pair do 4b, and one pair do 4b.

Assuming there are 3 groups of 6, each with 3 pairs, the tasks should be distributed as follows:

Group 1, pair 1	4a, 5a for Disease A
Group 1, pair 2	4b, 5b for Disease A
Group 1, pair 3	4c, 5c for Disease A
Group 2, pair 1	4a, 5a for Disease B
Group 2, pair 2	4a, 5b for Disease B
Group 2, pair 3	4c, 5c for Disease B
Group 3, pair 1	4a, 5a for Disease C
Group 3, pair 2	4b, 5b for Disease C
Group 3, pair 3	4c, 5c for Disease C

Thus, each group will have a full set of graphs showing the incidence, mortality, and case fatality for "their" disease compared with the other two diseases, and each will have a series of 3 graphs specific for "their" disease.

Have the students work in **pencil**. Students should be provided with arithmetic and 3 cycle semi-log paper, which can if necessary be photocopied. Let the learners work by themselves and decide how they want to do the graphs. For those working on semi-log paper, you may need to help them decide how to set up the cycles and how to use the paper. Some will choose arithmetic and other semi-log paper for the same graph; it will be interesting to compare the patterns observed with each.

As the students complete their work, you and the facilitators may wish to circulate amongst them and make sure that all graphs have adequate titles and that axes and, where relevant, curves are clearly labelled.

Exercise 6

Have the students work together to put together a brief presentation. If transparencies are available, they may wish to trace the graph onto the transparencies. If there are no transparencies available have them draw over the curves with thick lines in pencil or coloured pens so they can be seen by the others during the presentation.

The point of this portion of the exercise is to put findings into words, rather than to guess the disease. Graphs of the trends done on both arithmetic and semi-log paper are attached for your convenience, as are graphs – and, in the case of age, charts – for each of the diseases.

In commenting on the graphs drawn by the students at the end of their presentations, you may wish to review the advantages and disadvantages of arithmetic versus semi-log paper. A frequent problem also arises in the graphing of age-groups, since the categories are unequal. The solutions are to either draw a chart, or adjust the height of the bars for the broader age categories for a histogram, such that the area represented by the bar takes into account the number of cases and the width of the interval. For example, with disease A, the width of the category 12-23 months is twice that of the previous categories; therefore the total cases should be divided by half to determine the height of the bar. The category 36-59 months is 4 times as wide as the 0-5 and 6-11 month categories; in this case the total number of cases must be divided by 4 to determine the height of the bar. It is worth mentioning though that the chart gives a completely different impression of the age distribution of the disease than the histogram, and the histogram is probably a more realistic representation.

Disease A is diarrhoea (high incidence, low mortality, low case fatality; seasonal distribution also common with diarrhoea, as is age distribution with peak after weaning age). Recent declines in mortality may be due to improved treatment. Incidence largely unchanged; might be helped by improvements in water sanitation, handwashing etc.

Disease B could be either malaria or measles, although measles is much more likely given the cyclical trends over the years. This disease is characterized by fairly high incidence, low but non-negligible mortality, and a higher case-fatality rate than for disease A. The age distribution is also fairly characteristic for measles, as is a seasonal pattern. The decline appears to be due to immunization, without much improvement in treatment, as indicated by the stable case-fatality rate.

Disease C is neonatal tetanus based on its relatively low incidence, very high case fatality, unusual age distribution, and lack of seasonality. The changes

over time may be due to better maternal immunization coverage or better delivery practices. The increase in case fatality may be real and due to the cases being more severe or poorer case management. On the other hand, the numbers for this disease are relatively small, and the year to year changes may simply reflect random variation.

Remind learners that they should take the time to read Learning Unit 4 of the Learner's Guide in preparation for the next session.

Figure 2

Incidence, mortality, and case-fatality rates for disease A, Mantu, 1983 - 1987

Figure 3

Incidence, mortality, and case-fatality rates for disease A, Mantu, 1983 - 1987

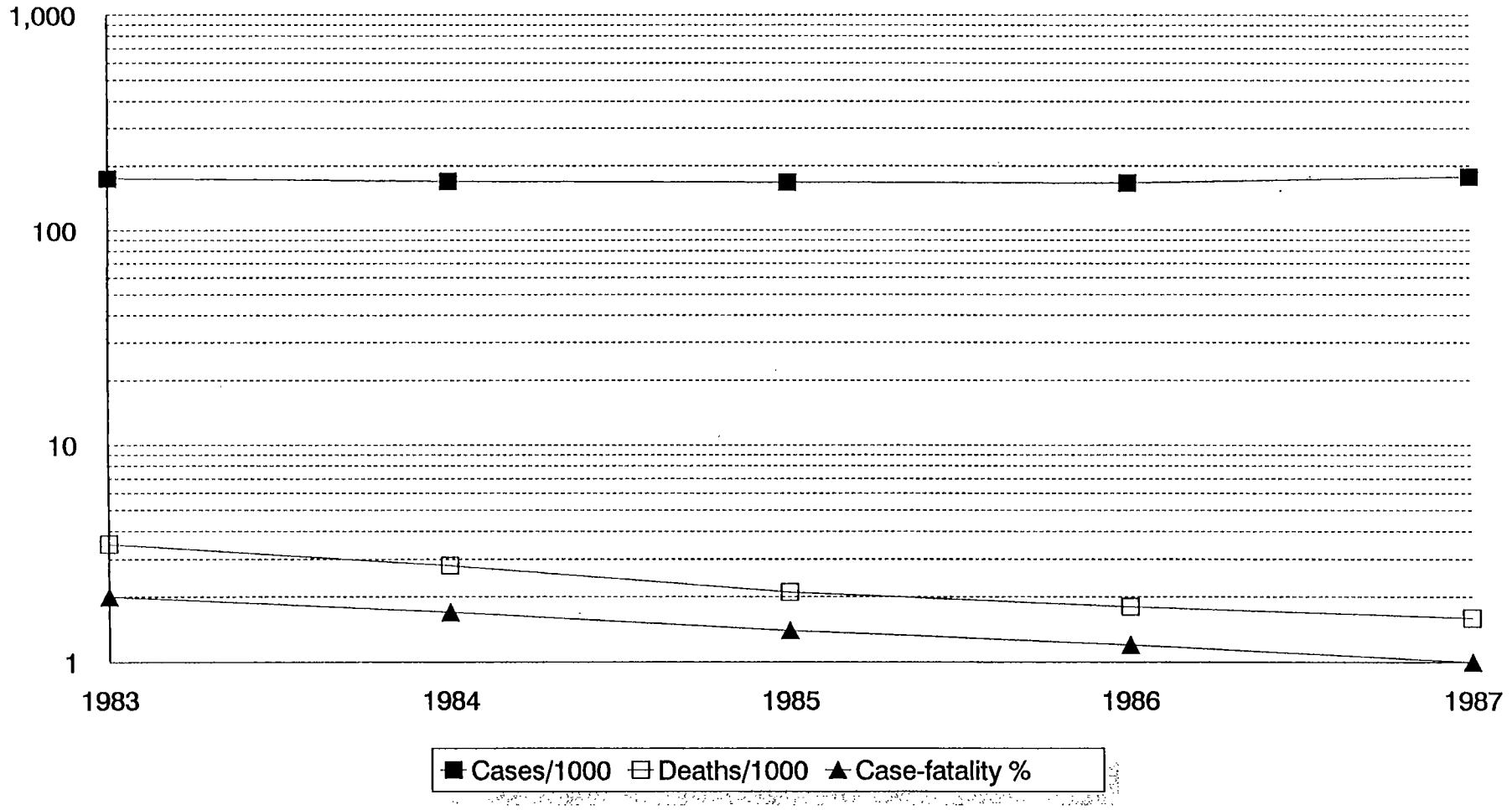


Figure 4

Incidence, mortality, and case-fatality rates for disease B, Mantu, 1983 - 1987

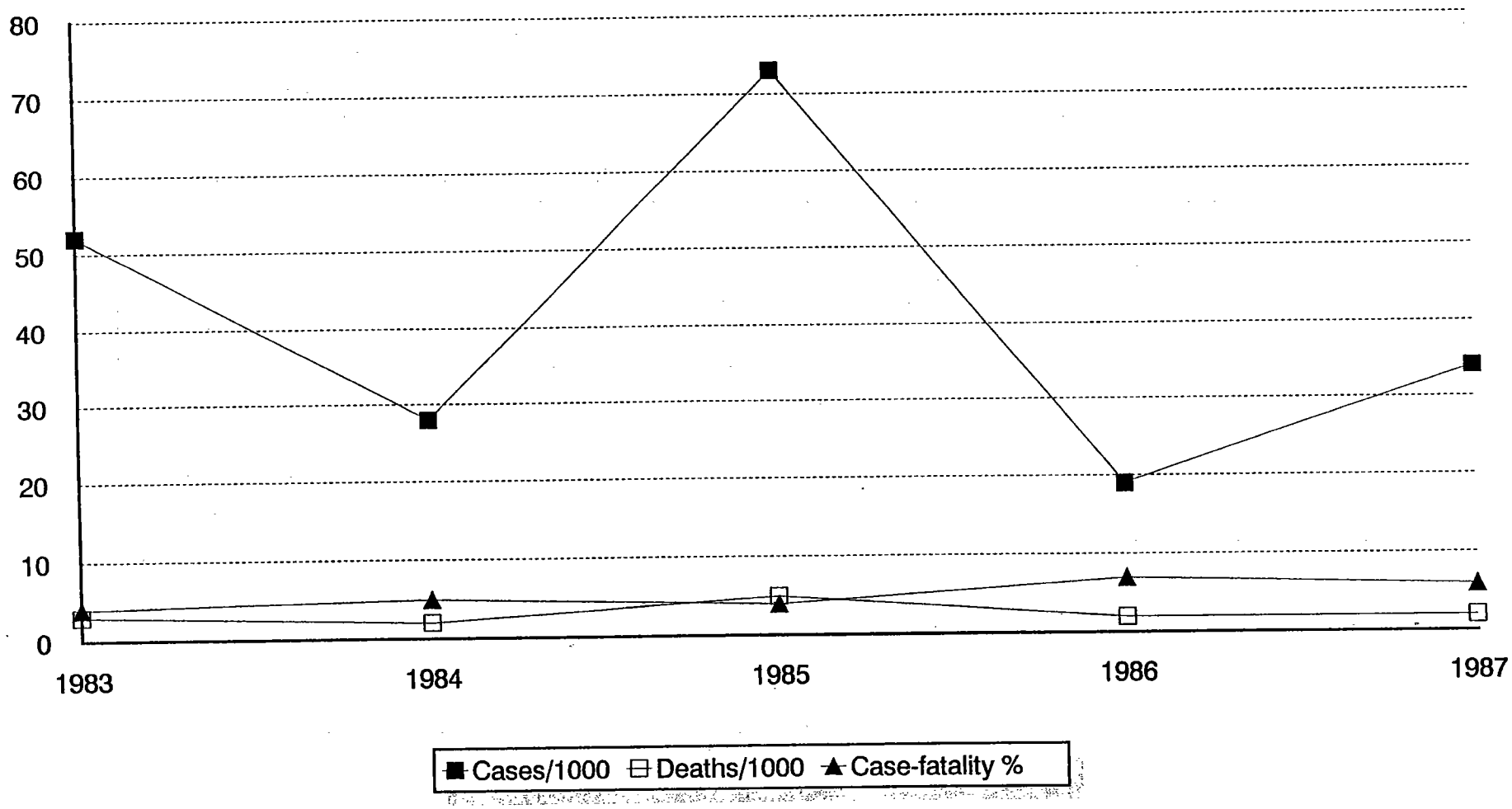


Figure 5

Incidence, mortality, and case-fatality rates for disease B, Mantu, 1983 - 1987

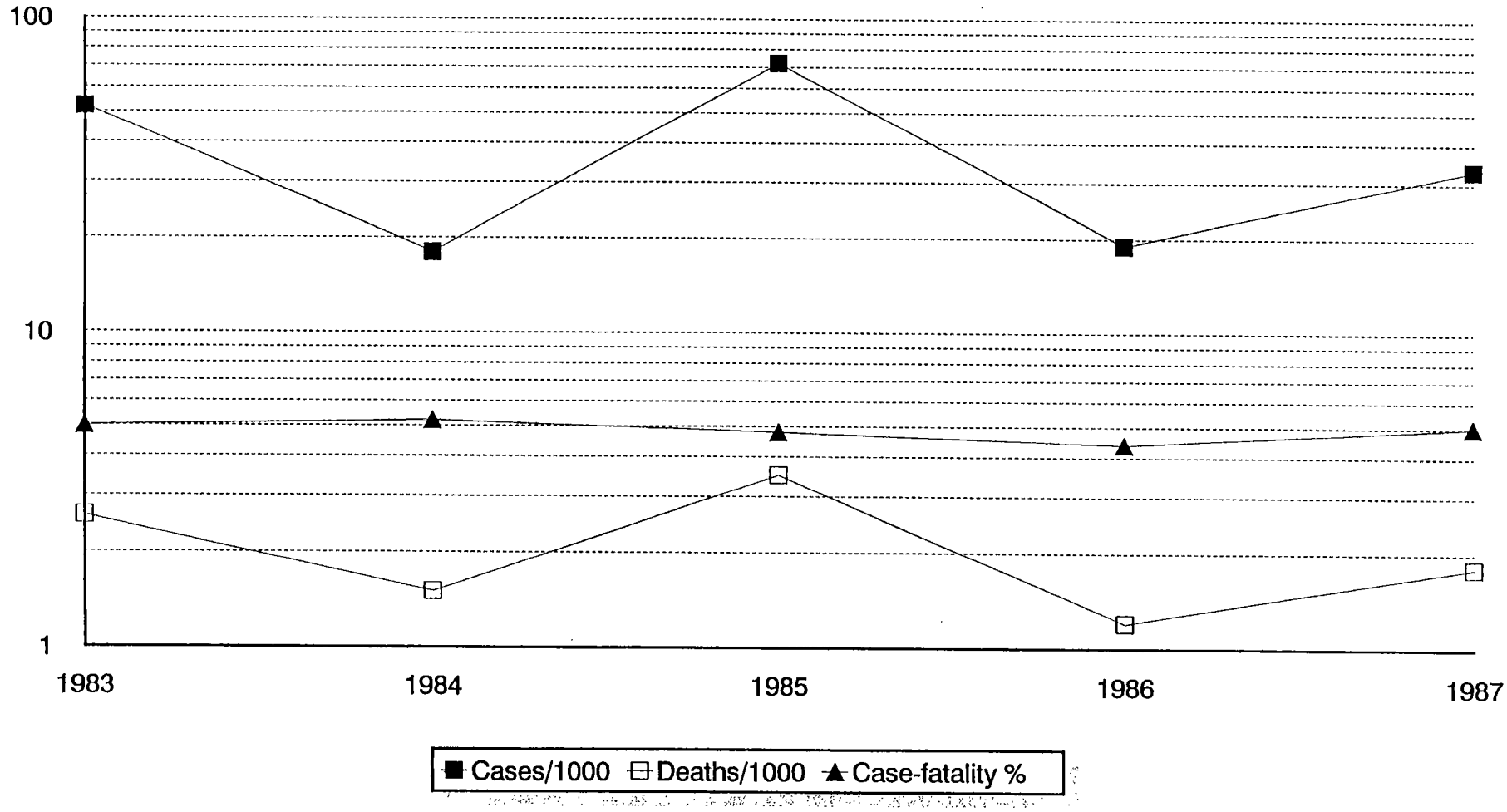


Figure 6

Incidence, mortality, and case-fatality rates for disease C, Mantu, 1983 - 1987

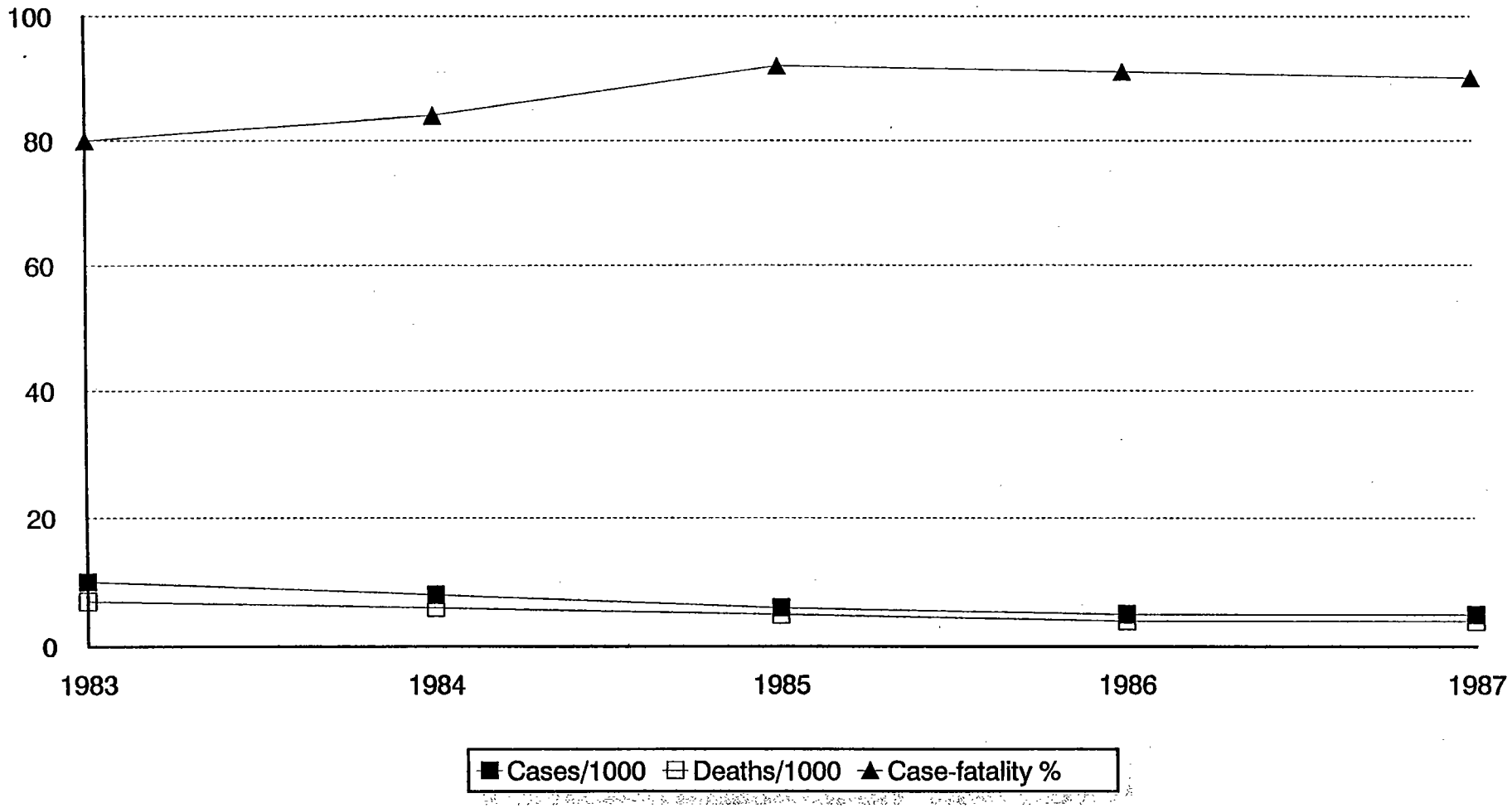


Figure 7

Incidence, mortality, and case-fatality rates for disease C, Mantu District, 1983 - 1987

