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Tuberculosis Surveillance In the European Region

Report on a Symposium

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Note

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This report is also available in French and Russian.

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1. INTRODUCTION

This Symposium was convened by the Regional Office for Europe of the World Health Organization in collaboration with the International Union against Tuberculosis and the Czechoslovak Medical Society. The Government of the Czechoslovak Socialist Republic was the host for the meeting, which was held in the Židlochovice Castle near Brno from 24 to 26 May 1976 to review the present situation of tuberculosis in the Region with special reference to the definition and role of surveillance in control programmes.

Although tuberculosis is steadily declining in most of the technically advanced countries in the European Region, it still represents a major health problem in other parts of the Region.

Over the years, the Regional Office for Europe has attached increasing importance to tuberculosis surveillance aimed at ascertaining the effect and value of tuberculosis control programmes, measuring the magnitude of the problem and ascertaining trends in this field.

The meeting discussed the most relevant criteria for epidemiological surveillance and for the evaluation of social and economic aspects of the tuberculosis problem, the experience gained in systems of surveillance in some European countries, and the organizational structure and functioning of national tuberculosis surveillance units.

Surveillance was discussed in the light of the general objectives of maintaining constant vigilance with regard to the distribution and trends of tuberculosis, and of determining the impact and effectiveness, from the epidemiological, social and economic points of view, of control programmes. It was emphasized that the principles and basic functions of surveillance are the same for all forms of disease, even though details may vary for particular diseases such as tuberculosis.

The Symposium was attended by more than 40 persons, including representatives of the organizations responsible for the meeting, WHO staff from headquarters, representatives of countries in the Region and temporary advisers. Among the participants there were economists, social workers, nurses, epidemiologists, and physicians concerned with the clinical and administrative aspects of tuberculosis control. A list of participants is given in the Annex.

This report is limited to a review of the factual presentations and discussions at the meeting.

The Symposium was opened by Professor B. Štípal, First Vice-Minister of Health of the Czech Socialist Republic, who emphasized the interest of his Government in promoting community health, especially by improving standards of living and the provision of medical care. He drew attention to the favourable trends in tuberculosis, but emphasized that there was no room for complacency. The present situation could be managed by a system of surveillance, which had already been initiated in Czechoslovakia.

On behalf of Dr Leo A. Kaprio, Regional Director for Europe of the World Health Organization, Dr M. Postiglione, Chief, Disease Prevention and Control, WHO Regional Office for Europe, expressed thanks to all who had taken part in making the arrangements for the meeting, especially the Ministry of Health of the Czech Socialist Republic and the Regional Health Office in Brno.

Dr Annik Rouillon (International Union against Tuberculosis - IUAT) expressed pleasure that this meeting, originally discussed some years ago, had been brought to fruition. A major objective of WHO and IUAT was the promotion of cooperation and understanding, and Czechoslovakia was an appropriate place for such a meeting in view of its participation in international projects in the tuberculosis field.

Dr J. Placheta was elected Chairman of the meeting and Dr V.H. Springett was made Rapporteur. Dr M. Postiglione acted as Secretary to the Symposium.

2. PRESENT SITUATION OF TUBERCULOSIS IN EUROPE

In general terms, the available information shows a wide variation in the level of tuberculosis between the countries of the European Region, with an underlying downward trend in tuberculosis in most countries since records were first available. The downward trend has been recorded in some countries over several decades, and was occurring before specific measures to control tuberculosis were undertaken and before the introduction of effective chemotherapy over 25 years ago.

The decline in mortality has been particularly noticeable. In the European Region tuberculosis is now thirteenth on the list of causes of death, but the third major cause of morbidity. Although it was responsible for only 0.2% - 2.8% of all deaths in the Region in 1971, the number of deaths from tuberculosis in some countries is still greater than of deaths due to all other notifiable infectious diseases as a whole.

Studies carried out before the introduction of chemotherapy showed the strong association of tuberculosis with a wide variety of socioeconomic factors, and it is probable that the decline in tuberculosis in many countries in Europe was brought about by a steady improvement in the standards of living in the broadest terms: improved nutrition, improved housing, improved working conditions, and improved understanding of hygiene.

The downward trend of tuberculosis in many countries before the introduction of specific control measures needs to be borne in mind when evaluating trends now and in the future. There is difficulty in assessing how much of the decline at present is due to the underlying trend, and how much can be attributed to organized control measures.

In presenting a satisfactory review of the current situation the greatest difficulty is the lack of uniform data on most aspects of the epidemiological situation and, also, the delay in collecting and publishing on a regional basis such information as is available.

2.1 Prevalence and incidence of infection

Although the importance of indices based on the evidence of tuberculous infection given by tuberculin testing has been recognized for several years, several contributors pointed out how little information based on such testing was available in the Region. In some countries this is because of the general use of BCG vaccination soon after birth, thus invalidating subsequent tuberculin surveys. But, even in countries not using BCG vaccination in infancy, relatively little information is being produced on a routine and continuing basis, and such information as is available is limited by a number of factors, including selectivity in the groups tested, and variability of techniques.