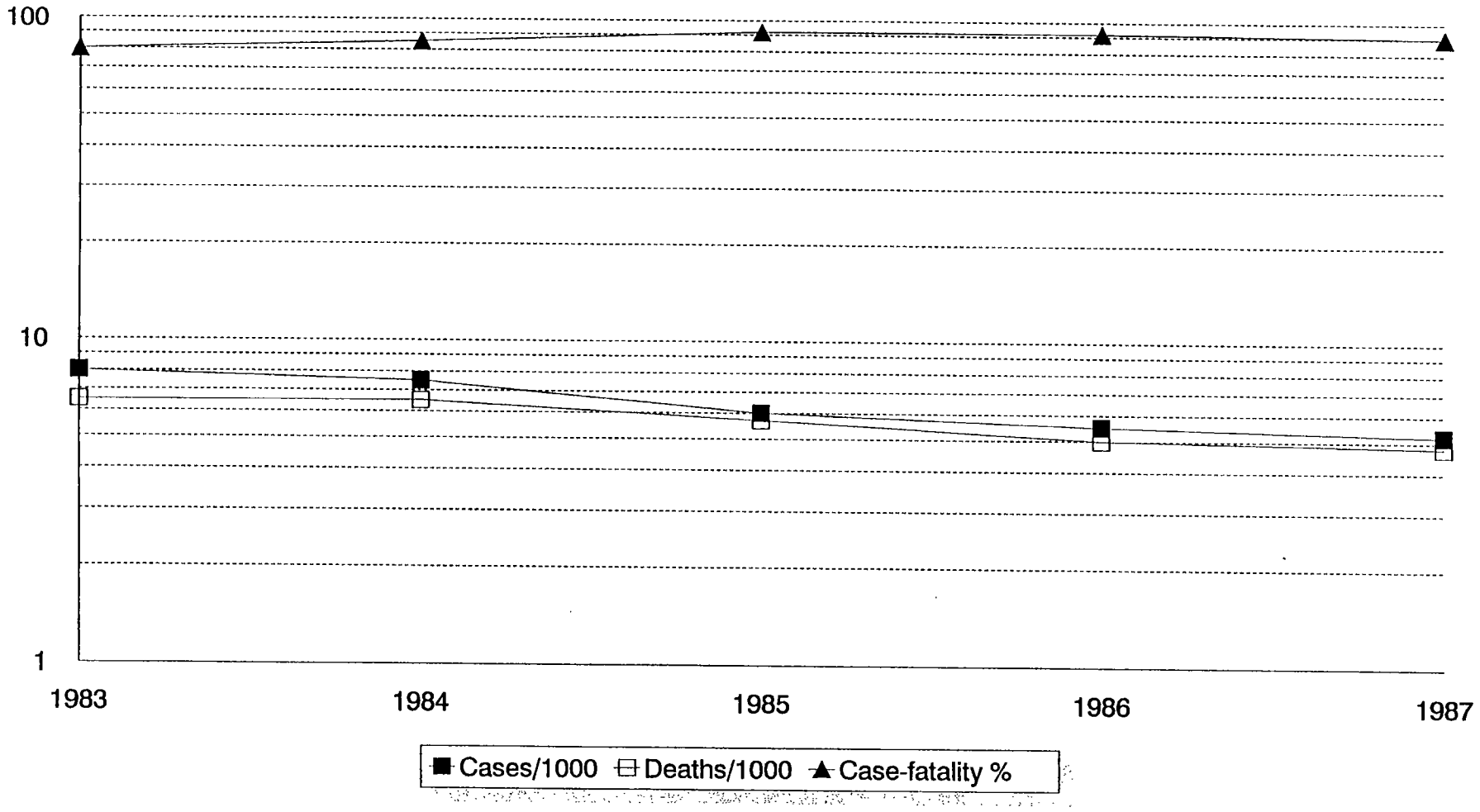


Figure 8

Incidence of diseases A, B, C, Mantu District, 1983 - 1987

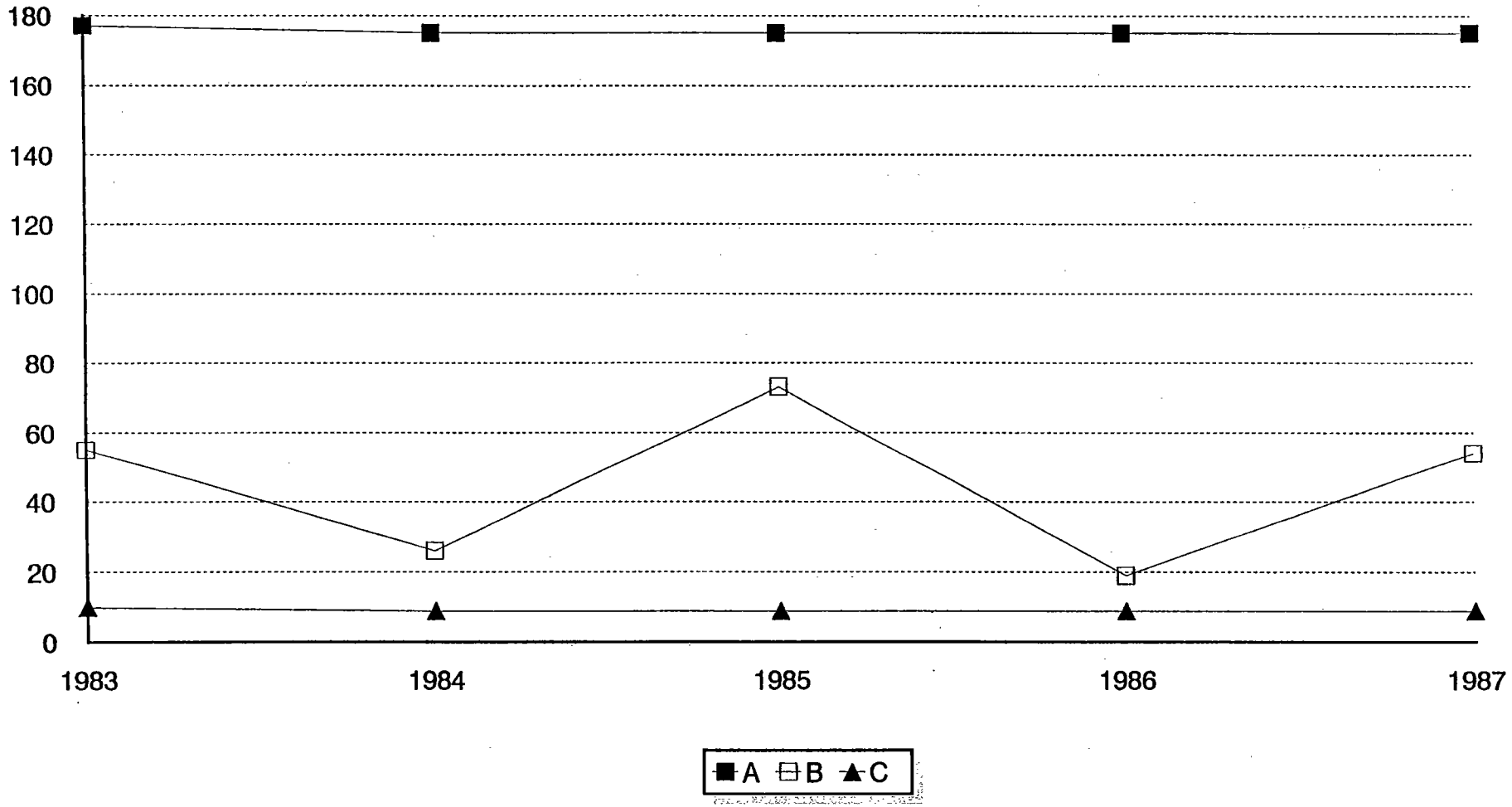


Figure 9

Incidence of diseases A, B, and C, Mantu District, 1983 - 1987

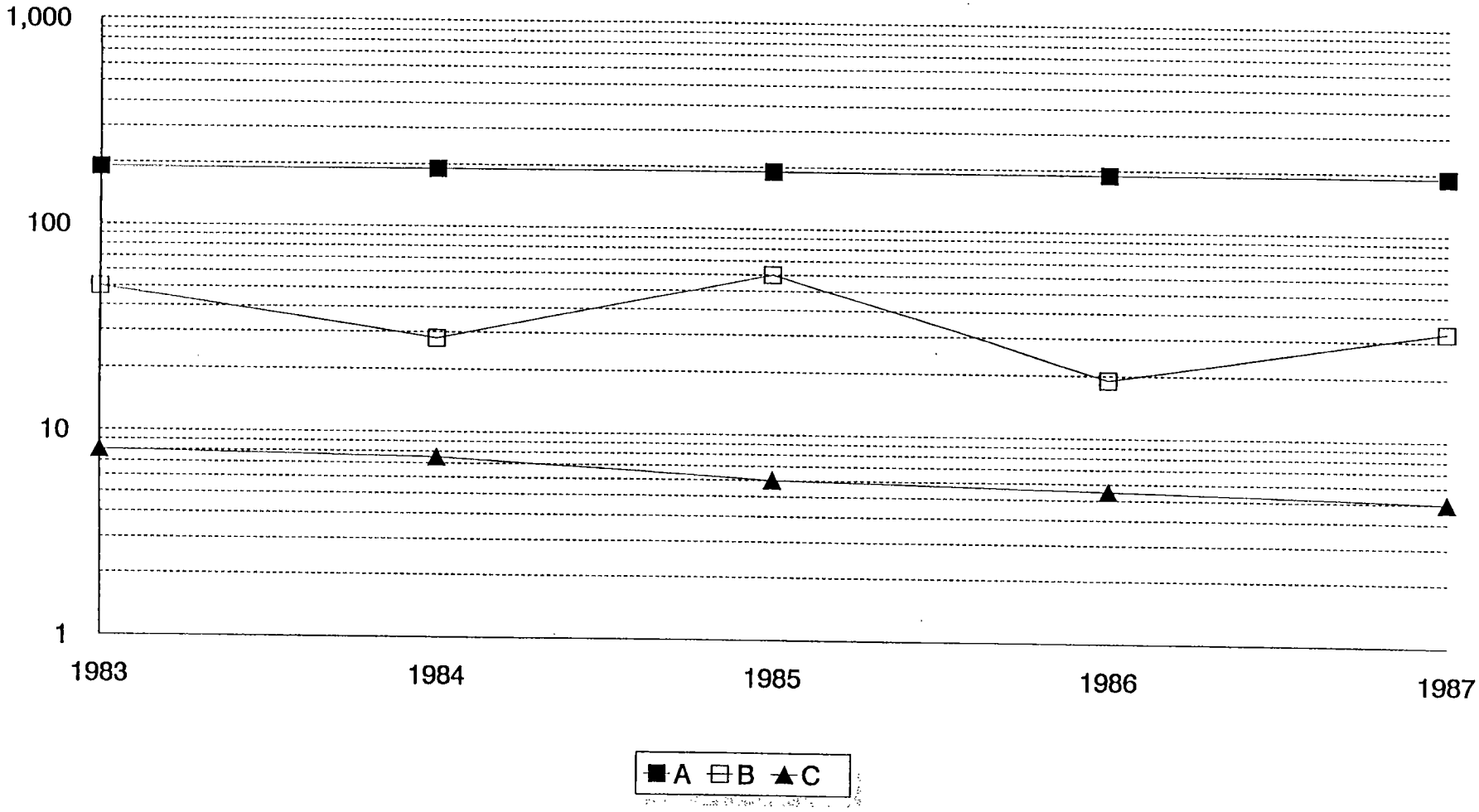


Figure 10

Mortality rates for diseases A, B, and C, Mantu District, 1983 - 1987

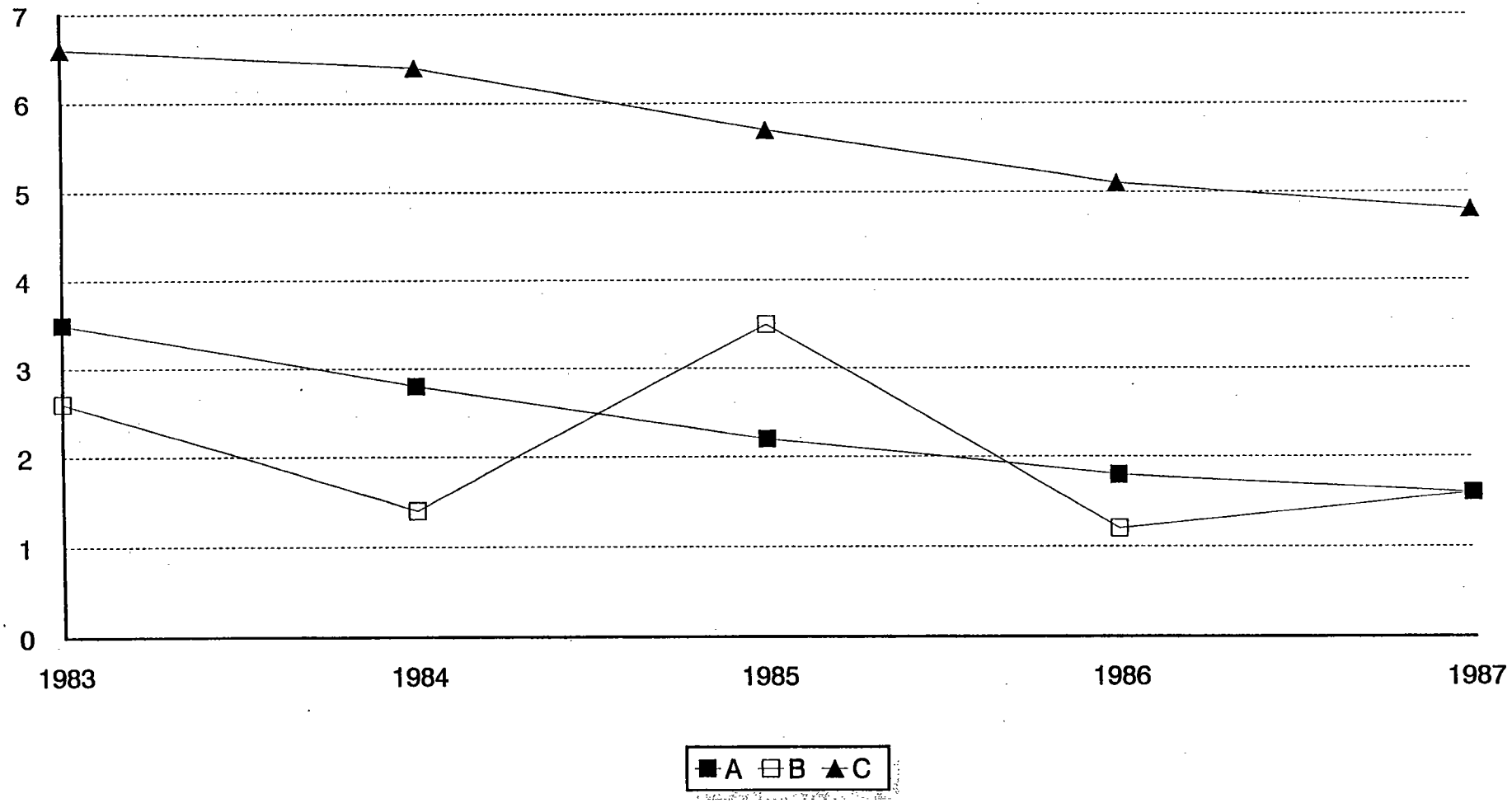


Figure 11

Mortality rates for diseases A, B, and C, Mantu District, 1983 - 1987

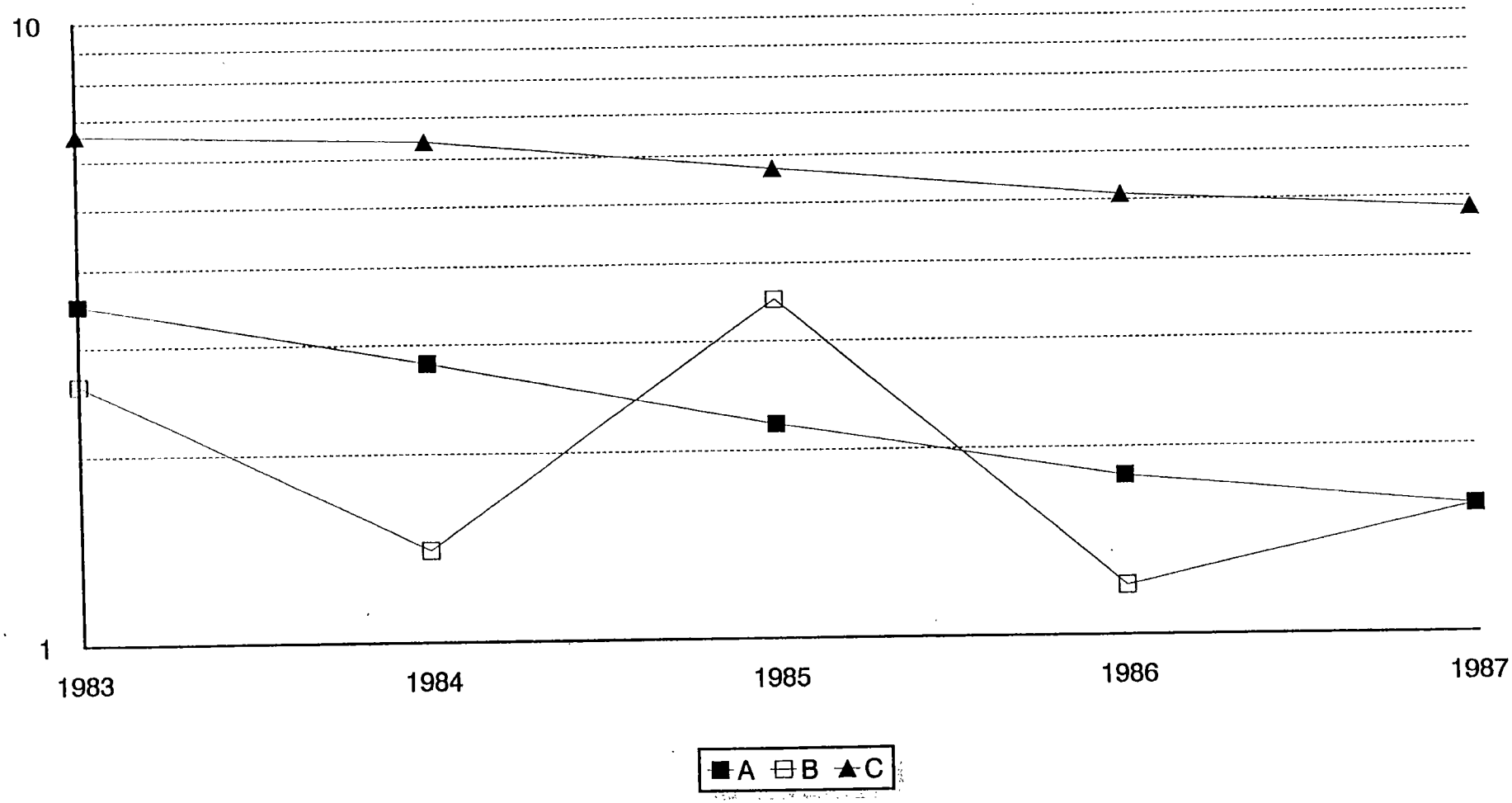


Figure 12

Case-fatality rate/100 for diseases A, B, and C, Mantu District, 1983 - 1987

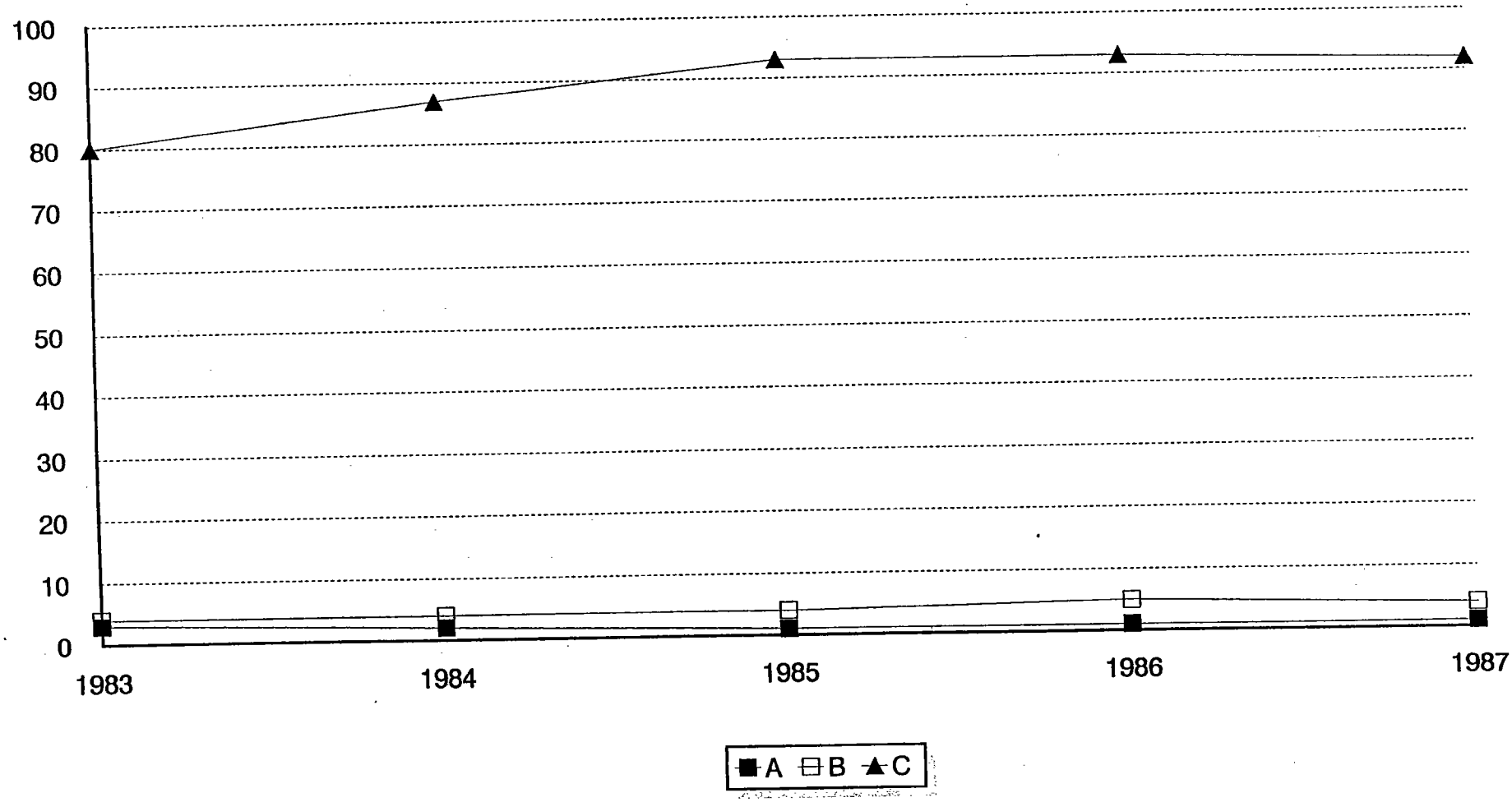


Figure 13

Case-fatality rate/100 for diseases A, B, and C, Mantu, 1983 - 1987

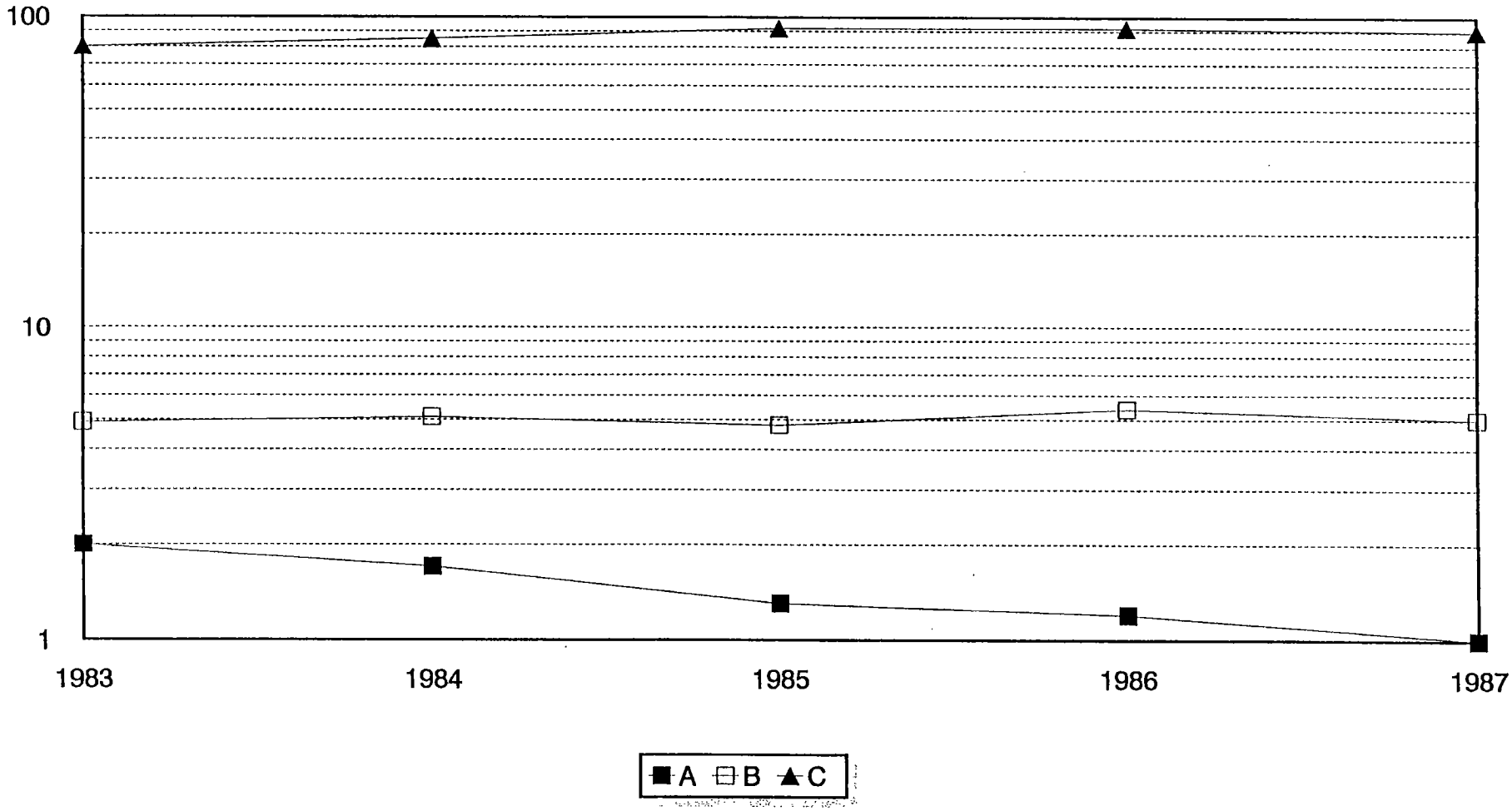


Figure 14

Age distribution, disease A, Mantu District Hospital, 1/1 - 31/12/1987

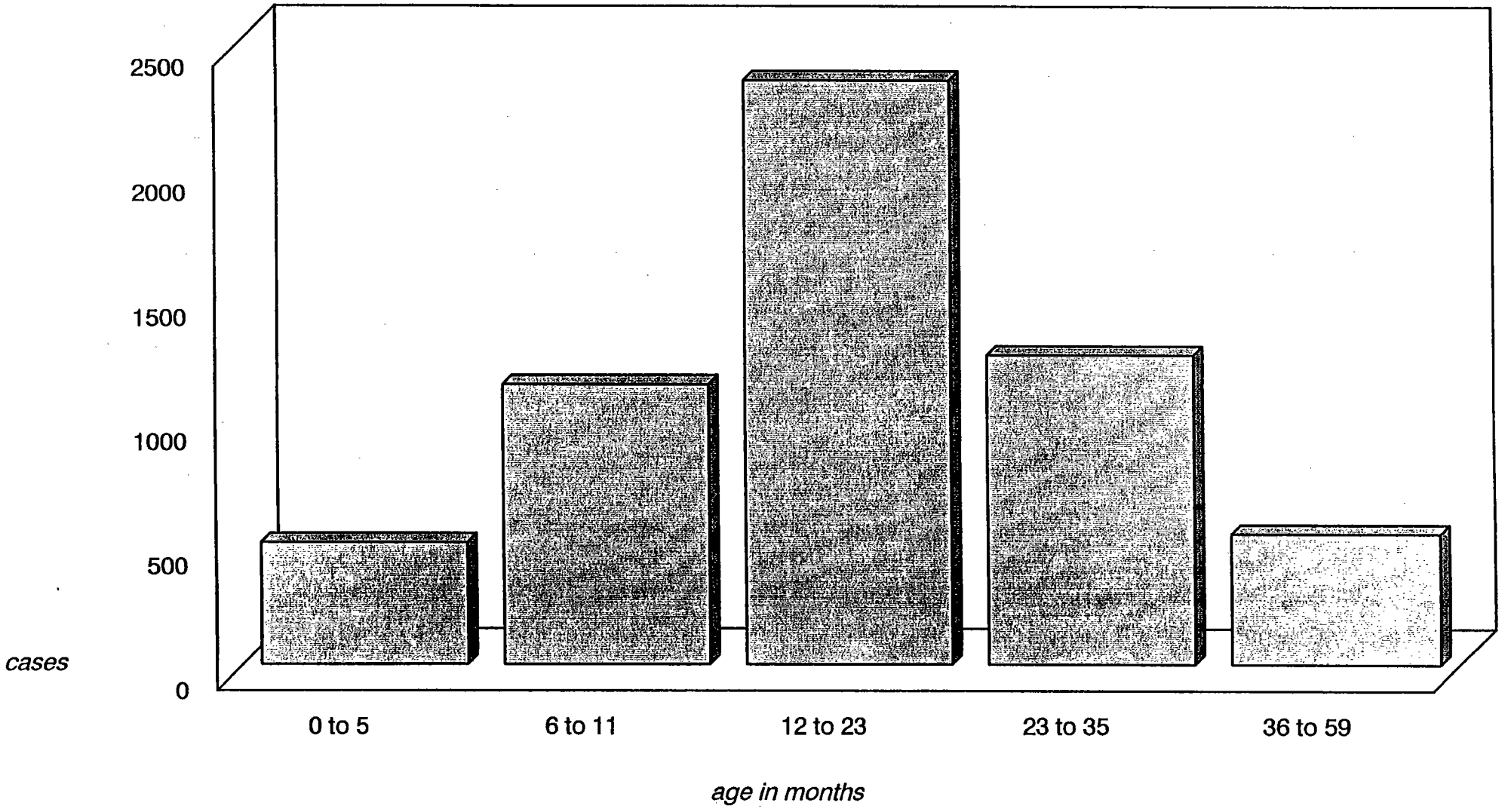


Figure 15

Age distribution, disease A, Mantu District Hospital, 1/1 - 31/12/1987

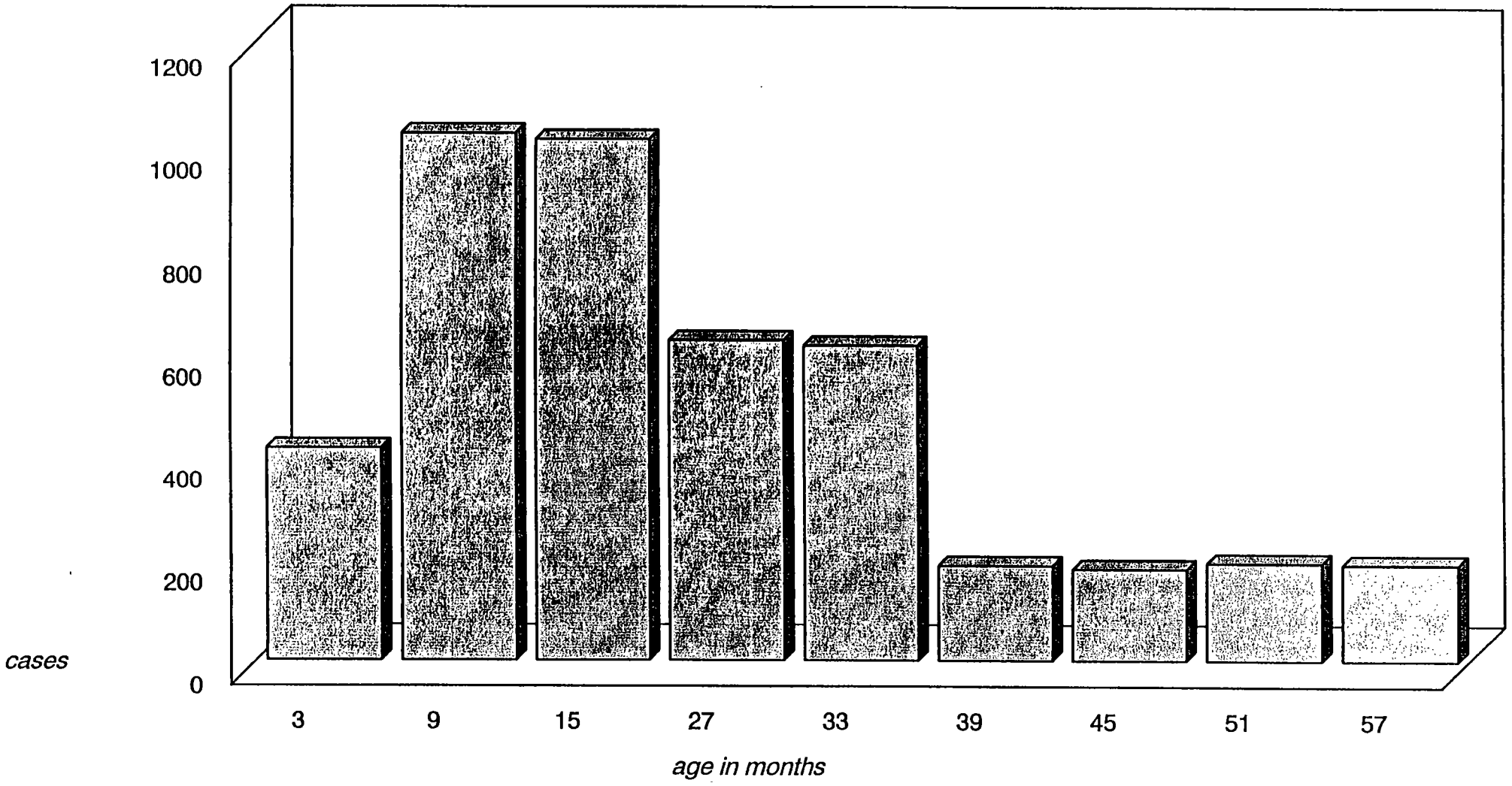


Figure 16

Age distribution, disease B, Mantu District Hospital, 1/1 - 31/12/1987

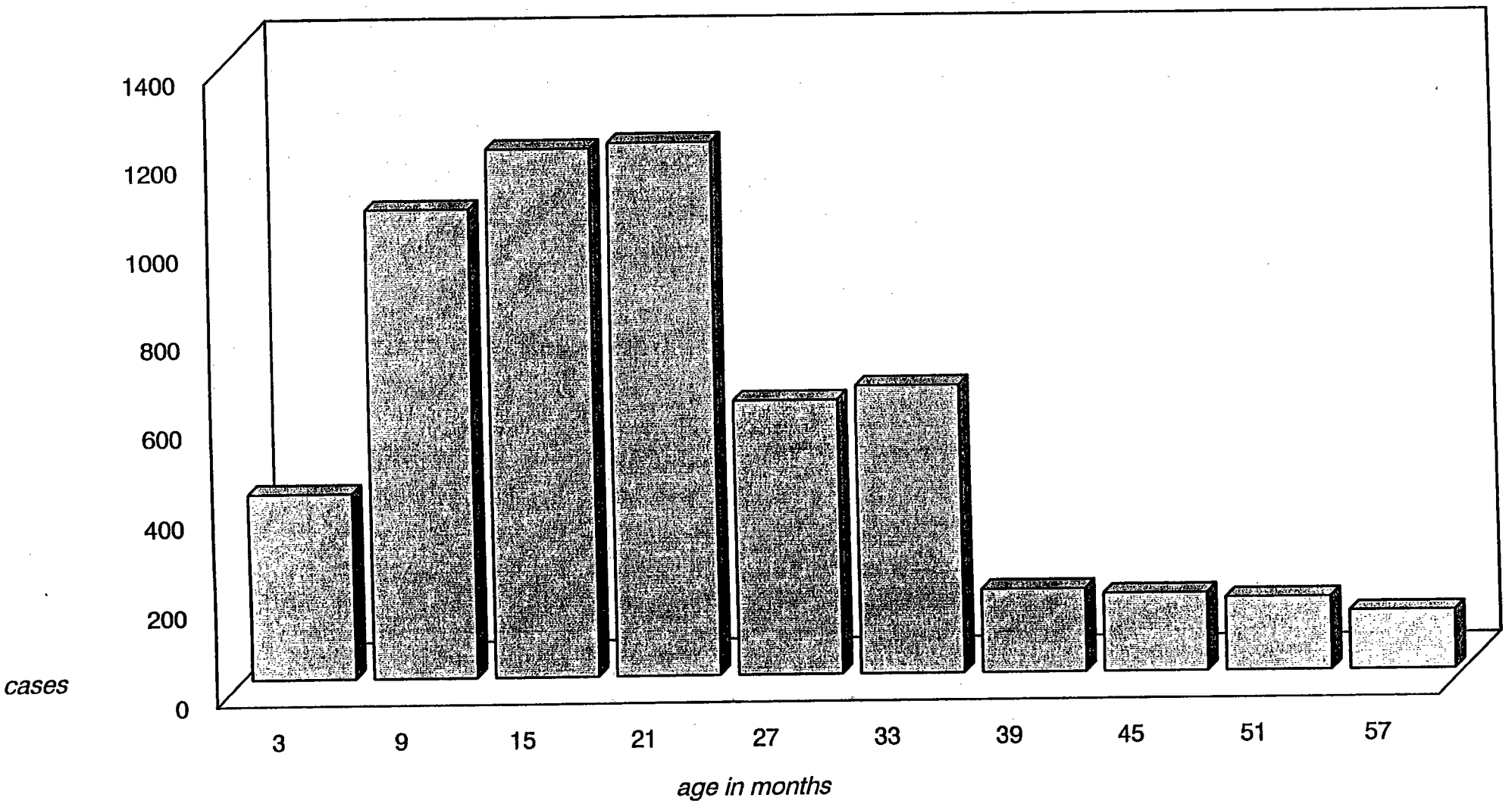


Figure 17

Age distribution, disease C, Mantu District Hospital, 1/1 - 31/12/1987

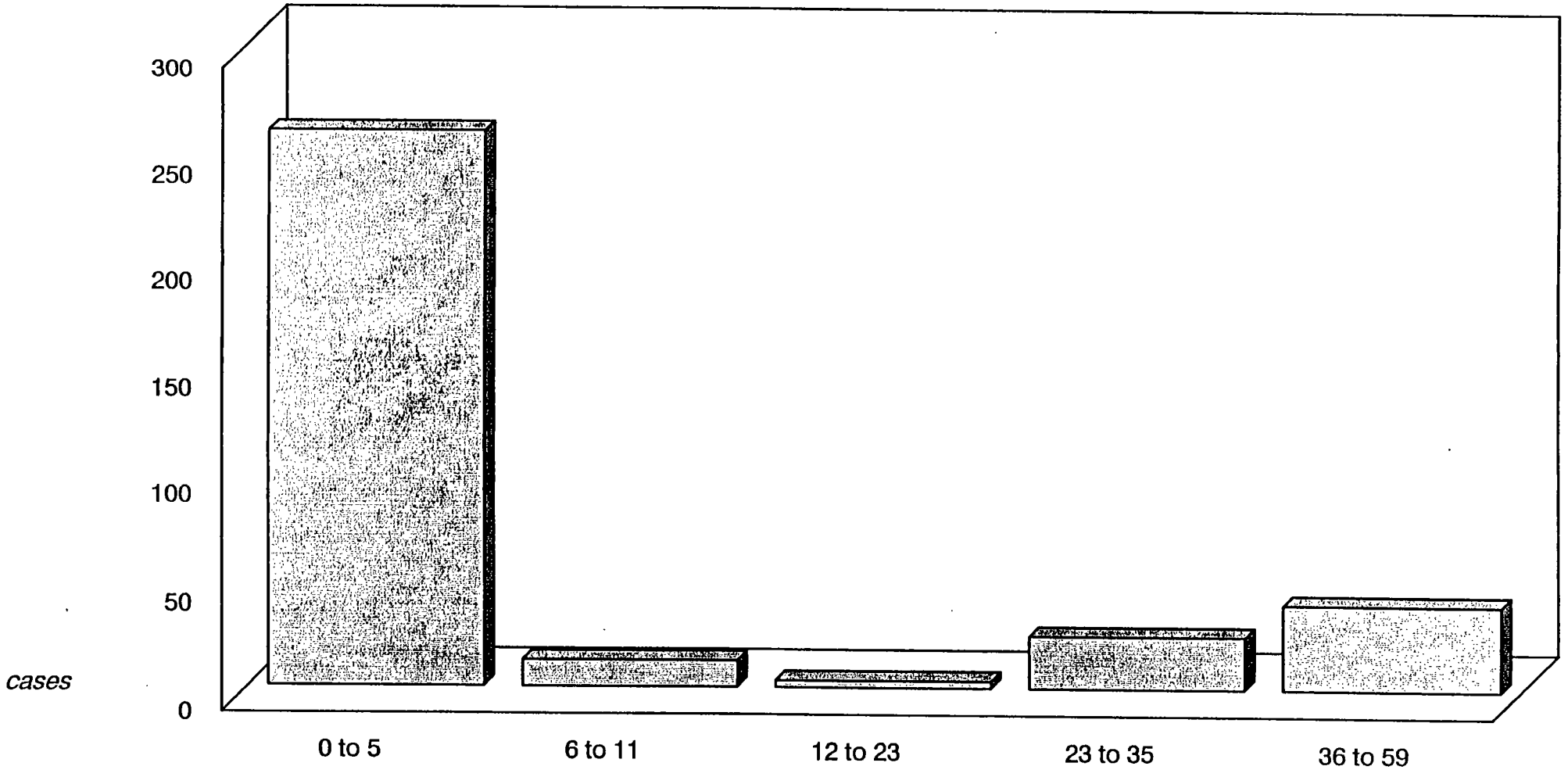


Figure 18

Age distribution, disease B, Mantu District Hospital, 1/1 - 31/12/1987

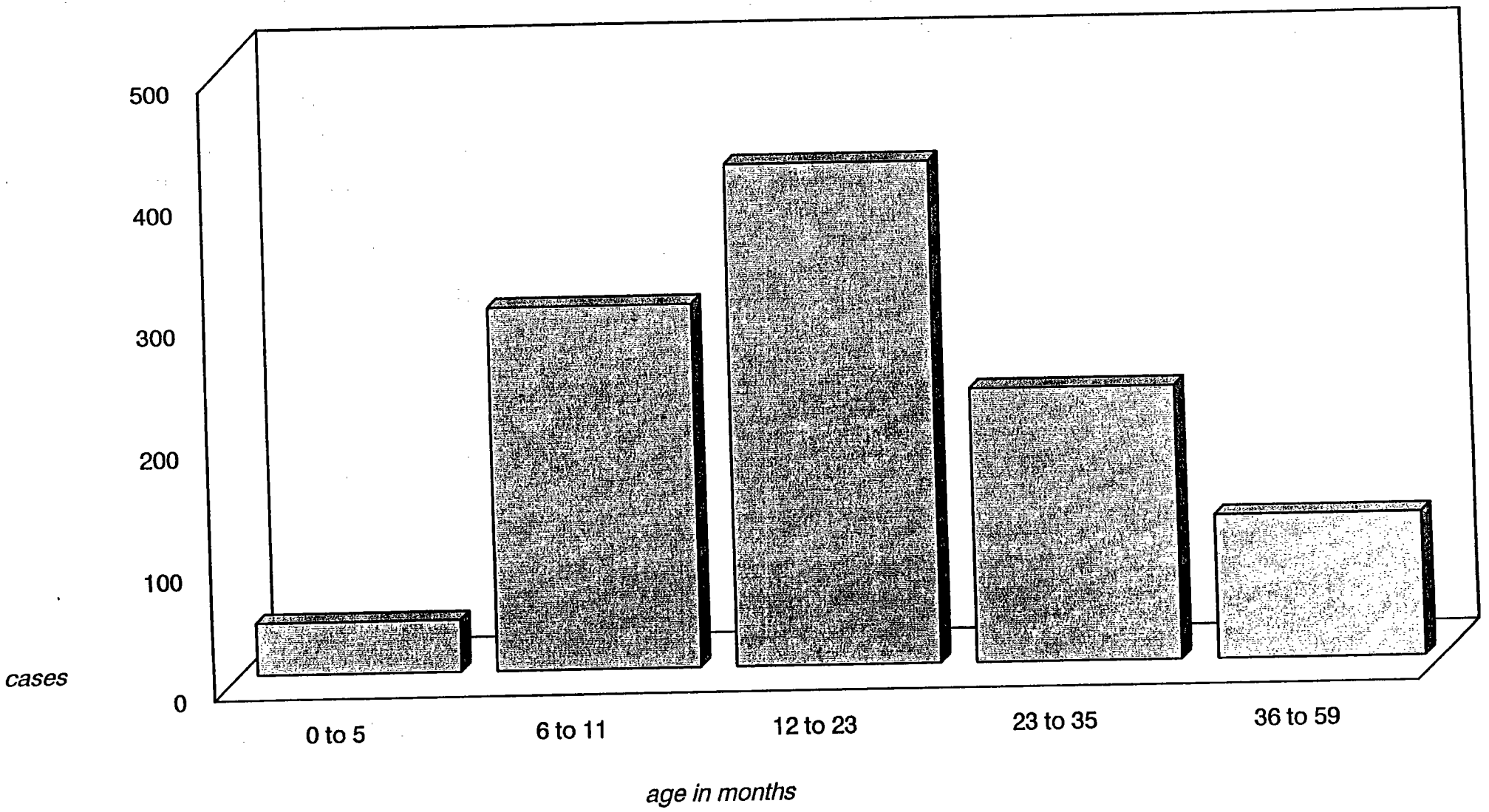


Figure 19

Age distribution, disease C, Mantu District Hospital, 1/1 - 31/12/1987

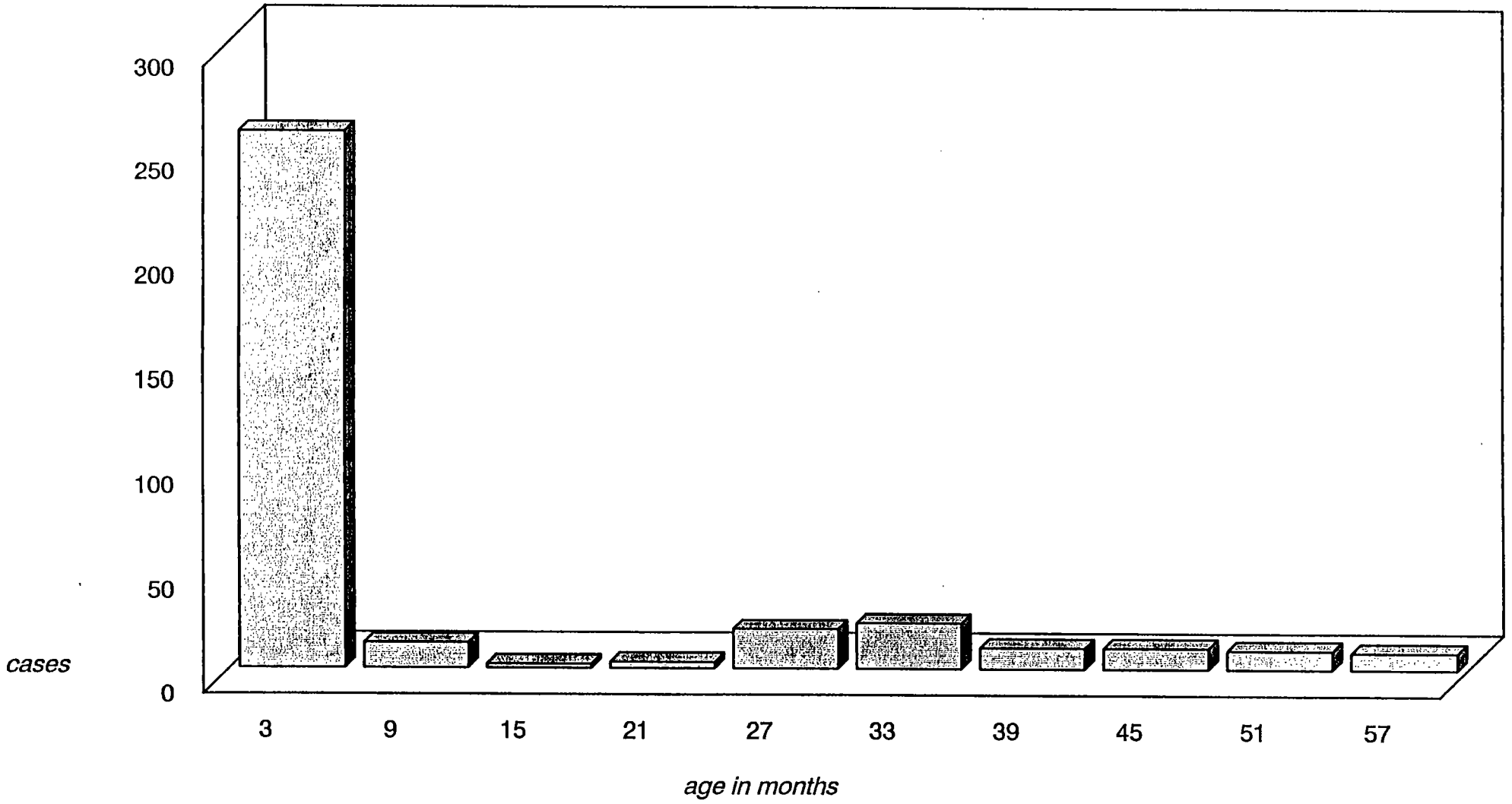


Figure 20

Average monthly distribution, disease A, 1983 - 1987

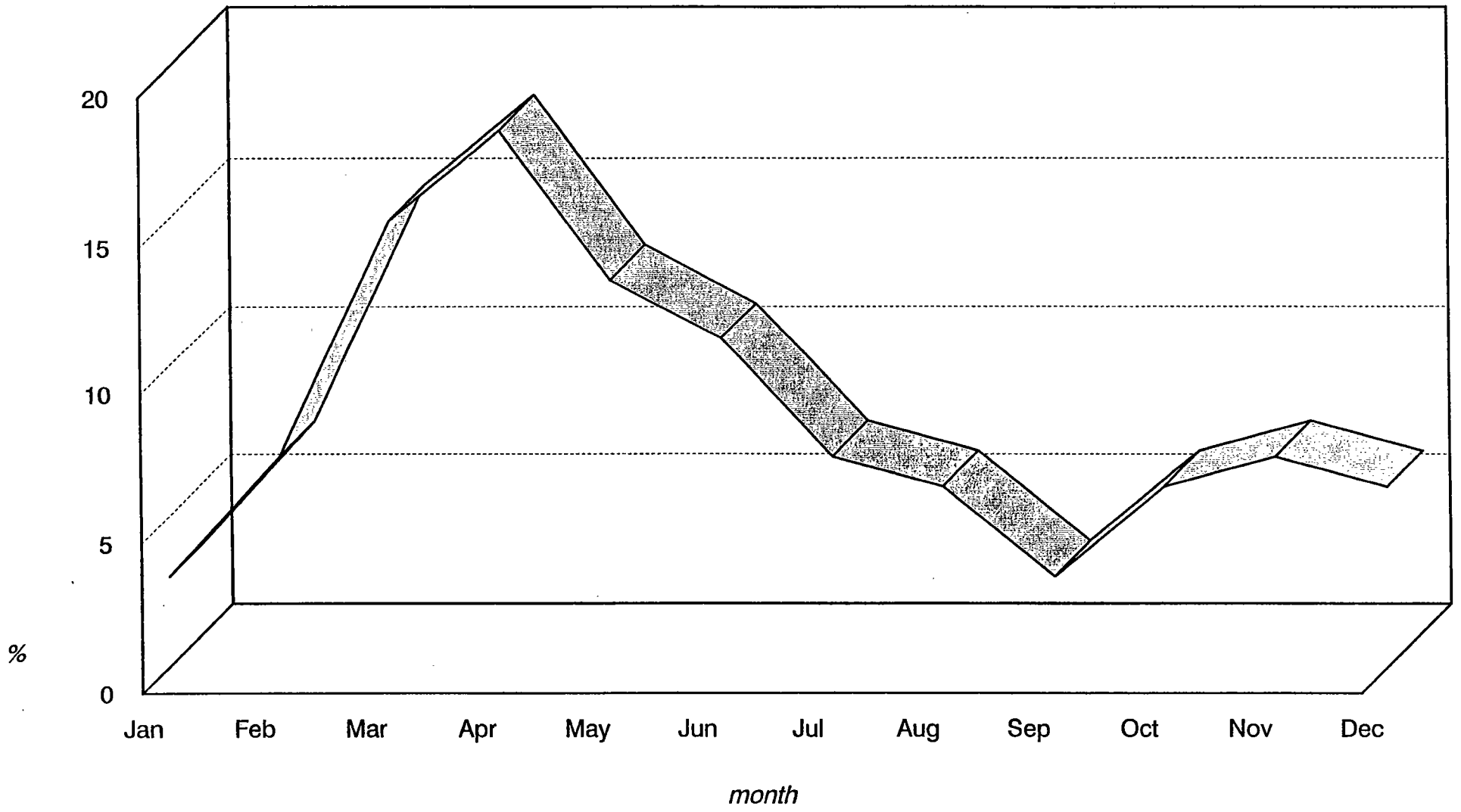


Figure 21

Average monthly distribution, disease B, 1983 - 1987

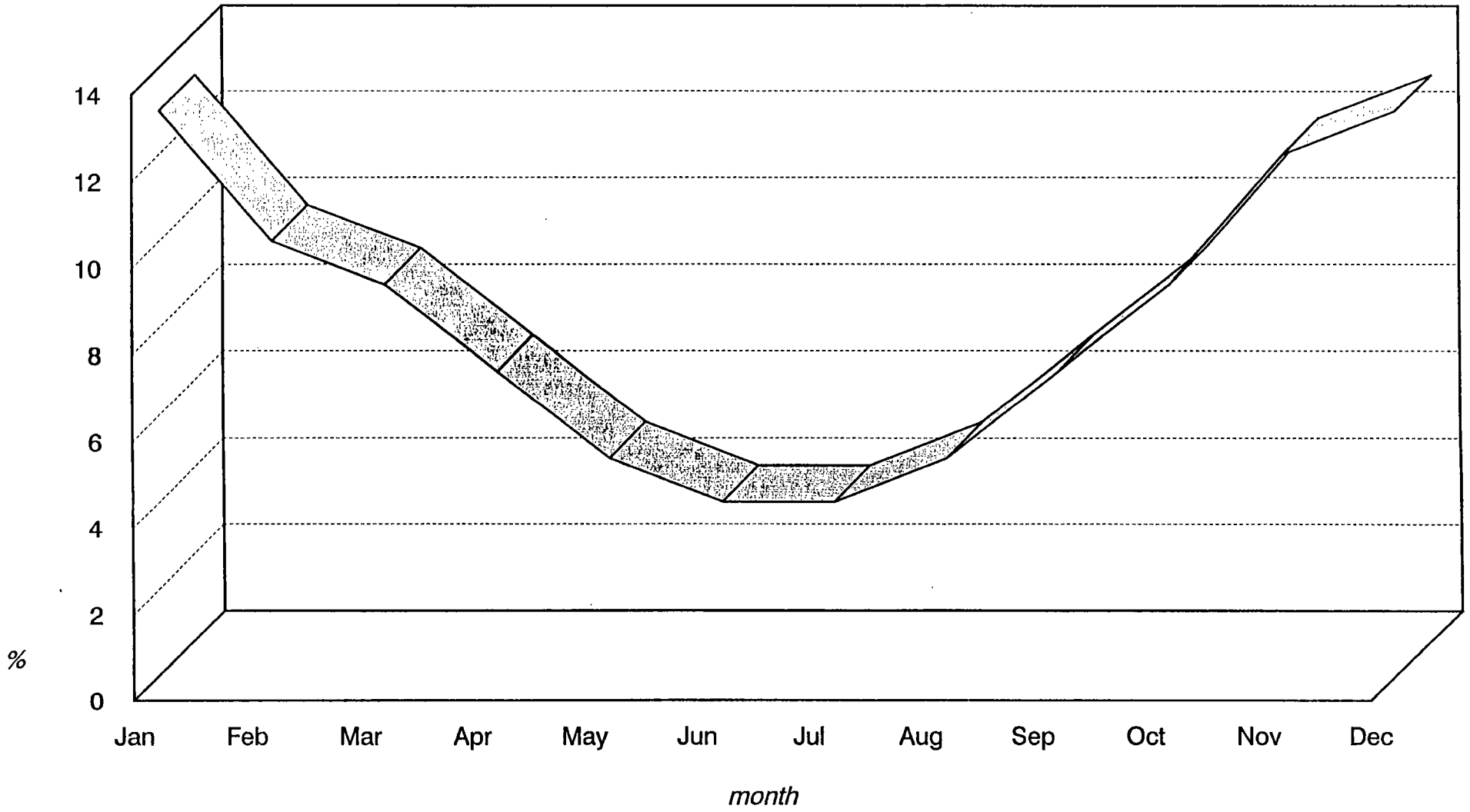
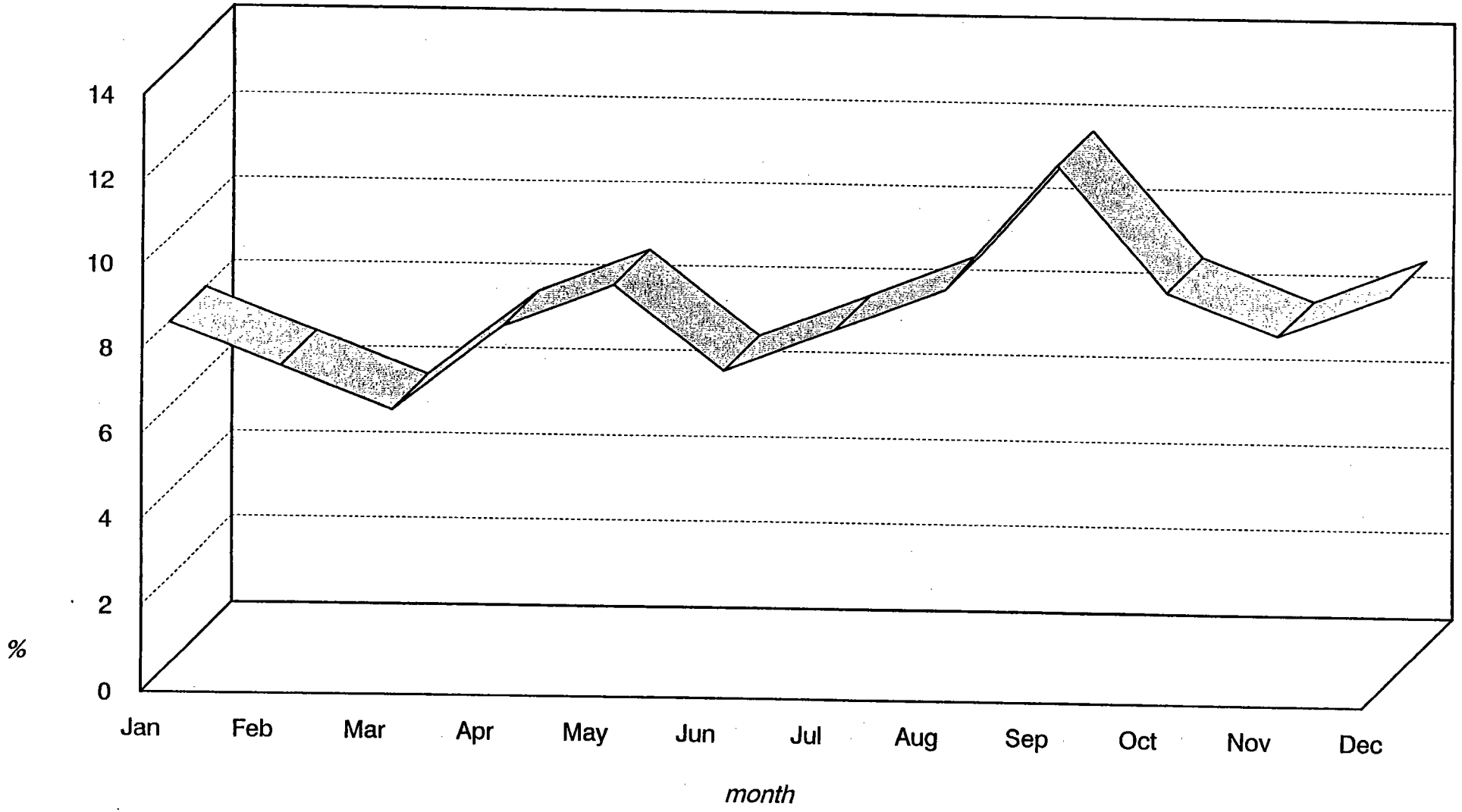


Figure 22

Average monthly distribution, disease C, 1983 - 1987



LEARNING UNIT 4

Measures of central tendency

As the learning objectives state, this Unit is intended to help the learners achieve the following :

- provide the definitions of mean, median and mode
- explain the advantages and disadvantages of using the mean versus the median
- practise calculating means, medians, and modes from individual and from grouped data.

After defining the terms: mean, median and mode and describing the advantages and disadvantages of using the mean versus median, allow the learners to work individually on the exercises provided in the Learner's Guide.

Exercises on measures of central tendency

If the group includes several people with weak maths skills in the group, you may wish to have them work in pairs with someone who is more comfortable with such calculations. You and the facilitators may wish to circulate amongst the participants to answer any questions, or to work with those who seem to be having difficulties.

Exercise 1

a) The mode is 3 years, which is represented 5 times in the data set.

b) The median is the (20+1)/2 or 10.5th value when the ages are put in rank order:

age	1	1	1	2	2	2	3	3	3	3	3	4	4	5	6	7	12	22	26	64
value	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

In this case, both value number 10 and value number 11 are 3. The 10.5th value is the average of these two: (3+3)/2 or 3 years.

c) The mean is (4 + 3 + 3 ... + 2 + 3 + 6)/20 or 8.7 years.

d) The mean and median are different in this case because the distribution of ages is skewed to the right by the 3 cases that are considerably older than the rest.