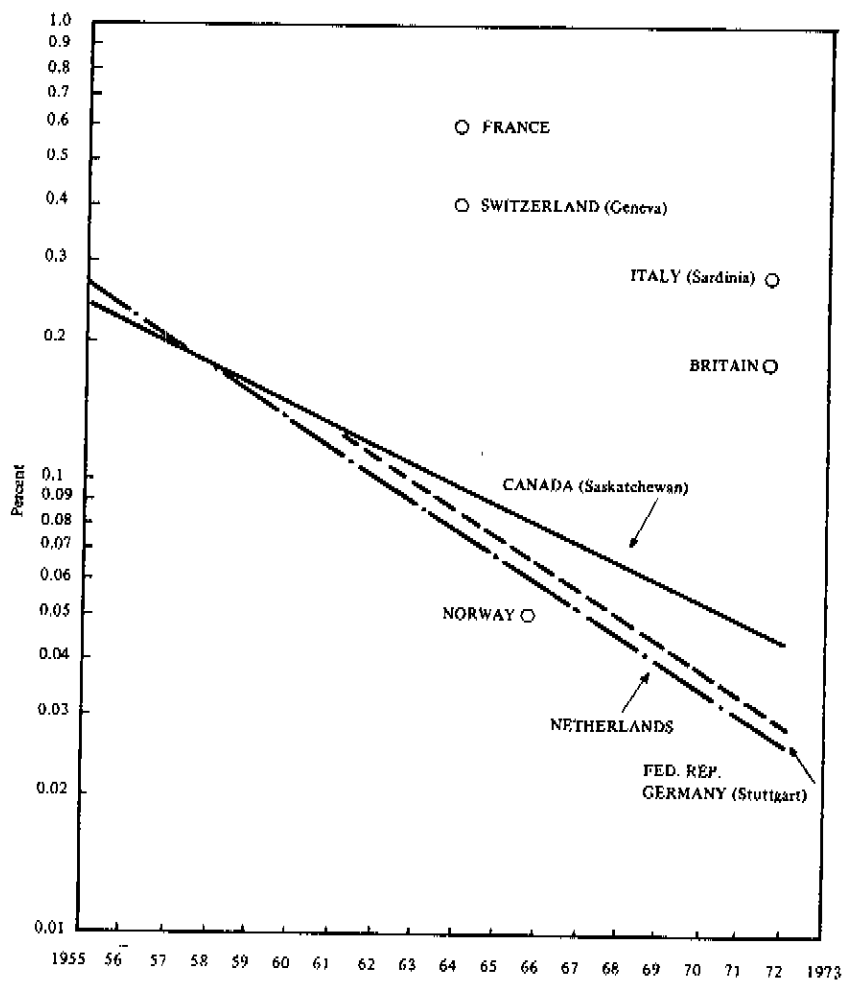
Data from surveys in various countries in the last 10 years show variations in the prevalence of tuberculin positives, at ages 5-7 years, from 0.3% to 8.8%. At ages 11-14 years, the recorded range is from just over 1% to as much as 27%. In most countries where such surveys have been made, the prevalence of infection is declining. The highest figures quoted are from studies made up to 15 years ago, and the lowest figures are from more recent studies. But there still remain substantial differences between countries when the year of study has been allowed for. A more generally used index is the annual risk of infection, either measured directly by repeated surveys or calculated from prevalence studies carried out in identical age-groups in the same community. Such figures are available for very few countries and are summarized in Figure 1, showing variations from 0.6% per year in some countries 10 years ago down to 0.025% per year more recently.

The main conclusion must be that reliable information on infection risk is available for very few countries, mostly those with quite low levels of tuberculosis. In these countries it shows a quite marked downward trend, attaining a rate of decline of 13% per year in some, but only about half this rate of decline in others.

2.2 Tuberculosis morbidity

Information on recorded new cases of tuberculosis is given in the World Health Statistics Annual, from which annual rates per 100 000 population can be calculated for the majority of countries in the European Region (see Table 1). There are, however, substantial differences between countries in the criteria and methods used for recording new cases, and this limits the usefulness of the information.

FIG. 1. ESTIMATED ANNUAL RISKS OF TUBERCULOUS INFECTION
IN LOW PREVALENCE COUNTRIES, 1955-1972



Compiled by Dr M.A. Bleeker, Organization for Health Research TNO, The Hague

Table 1. Morbidity and mortality rates from tuberculosis in the European Region
1972 or latest available year

Country	New cases of tuberculosis		Deaths from tuberculosis	
	All forms (per 100 000 population)	Respiratory (per 100 000 population)	All forms (per 100 000 population)	Respiratory (per 100 000 population)
Albania	...	...	...	...
Algeria	...	...	...	...
Austria	38.8	35.2	11.5	9.4
Belgium	...	28.0	6.0	5.4
Bulgaria	65.9	44.5	8.9	8.0
Czechoslovakia	67.9	59.3	6.8	6.5
Denmark	13.5	11.9	2.7	1.2
Finland	94.0	73.7	6.4	3.6
France	...	...	6.9	5.9
German Dem.Rep.	50.1	40.1	8.6	5.7
Germany, Fed.Rep. of	58.9	50.2	6.7	5.5
Greece	106.9	90.1	8.5	6.7
Hungary	78.9	...	15.8	13.0
Iceland	32.0*	24.3*	1.0	1.0
Ireland	38.1	29.3	6.1	5.1
Italy	12.6*	12.1*	6.2	5.5
Luxembourg	28.2	25.6	3.2	2.9
Malta	19.4	15.0	0.6	0.6
Monaco	...	...	...	8.3
Morocco	...	...	...	...
Netherlands	18.7*	15.1*	1.5	0.8
Norway	25.5	20.2	3.1	0.7
Poland	106.7	101.4	18.4	17.6
Portugal	100.3	94.4	14.5	12.9
Romania	126.2	109.0	14.2	13.1
Spain	...	10.3	8.8	7.8
Sweden	21.9	16.5	4.4	2.7
Switzerland	...	25.5	5.9	4.9
Turkey	...	...	14.1	13.8
United Kingdom				
England & Wales	22.6	17.7	3.0	2.0
Northern Ireland	17.8	15.1	3.2	2.2
Scotland	31.8	25.9	4.4	3.0
USSR	...	...	...	...
Yugoslavia	111.9	103.4	17.3	15.1
TOTAL (32 countries)	57.2 (22 countries)	45.1 (24 countries)	8.7 (27 countries)	7.6 (28 countries)

... Figures not available

* Figures from 1971

Sources: *World Health Statistics Annual 1971 and 1972*, Vols I & II (1975)

Główny Urząd Statystyczny, Warsaw, 1975, *Statystyka Polski*, No. 45, Rocznik Statystyczny Ochrony Zdrowia 1974 [Statistical Yearbook of Public Health]

Comparison of figures for 1972 with those for earlier years shows that there is a decline in recorded cases in most countries, and in some the rates have been reduced by more than 50% in less than 10 years. Large differences persist in the rates recorded for different countries with a greater than tenfold difference between the highest rates (in excess of 100 per 100 000) and the lowest rates (about 10 per 100 000).

The total number of new cases from 22 reporting countries in 1972 or 1971 was approximately 206 000, and these countries have a population of approximately 360 million, giving a rate of 57.2 per 100 000. The total population of the Region is 780 million, so that if the countries for which morbidity figures are not available have the same incidence as those whose figures are published, the total number of new cases in the Region in 1972 or 1971 can be estimated as being 7800×57.2 , or 446 160 new cases of tuberculosis in the European Region in 1972. For respiratory tuberculosis, the estimated total is 351 780.

2.3 Tuberculosis mortality

Tuberculosis mortality rates for most European countries can also be derived from the World Health Statistics Annual. As for morbidity, there has been a decline in most countries in the years preceding 1972, and in many countries the decline from 1961 is more than 50% of the 1961 rate. In 1972 there were still large differences between countries of the Region in their tuberculosis mortality, with a range from 0.6 per 100 000 to 18 per 100 000. However, for the majority of countries the range was rather less, from about 2 per 100 000 to about 14 per 100 000 — a sevenfold difference.

Bringing together the available figures for 27 countries with a population of about 499 million, one arrives at a total of 43 629 deaths in 1972, giving a tuberculosis mortality rate of 8.7 per 100 000. Applying this figure to the total population of the Region of 780 million gives an estimate of 67 860 deaths from tuberculosis in the Region in that year, of which 59 280 were due to respiratory tuberculosis.

2.4 General comments

The present situation with regard to tuberculosis in Europe, more than two decades after the discovery of powerful antituberculosis drugs, and with relatively well-developed countrywide control programmes, reflects the efficiency of the efforts deployed. The satisfaction obtained from the falling mortality and morbidity is, however, clouded by the heavy toll for the community which is still imposed by tuberculosis and the considerable differences between the highest and lowest levels attained within the Region.

The foregoing sections give an account of the available data on tuberculosis. As may be seen, it is not complete. It is hoped that statistical and

epidemiological intelligence will be improved, so that a better contribution will be provided to the progress of surveillance and control programmes.

3. CONCEPT OF TUBERCULOSIS SURVEILLANCE

3.1 Introduction

Surveillance of a disease, especially a communicable disease, is not a new idea, and indeed the basic methods of surveillance have been used in the control of many diseases. Even for tuberculosis, the limited information summarized in section 1 above shows that some aspects of a surveillance programme have been used in many European countries, but with the general decline of tuberculosis, the aims and therefore the methods of surveillance need to be reconsidered.

In this reconsideration there are some quite general points that need to be discussed before proceeding to the details of tuberculosis surveillance.