e) Because of these "outliers", the median probably gives a better idea of the age distribution of the population.

Exercise 2

a) There are two modes, 4 days and 5 days.

b) The median is the (11+1)/2 or 6th value. In this case, it is 5 days.

c) The mean is 64/11 or 5.8 days.

d) The mean and median are closer because the distribution has fewer outliers (it is more bell-shaped or normal).

e) In this case, either would be acceptable.

Exercise 3

Begin by determining the midpoint of each of the categories by adding the lowest value in the category to the highest and dividing the result by two. For example, the midpoint of the first category would be (2999 + 1000)/2 or 1999.5 parasites/1000 WBC.

Multiply the number of observations in that category by the midpoint value. In the first category, this is 20 x 1999.5 or 39 990.

Sum the values for all the categories, and divide by the total number of observations. Here, the value would be 1 049 900/200 or 5249.5 parasites/1000 WBC.

CATEGORY	MIDPOINT (MP)	FREQUENCY (F)	MP x F
1 000- 2 999	1 999.5	20	39 990.0
3 000- 4 999	3 999.5	70	279 965.0
5 000- 6 999	5 999.5	80	479 960.0
7 000- 8 999	7 999.5	25	199 987.5
9 000-10 999	9 999.5	5	49 997.5
TOTAL		**200**	**1 049 900.0**

To calculate the median, determine the midpoint of the data, which in this case will be the (200+1)/2 or 100.5th observation.

Calculate the cumulative total of the frequency distribution for the categories and decide which interval contains the midpoint:

CATEGORY	FREQUENCY (F)	CUMULATIVE FREQUENCY
1 000 - 2 999	20	20
3 000 - 4 999	70	90
5 000 - 6 999	80	170
7 000 - 8 999	25	195
9 000 - 10 999	5	200

The 100.5th observation falls in the 5 000-6 999 category, which contains observations 91-170.

Apply the formula, median = $L + JW/f$, where L is the **true** lower limit of the class interval containing the midpoint, J is the number of cases in this interval below the midpoint (calculated as: number of cases below the midpoint minus cumulative number of cases up to but not including this interval, W is the **true** width of the class interval, f is the total number of cases in this interval.

Here, the **true** lower limit of the interval L is 5000, the width of the interval W is 2 000, the number of cases in the interval **f** is 80, and the cumulative number of cases below the interval C is 90. J is then calculated as the midpoint minus C or 100.5-90 = 10.5. J/f is 10.5/80=0.13. $J/f \times W$ is therefore 0.13 x 2 000 = 260. The median is ($L + WJ/f$) or 5000 + 260 = 5 260.

- The modal parasite density is the interval **5 000 – 6 999**.

Remind learners that they should take the time to read Learning Unit 6 of the Learner's Guide in preparation for the next session.

NOTES

LEARNING UNIT 5

Measures of variability and normal distribution

As the learning objectives state, this Unit is intended to help the learners achieve the following:

- provide the definition of terms such as range, standard deviation and normal distribution
- explain the advantages and disadvantages of using the range and the standard deviation
- practise calculating ranges and standard deviation

After defining the terms range and standard deviation and describing the advantages and disadvantages of using the range and the standard deviation, allow the learners to work individually on the exercises provided in the Learner's Guide.