It is obviously desirable that the methods used for the surveillance of tuberculosis should be uniform within countries and similar in all countries so that valid comparisons can be made between countries. In many countries in the past, tuberculosis control in all its aspects has been organized separately from the provision of care for other diseases. Because of this, there has been a tendency for the surveillance of tuberculosis to develop independently of the surveillance of other diseases. But in many countries the tuberculosis control programmes are to an increasing extent being integrated into the general system of health care, and for this reason also the surveillance of tuberculosis should follow a generally acceptable pattern. It is also desirable that the methods used for surveillance of tuberculosis should be similar to those used for surveillance of other diseases.

The resources available for health care are limited and there is likely to be competition for resources for the control of the various diseases. In these conditions it is desirable that the needs for, and the achievements of, a tuberculosis control programme should be expressed in terms readily understood by those responsible for planning health care and for supplying the funds necessary to carry out an efficient control programme. Therefore, tuberculosis surveillance should be expressed in a form and follow a pattern that is practicable for other diseases also.

When tuberculosis was very frequent, as a cause both of disability and death, the need for activities to reduce its effect was evident to all members of the community, including those responsible for health care. Now that a general downward trend is recognized, and relatively low levels of tuberculosis are being reached in some countries, the need for control programmes

and their evaluation is becoming less obvious. There is, however, a continuing need for surveillance, namely for constant vigilance as to the distribution and trends of tuberculosis, associated with the evaluation of the effectiveness and impact of the control measures applied.

3.2 The elements of surveillance

Surveillance consists of three main elements. There is first the collection and evaluation of information on the level of tuberculosis and its trends. This portion of surveillance activities is recognized in many countries as shown by the review in section 1. That this aspect of surveillance could, however, be improved is not in doubt, and methods for this will be further reviewed in later sections.

The second element of surveillance is the evaluation of tuberculosis programmes. Many countries have monitored programme delivery but few, if any, are monitoring programme impact on a continuing basis.

The third element of surveillance is the continuous use of the information derived from the other elements to plan revisions of the control programme if required.

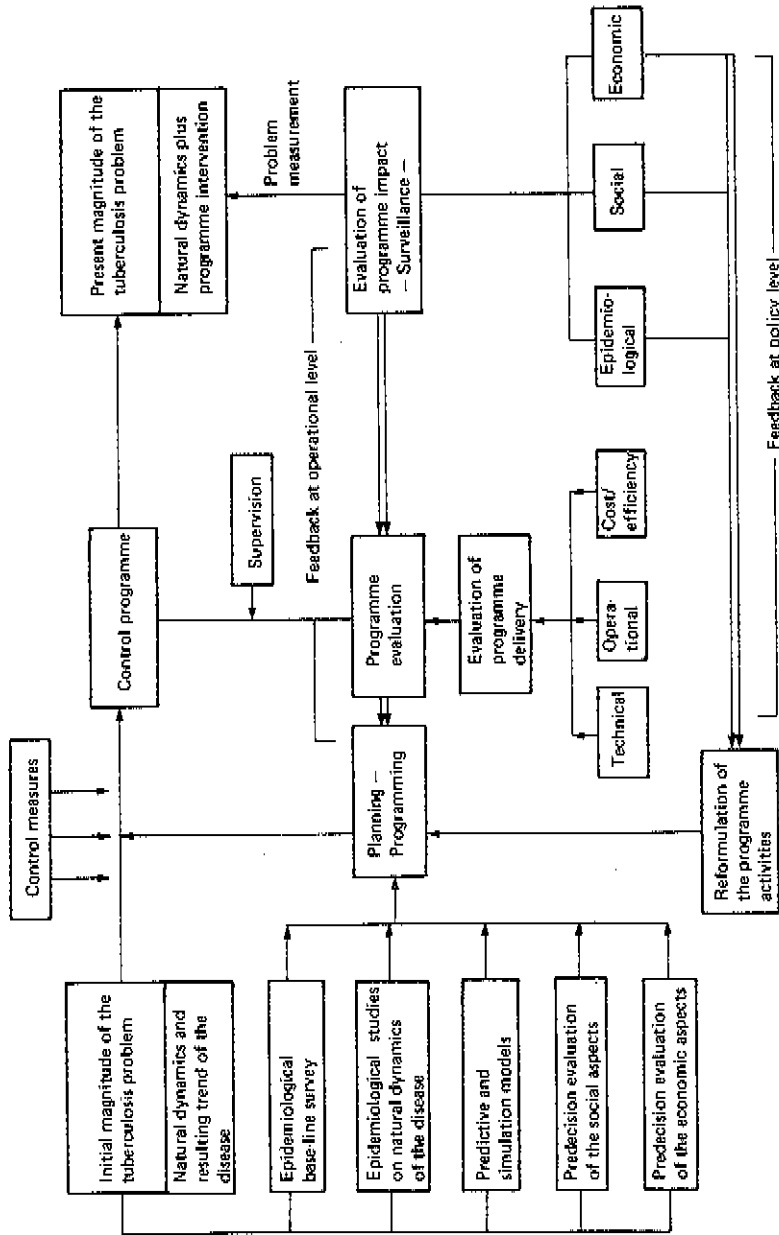
The process of surveillance, like the formulation of a control programme, is most appropriately carried out centrally for a whole country, but this does not imply that the organization responsible for surveillance necessarily has direct responsibility for the control activities in the field.