Measure of variability

Make sure the concepts of square and square roots are known, you may wish to give a simple and quick explanation if somebody requires it. You may allow learners to work in pairs in order to have couples in which someone is more comfortable with calculations. Tutor and facilitators may wish to circulate amongst the participants to answer any question that may arise or work with those who seem to be having difficulties.

Exercise 1

a) The range is 4 to 18 days

b) The mean is $(6 + 7 + 10...+ 6 + 11)/24 = 10.54$ days

c) The standard deviation is calculated as follows:

$$SD = \sqrt{\frac{2981 - 2667.04}{23}} = \sqrt{13.6} = 3.69 \text{ days !!!!!!!!}$$

Where $\Sigma x^2 = 2981$

$(\Sigma x)^2 = 64.009$

$(\Sigma x)^2/n = 2667.04$

$$SD = \sqrt{\frac{2981 - 2667.04}{23}} = \sqrt{13.6} = 3.69 \text{ days}$$

d) The standard deviation, because it mathematically takes into account the distance of each value from the mean value of the group and thus describes the dispersion (or variation) within data for each range..

Exercise 2

a) The range is 58 to 83 beats per minute

b) The mean is 59+72+58...+77+62+60/10 or 68.5 beats per minute

c) The standard deviation is calculated as follows:

$$\sqrt{\frac{\sum x^2 - \left(\sum x\right)^2 / n}{n-1}}$$

where: Σ^2 = 47 629

$(\Sigma x)^2$ = 469 225

$(\Sigma x)^2/n$ = 46 922.5

$$SD = \sqrt{\frac{47629 - 46922.5}{9}} = \sqrt{78.5} = 8.9 \text{ beats per minute}$$

Remind learners that they should take the time to read Learning Unit 6 of the Learner's Guide in preparation for the next session.

LEARNING UNIT 6

Principles of surveillance

As the learning objectives state, this Unit is intended to help the learners achieve the following :

- provide the definition of surveillance
- outline its use in epidemiology and public health
- explain the concept of a surveillance arc
- explain the concept of feedback and why it is important
- recognize the limitations of surveillance in drawing conclusions about health problems
- outline the criteria for evaluating the usefulness of a surveillance system
- apply these criteria to a country example

Go through the first five items in detail. Be particularly careful to explain those concepts that may be misunderstood. Allow time for discussion. Give the learners sufficient time for practical exercises.

Exercises on surveillance

Divide learners in groups of 6-8. Allow the learners to read the information and to work individually for about 25 minutes, then spend the rest of the time discussing their findings in plenary. Be sure to allow adequate time to discuss Exercise 2 (possible solutions)—it is easy to find problems, but it is often harder to come up with practical solutions.

Exercise 1

Several problems can be identified in this surveillance system. The following is a partial list:

Data collection

- Data being collected on too many diseases.
- A relatively complicated form with 3 age and 2 sex categories; with 43 diseases, this means that each month there are 3 x 2 x 43 = 258 boxes to be filled in on each form, and even more if the results are to be totalled for both sexes and for all age-groups.
- Guidelines not available.
- No reference manual for use by health personnel.
- Lack of supervision and lack of checking for data quality.

Data analysis

- Not timely; old data are unlikely to be useful for planning.
- Data represented in an unusable fashion as a series of complex tables with no interpretation.

Data use

- Data not being used at any level.
- Data not being used for planning or for detecting outbreaks.

Timeliness

- Considerable reporting delays at all levels within the system

Feedback

- No feedback to those who collect data; this leads to demotivation.
- Delayed feedback to higher levels, to such an extent that data are not likely to be very useful.

Exercise 2

The answers to this question will depend on the problems selected. In general, the system could benefit from

- a simplification of the forms (fewer diseases and fewer categories)
- better training in simple analysis of data at peripheral level (including such things as the development of a reference manual)
- better supervision of data collectors with an emphasis on feedback to make them see the usefulness of their efforts
- more rapid turnaround of the data at all levels
- development of a reader-friendly report that offers graphic presentation of key diseases and simple interpretative text
- etc.

Encourage learners to relate their findings and proposed solutions to their own situation.

Remind learners that they should take the time to read Learning Unit 7 of the Learner's Guide in preparation for the next session.

LEARNING UNIT 7

Health facility-based epidemiological studies

As the learning objectives state, this Unit is intended to help the learners achieve the following:

- provide the definition of the term facility-based study
- outline the types of information commonly collected in descriptive studies
- stimulate discussions on the use of these studies and their limitations in drawing conclusions concerning the general population
- outline the steps in conducting such a study
- provide sample data that allow learners to draw up an analytic plan, analyze, and interpret the results of a health-facility-based study.

Briefly present the topic and discuss with the learners the limitations of facility-based studies in drawing conclusions concerning the general population and outline the steps in conducting such studies, and their limitations.

Health facility-based studies exercises

For exercise1, the learners should work in groups of 6 to 8. Suggest that the students first develop univariate tables (e.g., sex, age at admission) and then those bivariate tables (e.g., sex and outcome, mother's immunization status and outcome) that will be needed to answer the study questions. Learners should work individually for about 15 minutes; then assemble the class, to draw up a list of the univariate and bivariate analyses that they think are necessary. Ask participants to describe the table outlines they will use to present their findings.

Regarding bivariate analyses, the tendency may be to cross several of the variables in a way that does not directly answer the study question (for example, sex by delivery site or presentation by duration of hospitalization). Although these may provide interesting results, they are not immediately relevant to what the health officer in the study wants to know.

Once the list of tables has been developed, divide the learners in groups of two for Exercise 2 and have them fill in their table outlines. Each group should do at least a couple of the univariate and a couple of the bivariate tables.

For Exercise 3, have each group of students present the results of their work to the class. Discuss the interpretations together as a class.

Answer Exercise 4 as a class after letting the students think a little about the answer.

Exercise 1

Univariate analyses include the following:

- month or quarter of admission
- sex
- age at admission
- delivery site
- presentation
- duration of hospitalization (discharge date - admission date)
- outcome
- mother's immunization status.

The students should construct tentative table shells for the summarization of data. A few examples are presented below:

Sex

Sex	**n**	**%**
Male		
Female		
Total		

Age at admission

Age at admission	**n**	**%**
0-6 days		
7-13 days		
∃14 days		
Total		

The bivariate analyses must be designed to answer the study question concerning risk factors for survival. Learners should avoid crossing at random

variables that are not specifically related to the study question (i.e. age x sex, delivery site x presentation, etc.). The bivariate tables might include:

- quarter x outcome (there are not enough observations to look at this issue by month)
- sex x outcome
- age at admission x outcome
- delivery site x outcome
- presentation x outcome
- mother's immune status x outcome.

As with the univariate tables, the learners should construct tentative tables for the data analysis. Two examples are given below:

Sex x outcome

	Outcome		
Sex	**Lived**	**Died**	**Total**
Male			
Female			
Total			

Age at admission x outcome

	Outcome		
Age at admission	**Lived**	**Died**	**Total**
0-6 days			
7-13 days			
$\geq$ 14 days			
Total			

Duration of hospitalization is a type of outcome variable, and it would not be very meaningful to do an analysis of this variable and outcome.

Exercise 2

Univariate analyses:

Quarterly distribution

Quarter	n	%
First	7	31.8
Second	6	27.3
Third	4	18.2
Fourth	5	22.7
Total	**22**	**100**

Sex: 16 (72.7%) males, 6 (27.3%) females. Male:female ratio = 16/6 = 2.7:1.

Age at admission

This can be broken into categories in a number of ways, either by using conventional breaks (weeks) or by dividing the patients into 2, 3 or 4 categories of equal size. Another way is to calculate the mean and standard deviation, and have 3 categories: < the mean minus the standard deviation, the mean minus the standard deviation up to the mean plus the standard deviation, and > the mean plus the standard deviation. Two possible presentations are shown below:

Age at admission	Cases	% of total
0-6 days	9	40.9
7-13 days	10	45.5
≥ 14 days	3	13.6
Total	**22**	**100.0**

Age at admission	Cases	% of total
0-5 days	7	31.8
6-7 days	7	31.8
≥ 8 days	8	36.4
Total	**22**	**100.0**

Delivery site:

Delivery site	Cases	% of total
Home	18	81.8
Clinic	4	18.2
Total	**22**	**100.0**

Presentation:

Presentation	Cases	% of total
Not sucking	16	72.7
Convulsions	6	27.3
Total	**22**	**100.0**

Duration of hospitalization:

Duration of hospitalization	Cases	% of total
0-6 days	6	27.3
7-13 days	7	31.8
14-20 days	6	27.3
> 20 days	3	13.6
Total	**22**	**100.0**

Outcome:

Outcome	Cases	% of total
Lived	5	22.7
Died	17	77.3
Total	**22**	**100.0**

Mother immunized:

Number of doses	Cases	% of total
0 doses	16	72.7
1 dose	5	22.7
2 doses	1	4.6
Total	**22**	**100.0**

Bivariate tables

Quarter x outcome:

	Outcome		Total
Quarter	**Lived**	**Died**	
First	2	5	7
Second	1	5	6
Third	1	3	4
Fourth	1	4	5
Total	**5**	**17**	**22**

Sex x outcome:

	Outcome		Total
Sex	**Lived**	**Died**	
Male	5	11	16
Female	0	6	6
Total	**5**	**17**	**22**

Age at admission x outcome:

	Outcome		Total
Age at admission	**Lived**	**Died**	
0-6 days	0	10	10
7-13 days	4	7	11
> 14 days	1	0	1
Total	**5**	**17**	**22**

Delivery site x outcome:

	Outcome		Total
Delivery site	**Lived**	**Died**	
Home	3	15	18
Clinic	2	2	4
Total	**5**	**17**	**22**

Presentation x outcome:

	Outcome		Total
Presentation	**Lived**	**Died**	
Not sucking	5	11	16
Convulsions	0	6	6
Total	**5**	**17**	**22**

Maternal immunization x outcome:

	Outcome		Total
Maternal doses	**Lived**	**Died**	
None	1	15	16
> 1	4	2	6
Total	**5**	**17**	**22**

Exercise 3

There appears to be no clear seasonal distribution of neonatal tetanus cases. Most (72.7%) of the hospitalized tetanus cases are among males, suggesting either a different risk of exposure, a different susceptibility, or a different probability of being brought to the hospital for boys compared with girls.

Over 85% of the infants were admitted prior to 14 days of age, with the infants nearly equally distributed between 0-6 and 7-13 days of age. The mean age at admission was 7.0 days, with a standard deviation of 3.8 days.

The vast majority (81.8%) were delivered at home, and the most common presentation (72.7%) was "not sucking".

Over three quarters (77.3%) of the infants died.

Most mothers were unimmunized (72.7%); among those who were immunized, none had received more than 2 doses.

Statistical testing is not a relevant concept here because the entire population instead of just a sample has been used in the study. In the population examined, female sex, young age at admission, home delivery, the presence of convulsions at presentation and lack of maternal immunization were all risk factors for neonatal tetanus death in the population examined.
Learners may wish to calculate the ratio of the risk of death among those "exposed" (i.e. female, home delivery, etc) compared with the ratio of those "unexposed" (i.e. male, clinic delivery) to each of the risk factors. ***This is valid only for the population and cannot be generalized.***

Exercise 4

Although it is valid to use this type of study to examine risk factors for mortality ***among children hospitalized with neonatal tetanus***, it is ***not*** possible to draw conclusions about risk factors for neonatal tetanus. To do so would require the use of a case-control study.

Remind learners that they should take the time to read Learning Unit 8 of the Learner's Guide in preparation for the next session.

LEARNING UNIT 8

Surveys and data management

As the learning objectives state, this Unit is intended to help the learners achieve the following:

- provide the definition of the term survey
- outline the types of information commonly collected in surveys
- stimulate discussion on the use of surveys and their limitations
- provide the definition of complete survey, simple random sampling, systematic sampling, and cluster sampling, and describe their advantages and disadvantages
- outline the steps in conducting a survey and the importance of developing an analytic plan as one of the first stages
- provide guidelines for development of an analytic plan for a survey
- outline the steps in questionnaire development and testing and the ordering of questions within a questionnaire
- discuss the advantages and disadvantages of open-ended versus closed questions in surveys advise on how to develop a questionnaire
- assist in the selection of a sample from a population list
- assist in examination and interpretation of data from a field survey if necessary.

The teaching session for this learning unit should alternate with the exercises. The unit is broken into four parts (overview and preparation, sampling problems, questionnaire design, implementation/analysis) and a four-part set of exercises (see proposed timetable on page 18). Discuss the most important points in each presentation and allow time for questions and explanations.

Exercises on malaria survey

As implied above, these exercises are meant to be done one part at a time, alternating with the teaching sessions on each of the topics. Learners should work in groups of 6-8. On some portions of the exercise, it may be useful to have them work in pairs.

As before, go through the questions one at a time, allowing the students time to think about the answers and then discuss their answers with the class. The answers are given below for each part.

Exercise 1

There is no right and wrong answer to this question. Possible objectives include:

- Determine what percentage of mothers have heard about home treatment of fever with chloroquine.

For those mothers who have heard about home treatment:

- Determine what percentage of mothers who know about home treatment can identify the correct number of tablets and the correct number of doses for their children under 5 years of age.

- Determine how many of those mothers actually used home treatment during the child's last episode of fever.

- Determine where those mothers obtained home treatment.

- Determine if those mothers used home treatment correctly.

- For the mothers who did not use home treatment, find out why not.

The learner may also set objectives designed to gather information that is useful in planning further campaigns, such as what percentage are literate, whether they listen to the radio, etc. However, this type of information should only be considered after the above questions have been answered or found unanswerable.

Exercise 2

Maternal demographic variables include:

- age
- educational level or literacy
- number of living children
- occupation
- ethnic group
- religion
- educational level/occupation of husband
- place of residence
- access to health services, etc.

Knowledge variables include:

- have heard of home treatment with chloroquine
- know where to obtain chloroquine tablets
- can correctly state the appropriate dose for their child, etc.

Examples of shell tables

Age x heard of home treatment

Heard of home treatment

Age of mother	**Yes** n /(%)	**No** n (%)	**Total** n (100%)
<20			
20-24			
25-29			
30-34			
35-39			
40+			

Education x "heard of home treatment"

Other tables must be developed for other maternal demographic characteristics.

For those who have heard of home treatment, the following is an example of a shell table:

Education x whether mother knew correct dose

	Dose reported by mother			
Education/ literacy	**Dose too low** n (%)	**Dose correct** n (%)	**Dose too high** n (%)	**Total** n (100%)
Illiterate				
Literate				

Other tables must be developed for other characteristics.

Exercise 3

First, the learners must decide who is the study subject (mothers versus children, age limit for children; if mothers chosen, which one of their children will you be asking about).

They next need to decide whether the study should be done at health facilities or in the villages. This should probably be done in the villages since those coming to the clinic are a biased sample and their knowledge and behaviour may be different from the knowledge and behaviour of those who do not come to the health centres. Specifically, those who come to the health centres may be those who have never heard of home treatment and thus come directly to the health centres, may represent home treatment failures resulting from inadequate dosage during home treatment, or may be those who are rich enough or live close enough to seek medical care and prefer not to treat their children at home.

Ideally, the population covered in the survey must be from those areas that have been part of the Ministry's home treatment campaign.

Possible methods for sampling include simple random sampling, systematic sampling, and cluster sampling. Unless the population is highly urban and unless the houses can be numbered, the best possibility is to do a cluster survey. A cluster survey requires a maximum of 30 site visits, which will save time and money. In addition, there is no need for a list for a visit to every household or individual in the population, provided there is a census of the survey area. However, your analysis may be a little more complicated than if you were to do one of the other types of sampling.

Exercise 4

Again there is no unique right answer. The sample size can be calculated using the usual formula $Z^2(p)(1-p)DEFF)/d^2$. Based on the physician's estimate, p is about 10% but this may be an underestimate since physicians only see those who do not apply home treatment or are treatment failures. If we do use 10%, let us take a d of 5%, which should be accurate enough for planning and future assessment purposes. Let us also assume a *DEFF* of 2, which is reasonable for "knowledge, attitude, practices (KAP)" surveys.

$1.96^2(0.1)(1-0.1)(2)/0.05^2 = 276$

If we think the physicians may have grossly underestimated the prevalence, we can take the worst-case scenario with respect to sample size and use 0.5 as the value for p:

$1.96^2(0.5)(1-0.5)(2)/0.05^2 = 768$

Exercise 5

As long as there have been no major shifts in the population distribution through war, famine, in-migration, out-migration, or urbanization, it is acceptable to use the list as it is. Since presumably the rate of natural increase is the same for all the villages, there is no need to try to construct 1991 estimates of the population.

If the list is felt no longer to be valid, it may be necessary to seek alternative censuses, such as voter registers, tax registers, etc.

Exercise 6

The first part of the exercise is to obtain the cumulative population for the first 5 villages; these figures have been left blank to give the learners the experience of calculating a cumulative population list. The steps are (1) to transfer the numbers for the first village/town to the cumulative population column. The cumulative population for (1) is then added to the population of (2) (2140 + 15 757 = 17 897 – cumulative total for village 2). To determine the third value, the population of village /town (3) is added to the cumulative population listed for village (2) (4 148 + 17 897 = 22 045).

VILLAGE/TOWN	POPULATION	CUMULATIVE POPULATION
1	2 140	*2 140*
2	15 757	*17 897*
3	4 148	*22 045*
4	1 732	*23 777*
5	2 506	*26 283*
6	2 171	28 454
7	29 098	57 552
8	1 092	58 644
9	4 973	63 617
10	1 884	65 501
11	957	66 458
12	4 907	71 365
13	3 009	74 374
14	14 871	89 245
15	59 895	149 140
...	...	...
...	...	...
122	4 029	885 221
123	8 771	893 992
124	13 491	907 483
125	3 733	911 216
126	8 933	920 149
127	7 066	927 215
	927 215	

The sampling interval is arrived at by taking the total population and dividing by the number of clusters desired: 927 215/30 = 30 907

Using a random number table, pick a 5 digit number between 1 and 30 907, say 17 281. The first cluster will be in the village containing person number 17 281 (village 2, which contains persons 2141-17 897). Add the sampling interval successively to this value in order to obtain the other 29 clusters. Cluster 2 will be in the village containing person 17 281 + 30 907 = 48 187 (village 7, which contains person 28 455-57 552).

Cluster 3 will be in the village containing person 48 187 + 30 907 = 79 094 (village 14, which contains persons 74 375-89 245) etc.

The number of mothers to be interviewed in each cluster is arrived at by taking the required sample size and dividing by the number of clusters to be examined (30): 276/30 = 9.2 rounded up to 10 or in the worst case scenario; 768/30 = 25.6 rounded up to 26.

Exercise 7

The easiest way is to do a quota sample, in which you find the centre of the village, choose a direction at random, count the houses between the centre and the end of the village in that direction, and pick a random number between 1 and the number of houses you have counted. You then go to the first house and proceed door to door until you have interviewed 10 or 26 mothers depending on the type of scenario considered.

It is also possible to undertake systematic sampling if the households were numbered already or could be easily counted. The only problem is that you would also need to know how many houses on average had mothers of eligible children in them so that you could correctly calculate the sampling interval.

If there is more than one cluster selected in a town, get an approximate census of each neighbourhood and make a cumulative list. Go on a small scale through the same procedure you went through to pick the original clusters (cumulative list, total/number of clusters desired, random start point is site of first cluster, sequentially adding the sampling interval until desired number of clusters is obtained). Alternatively, break the town into equal size units and pick the required number of clusters at random by numbering the units and drawing them from a hat, box, etc. In any case, go to the centre of the units chosen and proceed as if the unit were a village.

Exercise 8

There are no right or wrong answers here. However, the following points must be taken into account when writing the questions asked for in this exercise:

a) How to define fever so that all the mothers know what you are talking about?

b) How to define medical attention? Traditional versus Western medicine?

c) Should the answer be open-ended or categorical? If categorical, how to decide which categories to include on your questionnaire? Should the answers be read or should the mother answer and the results then be classified by you?

d) There is a need to build in a "skip" pattern for those who have never heard of home treatment, and to enter an intermediate question to find out whether the mothers gave any home treatment before finding out what they gave. At this point, you must figure out whether the mother really gave chloroquine or not (suggest use of visual reminders).

e) Same issues as for (c) above

f) How to know whether the dose is correct for her child, since usually it is based on a per-kilo grain basis? Can this be done on the basis of the child's age, or on the basis of the child's actual weight?

g) How to measure distance? By kilometre "as the crow flies", the distance along the road in km, the time it takes to get to the health centre? If a time measure is used, what is the mode of transport that must be taken into account?

Exercise 9

The following represents one way in which the data may be summarized:

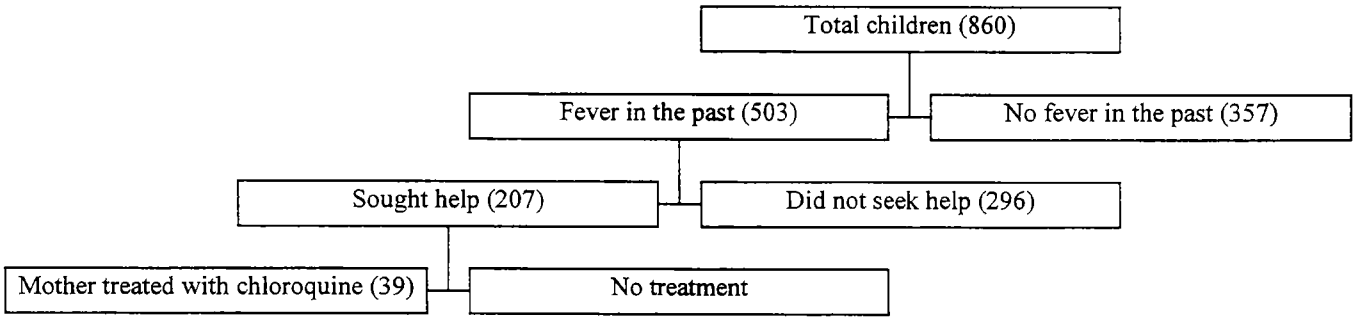
A total of 860 children under 5 were included in the study, 503 (58.5%) of whom had experienced fever in the previous month. Of the 503 mothers whose child had fever, 207 (41.2%) sought medical help. As shown in the following table, distance from the health centre was not an important predictor of whether the mother sought medical attention for the fever, nor was the child's sex. Rates of seeking medical attention were fairly similar for children under 4, although after 4 years, the rate was slightly lower.

Predictors of seeking medical treatment for episodes of fever in the previous month

CHARACTER-ISTIC	SEEKING HELP	TOTAL	%
Distance			
≤ 1 hour	93	194	47.9
1 - 1.9 hours	54	135	40.0
≥ 2 hours	27	65	41.5
Sex			
Male	100	256	39.1
Female	106	246	43.0
Missing	1	1	
Age			
< 1 year	39	95	41.0
1 year	53	116	45.7
2 years	46	117	39.3
3 years	47	110	42.7
4 years	22	65	33.8
missing	0	1	0

At total of 296 of the 503 mothers whose children did not have fever (58.8%) did not seek medical treatment. Among these, only a small minority (13.2%) treated their children with chloroquine on their own, as had been recommended by the government campaign. The remaining 257 children did not receive any treatment; thus 51.1% of the children with fever apparently went untreated.

The overall scheme can be represented as follows:



Among the 39 mothers who initiated chloroquine treatment on their own, 30.8% obtained it at the pharmacy, 20.5% bought it in the market, 17.9% had obtained it from a health agent during a previous illness, and the remainder obtained it from relatives, friends, or other sources.

Of those who did treat their children and for whom the amount given and the child's weight were known (n = 29), 37% gave their children too high a dose, and another 31% gave too low a dose. Thus only 31% gave an appropriate amount.

In summary, fever in the past month was a common occurrence in the study population. About 41% of those whose children had fever sought medical help. Of the remaining 59%, only 1 child in 8 was treated by the mother with chloroquine, and the rest went untreated. Chloroquine was obtained from the pharmacy and to a lesser extent from the market; in 2/3 of the cases, the dose was either too high or too low. These findings imply that the programme to encourage market purchase and home treatment has not been very successful, and that those who are giving home treatment are not doing so in a correct way.

From the data presented here, it is not possible to tell whether the mothers had not heard about home treatment or whether they had heard about it but had decided not to use it. The data collected in the survey must be carefully examined, and appropriate action taken either to disseminate information about home treatment in a more effective manner or to work on changing the attitudes about home treatment. The message on how to give home treatment should also be reviewed, since many of the mothers do not appear to be administering the treatment correctly.

Remind learners that they should take the time to read Learning Unit 9 of the Learner's Guide in preparation for the next session.

LEARNING UNIT 9

Assessing the accuracy of a test or surveillance system

As the learning objectives state, this Unit is intended to help the learners achieve the following:

- provide the definition of the terms sensitivity, specificity, positive predictive value, negative predictive value and describe their importance to health practitioners and patients
- describe the trade-offs between sensitivity and specificity
- outline the factors that contribute to high positive predictive value
- assist in calculation and interpretation of sensitivity, specificity, and positive predictive value from sample data.

Give a clear presentation on the subject and discuss with the learners the usefulness of the above-mentioned measurements to health practitioners and patients. Allow enough time for questions and clarification of any aspects not clearly understood.

Exercises on sensitivity and specificity

The learners should work individually or in pairs. Have them reflect on the questions for a few minutes by themselves, then have them answer as a class.

On exercise 2, you may wish to allow the learners to work a few minutes by themselves and then work with them together as a class to answer this exercise (see detailed instructions below on how to set up the table). The same applies to Exercise 3.

The learners can then work out Exercise 4 by themselves, with Tutor and Facilitators circulating to help those who are having problems.

Exercise 1

a) In this case, "test" corresponds to "fever and rigors", and "disease" to "positive thick smear". Of 100 people with positive thick smears ("disease"), 98 will have fever and rigors ("test"). The other 2 will have positive thick smears but no fever and rigors and will be considered false negatives. TP/(TP + FN) = 98/100 = 98%. The sensitivity is 98%.

b) Of 100 people who have negative thick smears ("disease"), 99 will not have fever and rigors ("test") and are thus considered true negatives . The remaining one will have a negative smear but will have fever and rigors and will represent a false positive. TN/(TN + FP) = 99/100 = 99%.The specificity is 99%.

Exercise 2

Steps

- Begin by constructing the 2x2 shell table. Make sure that everyone realizes that in this case the "test" is "presence or absence of fever + rigors", while the diagnosis of "disease" is based on the presence or absence of parasites in the thick smear.

- Place the number 100 000 in the lower right hand corner.

	"Disease status"		
Test	**Positive smear**	**Negative smear**	**Total**
Fever and rigors			
No fever and rigors			
Total			**100 000**

- Ask the students how they can fill in the other cells based on the numbers they already know. The first step is to multiply 100 000 by the prevalence, which gives you the total number of individuals with positive thick smears (100 000 x 0.02 = 2 000). This goes in the total of the "positive smear" column. The total number with negative smears can then be derived by subtracting 2 000 from 100 000 = 98 000.

"Disease status"			
Test	**Positive smear**	**Negative smear**	**Total**
Fever and rigors			
No fever and rigors			
Total	**2 000**	**98 000**	**100 000**

- The number who have fever with rigors and a positive thick smear can be calculated by multiplying the number with a positive smear by the sensitivity ($2000x0.98 = 1960$). The number without fever plus rigors and with a positive thick smear can then be derived by subtracting 1960 from $2000 = 40$.

"Disease status"			
Test	**Positive smear**	**Negative smear**	**Total**
Fever and rigors	1 960		2 940
No fever and rigors	40		97 060
Total	**2 000**	**98 000**	**100 000**

- The number who have negative thick smears and do not have fever and rigors can be obtained by multiplying the number with negative smears by the specificity, or 98 000 x 0.99 = 97020. Note that this number goes in the lower right hand box. The number with a negative smear who have fever and rigors can be obtained by subtracting 97 020 from 98 000.

The final table should read as follows:

"Disease status"			
Test	**Positive smear**	**Negative smear**	**Total**
Fever and rigors	1 960	980	2 940
No fever and rigors	40	97 020	97 060
Total	**2 000**	**98 000**	**100 000**

Thus:

a) The number of persons receiving treatment is the total with fever + rigors or 2940.

b) The number unnecessarily treated would be 980, which represents the number who have fever + rigors but a negative thick smear.

c) The positive predictive value is 1960 (true positives) divided by 2940 (true positives plus false positives) = 0.67.

d) The negative predictive value is 97 020 (true negatives) divided by 97 060 (true negatives plus false negatives) = 0.98.

Exercise 3

A positive predictive value of 0.67 means that 67% of those who have fever and rigors and are treated will actually have malaria (and conversely that 33% of those treated will not have malaria).

A negative predictive value of 0.98 means that 98% of those who do not have fever and rigors do not have malaria. In other words, if you do not have fever and chills, it is highly likely that you do not have malaria.

Exercise 4

From their experience with Exercise 2, students should be able to answer this question on their own.

	"Disease status"		
Test	**Positive smear**	**Negative smear**	**Total**
Fever and rigors	196	998	1 194
No fever and rigors	4	98 802	98 806
Total	**200**	**99 800**	**100 000**

Therefore:

a) The number treated each week would be 1194.

b) The number who would actually have malaria would be 196.

c) The positive predictive value would be 196/1 194 or 0.16

d) The negative predictive value would be 98 802/98 806 or 0.998.

Exercise 5

a) In the **low** endemicity area, only 16% of those treated would actually have the disease. This differs considerably from the 66% seen in the high endemicity area. Despite the fact that the sensitivity and specificity are identical in both situations, the prevalence differs between the two areas. In general, the lower the prevalence, the lower the positive predictive value.

b) More stringent criteria may be chosen for the definition of "test". For instance, instead of fever and rigors, adding the criterion that the person has been in the forest in the past 10 days. In such a case, the sensitivity of the test will be decreased and maybe some of those who actually have malaria will be missed, but at the same time, the specificity of the test is increased, thereby decreasing the number of false positives.

c) It may be acceptable to stop using thick smears in the high endemicity area, although about a third of the people that you treat on the basis of fever and rigors will not actually have malaria. However, the costs of the additional chloroquine and the risks linked to unnecessary treatment must be taken into consideration. For the low endemicity area, the strategy mentioned in (b) above is acceptable, if it is not decided to continue the current policy of performing thick smears on suspected cases.

ANNEX 1

Directions for writing multiple-choice questions

1. Make certain that the stem (that part of the multiple-choice question which precedes the various possible choices) consists of a complete statement, not just a single word.

2. Place all common elements in the stem of the item. This adds simplicity and compactness to the item.

3. Make each item completely independent of answers to other items (for instance, the stem of one should not suggest the answer to another).

4. Eliminate all unrelated details from an item.

5. In general, avoid negative statements, but if a negative expression does appear in the stem of the question, underline it to draw the student's attention to it.

6. Use *plausible* or logical *distractors* ("incorrect answers"). Each distractor should, by its content or nature, be such that it appears to have something to do with the question. Unrelated distractors appear silly to a thoughtful examinee. Since the number of possible answers is thereby cut down, the item loses some of its value.

7. Avoid the use of clues that may suggest the correct answer.

8. Be sure that the distractors and the correct answer possess homogeneity; they should be fairly similar in content or in the total number of words.

9. Be cautious of the use of "none of the above" as a distractor or as a correct answer.

10. If it is impossible to obtain more than three plausible answers, do not waste time trying to invent some others.

11. When dealing with items that have numerical answers, arrange the answers in order from large to small or vice-versa.

12. Arrange the place for the correct answer in such a way that, for the test as a whole, no letter corresponding to a given answer appears more frequently than some other letter.

Examples of multiple-choice questions

One "best answer" type

Question 1

In epidemiology, the term prevalence:

a) represents the number of new cases occurring in a given period
b) always relates to a denominator population
c) relates to the number of cases per population at a given time or for a given period
d) is expressed as a percentage
e) represents the total number of cases in a given population for a given period or at a given time

Question 2

Active immunisation is available against all of the following diseases *except:*

a) tuberculosis;

b) smallpox;

c) poliomyelitis;

d) malaria;

e) yellow fever.

The multiple-true-false type

(also called "multiple-answer item").

This type consists of a stem followed by several true or false statements. The candidate is to determine whether or not *each of the four* statements which follows is true or false. He then responds according to a code which permits one out of five possible combinations or answers whereby one, two, three, or all four statements may be true.

- when properly written, the multi-true-false item type tests the student's knowledge or understanding of several related aspects of a substance, a disease, or a process;

- each of the statements or completions offered as possibilities must be clearly true or false. This is in contrast to the type "1" format in which alternatives which are "partially correct" may be used as distractors;

- this type of item should be written so that no two of the alternatives are mutually exclusive, i.e. the answer "all are correct" *must be a possible answer.*

The directions for this item type are as follows:

For each of the incomplete statements below, *one* or *more* of the completions is correct. On the answer sheet blacken space under:

a) if only 1, 2 and 3 are correct;

b) if only 1 and 3 are correct;

c) if only 2 and 4 are correct;

d) if only 4 is correct;

e) if all are correct.

Question 3

A child suffering from an acute exacerbation of rheumatic fever usually has:

1. an elevated sedimentation rate;

2. a prolonged P - R interval;

3. an elevated antistreptolysin 0 titre;

4. subcutaneous nodules.

The matching type

Directions for constructing matching items

- Limit the number of entries to about 10. If situations arise where 20 or 30 entries must be considered, construct two or three matching items. When long lists have to be matched, the student wastes too much time in trying to find the correct answer.

- Do not break items by the bottom of the page. The complete item should be on the same page.

- Have a longer list of questions than of possible answers and state in the directions that these may be used more than once. When there are an equal number of questions and answers, it is possible for the student, after responding to some of them, to complete this task by elimination and guessing.

- Strive for homogeneity.