Since the major objective of surveillance is to assist planning, it is appropriate that the activities involved in surveillance should be expressed in terms and in a format that is familiar and acceptable to planners and administrators. A scheme for surveillance of tuberculosis based on Figure 2 was presented to the Symposium. While some participants pointed out that the full application of such a scheme was not possible at the present time in their country, others stressed the fact that, with built-in evaluation components, any tuberculosis control programme can provide, after a certain period, information useful for starting a surveillance system in the country. The main features of the scheme presented diagrammatically are discussed below.

3.2.1 *Predcision evaluation*

This is the first step in the iterative process of planning, programming, implementation, evaluation, surveillance; it consists of a comprehensive evaluation of the initial situation which is sometimes referred to as "situational analysis". The processes involved are summarized in the boxes forming the left-hand side of Figure 2. Besides epidemiological studies on the natural trend of tuberculosis (i.e. in a nonintervention situation) the predecision evaluation comprises epidemiological baseline surveys to establish the initial magnitude of the tuberculosis problem. It must include also the

FIG. 2 PLANNING - PROGRAMMING - EVALUATION - SURVEILLANCE



evaluation of related social and economic aspects, and give details of the administrative and organizational structure that is available.

All data and information thus obtained provide the input to the decision-making process regarding the control policies to be adopted and the most suitable strategies to be applied under the circumstances. Such decision-making, because of its complexity, is greatly facilitated by the use of predictive and simulation models.

3.2.2 Planning and programming

Planning and programming are two different, though very closely inter-related, activities of considerable complexity that the decision-making authorities have to carry out. The result is the formulation of the control programme "ready to implement". Both activities must duly take into account the information and data obtained from the above-mentioned predecision evaluation, consider effective available control techniques and ensure that these techniques will be applied with the greatest efficiency under the service programme conditions on a community-wide scale and on as long-term a basis as is required.

The programme must be formulated in such a way that it is commensurate with the resources and facilities available in the country concerned and can be integrated with the socioeconomic conditions that prevail there. It must meet the felt needs of the community and at the same time ensure optimum epidemiological returns for the investments made.

3.2.3 Programme evaluation

Evaluation of a control programme is an activity that must be built in from the beginning and must function throughout the operation of the programme. The aim is to monitor the progress made in achieving the stated programme targets and objectives in respect of: (1) programme delivery and (2) programme impact on the total health problem due to tuberculosis.

(a) Evaluation of programme delivery

The evaluation of how effectively and efficiently the programme and its respective components are delivered has to comprise the technical, as well as the managerial, aspects of the control measures applied. While the potential efficacy of these measures may be known from controlled clinical trials, it must be ensured that the measures retain their effectiveness when applied under service conditions. For this purpose, the quality of the preventive measures, case-finding and diagnostic procedures and curative services, and the adequacy with which they are provided, need to be made subject to quantitative evaluation. The coverages and yields obtained from each of these

programme activities within a certain period of time also need to be evaluated in a similar way.

In order to provide a more meaningful measure, it appears necessary to relate the output to a denominator which is well-defined in epidemiological terms and which is directly linked to the principal objective of the programme activity. Thus, the result of case-finding and treatment may be expressed by the number of new patients cured in a certain period of time in relation to the number of new cases estimated to have occurred during the relevant period.

While analysing each programme activity from a technical and operational point of view, the entire organization of the programme requires concurrent investigation because deficiencies in programme delivery may be found when the individual activities are linked to make a complete programme.

Finally, to determine how well the resources have been utilized to achieve stated programme targets and objectives, it is appropriate to relate the effectiveness and the health benefits of the programme to its costs.

Evaluation undertaken at the operational level is capable of yielding results early in the development of a programme. On the basis of the data and information thus gathered, it is possible for the responsible authorities to take specific action whenever necessary, to improve the delivery of individual programme activities and components ("feedback at operational level").

Another programme component that has to be implemented right from the beginning is supervision. Unlike quantitative evaluation, supervision relates to the checking of organization and methods by means of observing the programme activities being carried out in the field. The way in which control techniques and procedures are performed is compared to established norms and standards of work. The aim is immediately to rectify detected shortcomings and observed inadequacies and to provide requisite training on-the-spot.

(b) Evaluation of programme impact

While it is highly desirable to measure the impact which a control programme is making, this is not an easy task, especially not when a protracted communicable disease such as tuberculosis is being dealt with. Moreover, as is the case with other diseases, the scale of the tuberculosis problem and its trends are the aggregate result of (1) the natural dynamics intrinsic to transmission of the infection and development of the disease, both of which are themselves influenced by ecological and environmental factors; and (2) the impact which specific control measures may make when applied to best advantage, viz. by causing a decline in the epidemiological trend or by accelerating such a decline if it already exists.

For these reasons it is usually extremely difficult to make an independent evaluation of the impact of the control programme, such as quantifying the specific total contribution to the overall problem situation which it is making

through preventive and curative measures. However, by means of continued and responsible alertness regarding the magnitude and trend in the epidemiological situation as well as of the social and economic aspects related to the disease, surveillance services will provide the responsible authorities with information pertinent to feedback at the policy level.

On the basis of such information, reformulation of the control programme may be required.

3.3 Discussion

While the detailed procedure described above was accepted as a full statement of what surveillance implies in modern terms, it was recognized that there were a number of problems in the implementation of its various elements of data collection and analysis and in carrying into effect any programme revisions indicated.

The importance of understanding the difference between evaluation of programme delivery and evaluation of programme impact was repeatedly stressed. They are quite separate activities, and it is essential to discuss them individually, while recognizing the importance of each. It is generally easier to evaluate programme delivery than programme impact, and programme delivery has been much more generally monitored than hitherto had been the case with programme impact.

One of the main reasons for the relative lack of information on programme impact was the great difficulty of separating programme impact from the underlying downward trend that had been shown for many countries of the European Region. This difficulty was also repeatedly stressed, and there were few, if any, examples of the impact of a programme that might be separated from the underlying downward trend. The acceleration of the decline of tuberculosis mortality following the introduction of effective chemotherapy is one example, and the great reduction of chronic sputum-positive patients as a result of the Kolin project was quoted as another (though it was also noted that similar reductions had occurred in some other places without a specific revision of the control programme).

Surveillance is part of the iterative process of situational analysis, planning, programming, implementation, and evaluation. To be carried out efficiently it needs to be problem-oriented, i.e., it is necessary to know the nature of the problems arising from tuberculosis, and to collect the data appropriate to answer the questions posed by the problems. There is a danger in collecting all possible data on tuberculosis, much of which, though perhaps interesting, is useless for making planning decisions. It was asked whether the cost and complexity of surveillance justified the results likely to be obtained from it. In any case, for some countries with a high prevalence of tuberculosis and very limited resources, much of the proposed detailed scheme of surveillance is impossible at the present time.

Surveillance of other diseases has been found of value as part of an early warning system. A rather similar function in tuberculosis control is the identification of risk groups.

Many groups with a specially high prevalence have already been recognized, including males over age 65 years, previously treated patients who have not had adequate chemotherapy, patients with fibrotic lesions, migrant workers, their contacts, and patients with silicosis, or those being treated with steroids. Indeed, the most important risk group of all consists of those with symptoms, especially cough persisting for more than three weeks.

Finally, it may be noted that changes in the control programme indicated by the surveillance procedure, including the use of epidemetric models, may require the introduction of aspects of health care not directly involved in tuberculosis, or the cessation of aspects that have become traditional in tuberculosis control.

With regard to the cessation of traditional procedures, it was noted that very few planning decisions had so far been made on the evidence of surveillance methods, though some activities previously in general use had been discontinued in some countries for various reasons. Thus, there are now substantial differences in the control programmes of different countries which are not reflected in their tuberculosis prevalence. The Netherlands has achieved some of the lowest rates in Europe, but has never made use of BCG vaccination on a community scale. Many countries, some with low prevalence and some with high, are not now using active case-finding in the form of routine radiography of healthy persons not in risk groups, while in many others this activity persists. In some countries treatment is now largely on a domiciliary basis, while in others patients spend a substantial period in hospital or a sanatorium as part of their treatment.

Indeed, the only activities in tuberculosis control that all countries endeavour to provide is the availability of diagnostic procedures for patients with symptoms (passive case-finding) and the provision of adequate chemotherapy for those found to have tuberculosis.

Tuberculosis prevalence varies greatly from country to country, but even within a single country there are wide variations in the amount of tuberculosis, which nowadays may occur in pockets.

As tuberculosis becomes a rare disease in parts of some countries, physicians and surgeons not directly concerned with tuberculosis control will tend to forget the possibility of tuberculosis as the cause of illness in their patients. At that stage, an appropriate educational programme for established practitioners may become of importance for the detection of tuberculosis.

4. CRITERIA FOR EPIDEMIOLOGICAL SURVEILLANCE

4.1 Introduction

Until the introduction of effective chemotherapy about 30 years ago, accurate records of tuberculosis mortality provided the best index of the tuberculosis situation in the community for reasons given below.

In recent years, increasing attention has been given to the annual infection rate as measured by the tuberculin testing of children. The value of the annual infection rate as an index was fully recognized by the participants at the Symposium, but the many difficulties in measuring this on a continuing basis were also emphasized. Between the two indices, based on the frequency of the initiation of the tuberculous process by infection and its end result in death, there are a number of indices based on the measurement of the occurrence of disease, using clinical, radiological and bacteriological techniques. Some of these indices are generally available (see section 1 above), but unfortunately the indices of greatest value and precision for surveillance purposes are not so easily obtainable. There is a further difficulty in that indices based on the incidence of tuberculosis morbidity depend on the intensity of case-finding procedures, in addition to the real level of tuberculosis in the community. For surveillance purposes, the indices of greatest importance are those most closely related to the chain of infection in the community. Because of the importance of infection risks for surveillance purposes, this report first considers indices based on infection, and then those based on morbidity, including the occurrence of drug resistance. The comments on each index are based on the presentations and discussions which took place, though in a different sequence. Only those aspects of these epidemiological indices which are of importance for surveillance are discussed here, mainly in terms of their scientific value and practical availability, which appear to show an inverse relationship. Actual figures are not given, since it is the value of the indices for surveillance, and not the levels achieved, which were the objectives of the Symposium.