The directions given to examinees for this type of item are as follows:

"Each group of questions below consists of lettered headings followed by a list of numbered words or statements. For *each* numbered word or statement, select the *one* lettered heading that is most closely associated with it and blacken the corresponding space on the answer sheet. Each lettered heading may be selected once, more than once, or not at all.

Examples:

Questions 4 to 9

a) blood transmission

b) dehydration

c) anaemia

d) restricted to South America

e) blood in stools

4. malaria

5. Chagas disease

6. cholera

7. kala-azar

8. amoebic dysentery

9. hepatitis B

Questions 10 to 14

a) chloroquine

b) mefloquine

c) quinine

d) none of the above

10. an antimalarial against which there is resistance in most parts of the world

11. an antimalarial which may cause depression and cardiac problems

12. an antimalarial that must not be associated to chloroquine

13. an antimalarial that should not be used as a front-line drug

14. an antimalarial that can lead to heamoglobinuria.

The comparison type

The "comparison" type permits one to compare and contrast two diseases, signs, symptoms, laboratory findings, etc.

When using this type of item, one must be careful to:

- avoid the trivial;

- avoid selecting as one of the pair something that is rare or unusual. For example, if the item asks about the relation of a certain symptom to disease "x" or "y", and the frequency of the symptom in the two diseases is 90% and less than 1% respectively, then the examinee is in a dilemma. If he or she follows the principle of the "general rule", he may select answer A ("x" only); but if he or she is aware that the symptom does occur in the exceptional case of disease "y", then the examinee may select answer C ("both"). Which answer is correct?

The instructions for this type of item are as follows:

"Each set of lettered headings below is followed by a list of numbered words or phrases. For each numbered word or phrase, blacken the space on the answer sheet under:

a) if the item is associated with (a) *only.*

b) if the item is associated with (b) *only;*

c) if the item is associated with both (a) *and* (b);

d) if the item is associated with neither (a) *nor* (b).

Examples:
Questions 15 to 17

a) hookworm disease;

b) ascariasis;

c) both

d) neither;

15. eosinophilia;

16. hypochromic anaemia;

17. infection through the skin.

Test and measurement, or the study of tests used in measurement techniques, is a fairly new science. It was introduced into the world of health sciences teaching about 50 years ago against some opposition. The problem has aroused the interest of teachers, even if some of them feel that the evaluation "specialists" are trying to poach on their preserves, and that this will limit their academic freedom. Better information on this subject will help to disarm the defence mechanisms and reactions displayed by teachers. If no reference is made here to

questions of the "true-false" type, this is not a chance omission! They are really very bad and should not be used.

ANNEX 2

Sample pre and post-test questions

Instructions for the learners

The following test includes a mixture of problem-solving questions, the answers to which will need some calculations and reasoning, and multiple choice type questions. In all cases you are advised to read the questions carefully. In the case of multiple choice type questions, you must indicate the answer selected, with a tick or ticks in the boxes provided. You must decide if there is more than one correct answer, but remember that negative marking will be used: for every incorrect answer one mark will be deducted.

Sample questions

1. **In January there were 50 cases of malaria diagnosed in District X,which has a population of 200 000. Of these, 30 were in males and 20 were in females.**

a) What is the rate of malaria cases/100 000 in this population during the month of January?

Answer:

b) What proportion of the cases were in males?

Answer:

c) What is the ratio of male cases to female cases?

Answer:

d) The differences in the number of male and female cases might be explained by:

i) A greater number of males than females in the population

ii) Higher risk of exposure to malaria among the males compared with the females

iii) Different risk of developing clinical illness if exposed among males and females

iv) Better diagnosis of cases among males than females

v) All of the above.

2. **A survey in which thick smears are performed on all of the villagers in one village shows that 14 per cent are positive. Does this represent an incidence rate or a prevalence rate?**

Incidence rate

Prevalence rate

3. **During January in village X, there were 7 people under treatment for tuberculosis, one of whom finished treatment on January 15. Three new cases were diagnosed during the month. The total population of the village is 1000 persons.**

a) What was the incidence rate of tuberculosis during January in village X?

1) 7 per 1000.
2) 3 per 1000.
3) 10 per 1000.
4) 2 per 1000.
5) None of the above.

b) What was the period prevalence of tuberculosis for January in Village X?

1) 10 per 1000.
2) 7 per 1000.
3) 3 per 1000.
4) 2 per 1000.
5) None of the above.

4. **Twelve people were admitted to a district hospital in January with cerebral malaria. Their ages were as follows:**

8, 1, 64, 2, 3, 2, 4, 1, 2, 6, 13, 3.

a) What is the range of ages in years?

Answer:

b) What is the mean age of the patients, in years?
Answer:

c) What is the median age of the patients?
Answer:

d) In this case, is the mean or median the best measure of the distribution of the population? Select one only.

mean

median

5. **Surveillance:**

1) Is useful in examining disease trends over time.

2) Usually involves the collection on detailed data on each patient.

3) Requires highly trained personnel for data collection.

4) Is usually expensive to operate.

5) All of the above.

6. **Surveillance can be used:**

1) To detect epidemics.

2) To monitor the progress of interventions.

3) (i) and (ii).

4) To identify socioeconomic risk factors for the development of disease.

5) All of the above.

7. **To be useful, a surveillance system should:**

1) Provide timely feedback to those who collect and utilize the data.

2) Gather detailed information on as many diseases as possible.

3) Measure all the cases of a disease.

4) (i) and (iii).

5) All of the above.

8. **A health facility-based study of 100 measles cases performed on the paediatric ward of the district hospital:**

1) Allows for more detailed data collection about measles cases than is available in surveillance.

2) Provides results about the epidemiology of measles that can be generalized to the population of the district.

3) Permits the determination of risk factors for measles.

4) (i) and (iii).

5) All of the above.

9. **Health facility-based studies may be performed by:**

1) Reviewing hospital charts.

2) Collecting information on new cases as they occur.

3) Reviewing laboratory records.

4) Reviewing outpatient records.

5) All of the above.

10. The malaria officer wishes to provide a graphic presentation on the sex distribution of malaria cases in his region. He could use:

1) A bar chart.

2) A histogram.

3) A pie chart.

4) (i) and (iii).

5) All of the above.

11. Time trend data from different regions should be plotted on semi-logarithmic graph paper:

1) When the purpose is to compare the rate of change over time.

2) When there is a wide variation in the rates among the different regions.

3) (i) and (ii).

4) When it is important to be able to read the actual numbers for each area from the resulting graph.

5) All of the above.

12. If there is a complete list of all individuals in the population, the selection of person to be included in a survey can be done by:

1) Simple random sampling.

2) Cluster sampling.

3) Systematic sampling.

4) (i) and (iii)

5) All of the above

14. A questionnaire should be pretested (tick one only):

1) Before the interviewers are trained.

2) After the final version has been sent to the printer.

3) On the population to be studied.

4) (i) and (iii).

5) All of the above.

15. Open-ended questions (tick one only):

1) Are useful in the preliminary states of designing a study.

2) Are difficult to code and analyze.

3) Provide more information than close-ended questions.

4) (i) and (iii).

5) All of the above.

16. In general, a good questionnaire that is to be administered by a trained interviewer has all of the following characteristics *except* (tick only one):

1) Can be directly coded for analysis purposes at the time of interview.

2) Asks the most sensitive and difficult questions at the beginning rather than the end before the person being interviewed loses interest.

3) Is written so that the language and concepts can be clearly understood by the person being interviewed.

4) Are organized so that all the questions on a certain topic are asked before proceeding on to the next topic.

17. The size of the sample in a survey should take into account:

1) The expected prevalence of the condition or behaviour being studied.

2) The desired level of precision.

3) The method of sampling used in the survey.

4) (i) and (iii).

5) All of the above.

18. The order to be followed in undertaking a survey should be:

1) Develop objectives, write questionnaire, conduct study, develop plan for the analysis, analyze data.

2) Write questionnaire, develop objectives, develop plan for the analysis, conduct study, analyze data.

3) Develop objectives, develop plan for the analysis, write questionnaire, conduct study, analyze data.

4) Write questionnaire, conduct study, develop objectives, develop plan for the analysis, analyze data.

Answers

1a	25 per 100 000
1b	0.6 or 60% are acceptable answers the ratio is 1.5 to 1; 1.5 is also acceptable
1d	(v)
2	prevalence
3a	2
3b	1
4a	1-64; 63 is also acceptable
4b	9.1; 9.08 is also acceptable
4c	3
4d	median
5	1
6	3
7	1
8	1
9	5
10	4
11	3
12	4
13	2
14	4
15	5
16	2
17	5
18	3

ANNEX 3

Questionnaire for evaluation of training

Instructions for completion of questionnaire

Use the following code to indicate the extent to which you agree or disagree with each of the statements made in the questionnaire:

1 Disagree strongly
2 Disagree
4 Agree
5 Agree strongly

These numbers are printed alongside each question. You should circle the number that corresponds most closely to your opinion.

The difference between options 1 and 2 and between options 4 and 5 is one of degree only. To make sure that you express a definite opinion, no code 3 has been included (except for question 12); this allows a "satisfaction index" to be calculated for each question.

Take your time over completing the questionnaire. You do not have to put your name on it if you would rather not, but *please answer the questions as frankly as possible.*

Section I. Overall assessment of the training activity

1. The overall organization of the training programme was satisfactory.

   1 2 4 5

2. The training programme covered all the subject matter in adequate detail. (If you disagree with this, state which subjects should have been given greater coverage.)

   1 2 4 5

Comments:

The tutors and facilitators for this training course had sufficient knowledge and teaching ability to provide you with the necessary skills and competence.

1 2 4 5

Comments:

4. The time allocated to each part of the training was adequate relative to the total time available. (If you disagree with this, state which particular topic should have been allotted more or less time.)

1 2 4 5

Comments:

Section II. Relevance and usefulness of the different teaching methods

5. Overall, the teaching methods used in this training course were effective.

1 2 4 5

6. The use of the various teaching methods listed below was appropriate.

Large group presentations 1 2 4 5

Comments:

Practical demonstrations (laboratory) 1 2 4 5

Comments:

Laboratory work and facilities (including equipment) 1 2 4 5

Comments:

Field work 1 2 4 5

Comments:

Small group discussions 1 2 4 5

Comments:

Self-study 1 2 4 5

Comments:

Quizzes, tests and other evaluation exercises 1 2 4 5

Comments:

Section III. Assessment of teaching materials

7. The audiovisual materials (slides, overhead projection transparencies) used in the training were helpful.

1 2 4 5

Suggestions for improvement:

8. The teaching materials provided were satisfactory in all respects.

1 2 4 5

Suggestions for improvement:

Section IV. Implementation of training; attitude of tutor and facilitators

9. The general atmosphere of the training course made this a good learning experience.

1 2 4 5

Comments:

10. Every effort was made to help you achieve the learning objectives.

1 2 4 5

Comments:

11. You were able to achieve all the learning objectives of the training programme.

1 2 4 5

Comments:

Section V. Overall evaluation of the training

12. What overall rating would you give to this training programme? (Circle your answer)

Lowest 1 2 3 4 5 Highest

13. With regard to this training experience, state the following (giving actual examples):

(a) the three aspects that impressed *you most favourably*

_____
_____
_____
_____
_____

(b) the three aspects that impressed *you least favourably*

_____
_____
_____
_____
_____

14. Do you have any additional comments regarding any aspect of the training programme? If so, please make them below.

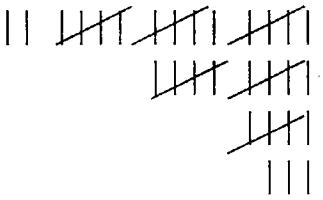
_____
_____
_____
_____
_____

Analysing answers to the questionnaire

The following method will allow you to analyse the answers to the questionnaire simply and quickly. Take a fresh (uncompleted) copy of the questionnaire; against each question, mark the learners' answers. For example:

5. Overall, the teaching methods used in this training course were effective.

1 2 4 5



This shows that two learners considered the teaching methods were not effective while 28 agreed that they were effective.

Now multiply the number of answers by the corresponding coefficient:

$(2 \times 2) + (10 \times 4) + (18 \times 5) = 4 + 10 + 40 + 90 =$ **134**

The "satisfaction index" is calculated as a percentage. For the above example, the number 134 is multiplied by 20 (i.e. 100 divided by the maximum coefficient, 5) and divided by 30 (the number of learners):

$$\frac{134 \times 20}{30} = 89.3\%$$

Since the satisfaction index is calculated in such a way that 60% represents "average" satisfaction, you should make a note of any questions for which the index is below 60% (if there is none, identify the five questions for which the index is lowest and the five for which it is highest). Let the learners know the results of this questionnaire at the final evaluation session on the last day of the training programme.

ANNEX 4

Commonly used methods of teaching and their objectives

Teaching method	Purposes
Audio tapes May be used with large or small groups of learners or by the individual learner.	• To guide practical work. • As a variation in the method of presentation of material. • For the acquisition of new knowledge
"Brainstorming" Intensive discussion focusing on a single problem. Participants are asked to develop as many solutions as possible to a problem within a limited time - generally not more than 10 minutes. No critical evaluation of solutions is offered.	• For developing new and creative ideas. • As a prelude to detailed, in-depth problem-solving.
"Buzz-groups" Groups of 2-4 people discuss a particular topic for a short time - generally no more than 5 minutes - within the context of a large-group lecture.	• To encourage all learners to participate. • To develop group cohesion and encourage learners to help one another. • To "rehearse" understanding and thus consolidate factual learning. • To stimulate creative thinking.
Case discussion Real or hypothetical problems are analysed in detail. Learners are encourage to find solutions and make decisions.	• To help in understanding the facts underlying the problems and to eliminate misconceptions. • To show how various principles are applied to real problems.
Controlled discussion Under the control of the tutor, learners are encourage to ask questions, raise problems and make comments following a lecture.	• To provide further consideration of factual learning. • To bring together and synthesize the contents of a lecture and provide feedback to tutor and learners.

Demonstrations Certain procedures are performed by the tutor to demonstrate skills that must be acquired by learners.	• To help develop learners' power of observation. • To provide knowledge of principles as a prelude to learners practising the skills for themselves.
Video tapes	• For development of skills in interviewing, counselling, etc. • To allow learners to see themselves "in action". • To provide learners with direct feedback.
Free group discussion Discussion in which the content and direction are principally under the learners' control. The role of the tutor is that of an observer.	• To develop effective small-group functioning. • To help learners establish the practice of self-learning. • To allow the tutor to observe developments in the learners' problem-solving skills.
Group tutorial Tutorial with 12-15 learners. The subject and direction are usually, but not invariably, under the control of the tutor.	• To facilitate understanding of particular topics, and bring together ideas. • To develop group-functioning skills.
Projects Varied in format and content, but generally submitted as a written exercise by a small group of learners or by individuals.	• To develop skills in gathering organizing, applying and illustrating information in the context of a particular problem. • To provide practice in the presentation of data.
Private reading • To assist in acquiring and understanding new information. • To assist the development of critical thinking skills.	• To develop an ability to select and retrieve relevant information.

Role-playing Learners are assigned or select certain roles (e.g. village leader, mosquito collector), then create and act out typical situations. It is essential that the content of the role-play be discussed at length by participants and observers; without this, the exercise has little value.	• To develop "self-awareness", i.e. to help the learner appreciate the effect that his or her attitudes have on other people. • To improve attitudes and behaviour by encouraging the learner to "get into the skin" of another person.
Seminar Presentation of material by one learner to a group of fellow learners, followed by critical analysis and discussion. It is not essential that the tutor be present.	• To present new information. • To help with understanding of new material.
Individual tasks The type of task assigned to the individual learner may vary, but it will generally be a problem to be solved within or outside the classroom situation.	• To foster active, direct learning. • To develop problem-solving skills. • To provide a context in which the tutor can help learners to remedy particular weaknesses.
Lecture The "classical" lecture is an uninterrupted talk by the tutor to a group of learners, generally lasting about 1 hour. The form may be modified and used in conjunction with "buzz groups", syndicate groups, etc.	• To transmit information. • To impart general background knowledge of a particular subject. • To synthesize a wide variety of information into a coherent whole.
Practical classes Learners perform experiments, write up their results, and draw appropriate conclusions.	• To develop powers of observation. • To develop familiarty with equipment and skill in its use. • To develop problem-solving through collection, analysis and evaluation of data.
Problem-centered groups Problem solving in the classroom situation by groups of 4-8 learners, partly under the direction of the tutor.	• To develop skills in analysing and solving problems and in decision-making. • For practice in applying theoretical knowledge to "real" problems.

Step-by-step lecture A lecture format linked to an organized around, for example, a set of 35-mm slides or a number of multiple-choice question.	• To impart new information and reinforce its understanding.
Step-by-step discussion Working with a small group (8-10) of learners, the tutor directs a discussion centred on a particular issue or a set of pre-prepared questions. The intention is to draw out from the learners the required information.	• To present a new factual material. • To help learners in the process of scientific and deductive reasoning and of drawing appropriate conclusions.
Syndicate group The class is divided into groups of 4-6 people; all groups work on the same, or closely related, problems, with occasional teacher contact. Each group prepares a report, which is presented to the rest of the class. The syndicate group technique can be used in conjunction with tutorials.	• To develop skills in seeking out, organizing and presenting information. • To foster cooperation between learners in planning, writing and presenting a report