4.2 Indices based on tuberculin testing as evidence of infection

The value of these indices was fully accepted by the Symposium, but it was noted that despite the number of years over which their value had been recognized, they were still not available on a continuing basis for more than a small minority of countries. The International Tuberculosis Surveillance Centre, The Hague, is assisting in studies on infection incidence in a number of countries and would be willing to cooperate with other countries who wish to take part in similar studies.

The most common difficulty in using tuberculin studies as an index is the use of BCG vaccination for all infants. Attempts have been made to distinguish tuberculin sensitivity due to vaccination from that due to natural infection, but no generally accepted method for this has been achieved. Even in communities not using BCG vaccination in infancy or early childhood, indices based on tuberculin testing could not be obtained except as the result of special surveys. In addition, there are the well-known difficulties of obtaining reliable and reproducible results caused by the problems encountered in standardizing all aspects of the testing procedure.

There are two indices based on tuberculin testing:

(1) *Prevalence of tuberculin positives, usually expressed as the percentage of positive reactors amongst those tested.* This prevalence shows a relationship with age and reflects the cumulative risks of infection during previous years of life. If studies are made in successive years, on the same age-group by similar techniques, then a useful indicator of the trend of the level of infection in the community is obtained.

(2) *Annual infection rate, usually expressed as a rate per 1000 per year for those undergoing tuberculin conversion.* This can be calculated from results obtained by repeated tuberculin testing of identical age-groups in the same community.

For scientific purposes, this is the most satisfactory index of the current tuberculosis situation, as it reflects the risks of the transmission of tuberculous infection and its trend.

4.3 Indices based on morbidity

The methods used in obtaining these indices are of such a varied nature that no preliminary discussion is of value. They are generally expressed as cases per 1000 (or 100 000) population per year. The problems and difficulties are discussed with the indices.

4.3.1 Incidence

(a) *New smear-positive case rate.* This index is of practical importance, and measures the magnitude of the infective sources, or more strictly those parts of the infective sources brought under medical care. It is the most useful of the indices based on incidence of morbidity, and has direct application in leading to treatment to eliminate infectivity. Its value as an index is increased if it can be ascertained for separate age-groups and by sex. The rate of occurrence of new smear-positive cases in adolescents and young adults gives a good index of opportunities for infection in the fairly recent past.

It is unfortunate that this index is available for so few countries: the required information is recorded in most individual case-files, but it is not collected in some low-prevalence countries, though it is available for some which have a high prevalence. One further problem is that of standardization — a casual examination of one specimen obviously has a different significance from the systematic examination of several sputum specimens by a well-trained technician.

(b) *New bacteriologically positive case rate.* This index is obtained by combining the results of culture examinations of sputum with those from microscopy. It has no real advantage over (a) the new smear-positive case rate as index for surveillance. The opportunities for variability from technical factors are greater and its relationship to spread of infection is less close, since patients positive only on culture are not important sources of infection. If for practical reasons the information for all bacteriologically positive cases can be more easily collected than for those which are positive only on microscopy, then this group of bacteriologically confirmed new cases is to be preferred as an index to the remaining indices based on incidence.

(c) *New case rate, not bacteriologically confirmed.* This is an unsatisfactory group of little or no value for surveillance. It is imprecise because the lack of bacteriological confirmation may be due to a failure to make sputum examinations, or because good bacteriological examinations have given negative results. Even if the two subgroups could be satisfactorily separated, it is an index of no value in relation to the transmission of infection or for surveillance. It is included only for completeness and to emphasize the importance of criteria based on bacteriological findings, especially microscopy.

(d) *New case rate, not further defined.* This rather unsatisfactory index results from the grouping together of the two preceding indices, without distinguishing those bacteriologically confirmed from those negative or not examined. For some countries, it may include patients who have relapsed, leading to further difficulty in interpreting its significance. Unfortunately, for many countries it is the only index of morbidity which is available. If the pattern of notification procedure remains reasonably constant over a substantial period of time, then the changes occurring in this index may give some indication of the underlying trend of tuberculosis. Further, if case-finding procedures are applied with equal intensity to the whole population, then it may be possible to determine high- and low-risk groups as a guide for future case-finding programmes. It is highly desirable that all countries should record smear-positive cases as a separate group.

(e) *Relapse or recurrence rate.* This is the separate enumeration of patients previously treated who present with a further episode of tuberculosis.

Here again it is important to distinguish those with positive sputum, and to keep this group separate from patients presenting for the first time which, as already noted, is not always done. The magnitude of the relapse rate gives important information on the adequacy of the treatment programmes and their delivery (as discussed below).

(f) *New case rate of tuberculous meningitis in children.* Because of its association with recent infection, this was, in the past, in many countries, a useful indicator of trends in infection risk. It has fortunately become so rare in most countries that it is no longer of use as an epidemiological index, but it continues to be of value in countries which have not yet been able to bring the risk of infection down to really low levels.

4.3.2 *Prevalence*

It would theoretically be possible to compile indices based on prevalence for most of the items discussed under incidence. But, with the increased effectiveness and rapidity of action of modern treatment, relatively few patients remain long enough in their original diagnostic category to appear in prevalence figures a year later. The relatively small number of sputum-positive patients who continue to excrete tubercle bacilli for more than a year, or who excrete bacilli during the second year or later after a period of negative sputum, form a group of patients in whom treatment is failing. In those countries which measure prevalence of sputum-positive patients, it is generally used in association with the incidence of newly diagnosed positive cases, to give a ratio as follows: all (new and old) patients smear-positive in year divided by new smear-positive patients in the same year. With a good treatment programme effectively carried out, this ratio should approach very close to unity. If values much over unity are found, or if there is a tendency for the ratio to increase, then there is a need for revision of the treatment programme or its delivery.

4.3.3 *Drug resistance*

The occurrence of drug resistance, whether primary or acquired, is an indication of failure of some aspect of the control programme.

(a) Acquired drug resistance must indicate a failure of the treatment regimen, and calls for review at an individual patient level to determine the reason for the failure. If more than very occasional isolated examples of acquired drug resistance occur, then there is need to review all aspects of the treatment programme. From the proportion of relapsed patients with acquired drug resistance it may be possible to deduce whether it is the quality or the duration of the treatment regimen that requires modification.

(b) Primary drug resistance is also an indicator of treatment failure, usually in the past when the need for adequate regimens was less well understood. Some evidence was presented to the Symposium that the incidence of primary drug resistance is in some areas falling less rapidly than that of acquired drug resistance: this was attributed to the transmission of resistant bacilli by patients who had themselves been originally infected with drug-resistant organisms and shows a cumulative effect from treatment failures in the more remote past.

4.4 Mortality

As previously noted, until the introduction of effective chemotherapy about 30 years ago, the tuberculosis mortality rate was the most satisfactory index for surveillance. This was because, in many European countries the incidence of new bacillary cases was about twice the mortality rate, reflecting an underlying case fatality of 50% and the prevalence was about twice the incidence, reflecting an average two years' survival in the sputum-positive state.

The introduction of effective chemotherapy completely upset these relationships by greatly reducing case fatality and the duration of the sputum-positive state after diagnosis. It is now realized that the mortality rate has lost its value as an index of the tuberculosis situation, and hence for tuberculosis surveillance. However, the persistence of any measurable mortality rate does have some value because it suggests that potentially preventable deaths are occurring.

In practice in most European countries, the main use that can be made of mortality figures is on a local or individual basis. If the diagnosis is made only after death, or within a few days of death, it indicates failure of the case-finding programme. If death occurs after a longer interval from diagnosis, it suggests failure of the treatment programme. However, some studies have shown that in some of these later deaths in older people, it is extremely doubtful whether tuberculosis was the real cause of death, and the possibility of over-estimating tuberculosis death rates in this way needs to be kept in mind.

4.5 Discussion

While the epidemiological indices available for tuberculosis surveillance have not in themselves undergone great change, in the past 30 years (except for the introduction of those based on drug resistance) their relative usefulness for surveillance has undergone great change. Mortality has lost its dominant position, to be replaced by the annual infection rate. In practice, however, the annual infection rate has not been estimated on a sufficiently widespread basis to become a major criterion of the epidemiology of tuberculosis. Because

of its usefulness for diagnostic purposes, its relative precision and its importance as the source of infection, the new smear-positive case rate should be regarded as an important index for tuberculosis surveillance in practice. In countries relying on a new case rate, which includes those with and those without bacteriological findings, every effort should be made to collect information which can give the new smear-positive case rate.

5. CRITERIA FOR EVALUATION OF THE SOCIAL AND ECONOMIC ASPECTS OF THE TUBERCULOSIS PROBLEM

5.1 Historical and geographical background

The association of tuberculosis with socioeconomic factors has been demonstrated in many ways and on many occasions. The general downward trend in tuberculosis that has already been noted has occurred in association with, and is almost certainly due to, improvement in standards of living. The association of tuberculosis mortality and morbidity with several socioeconomic indices was demonstrated in many prewar studies, though because of the strong correlations that exist between the socioeconomic indices, it is not possible to decide which of them, if any, was of greater importance. The indices studied were those of income levels shown by social class, of educational levels, of housing conditions in terms of overcrowding, of nutritional standards, and of occupation. There is also evidence of differences in tuberculosis levels in different ethnic groups, and in migrant populations, both within countries and from one country to another.

The social and economic deterioration following the Second World War was associated with an increase in tuberculosis in many countries, indicating that the general downward trend can be disturbed by socioeconomic factors.

It was further pointed out that in countries with low risks of tuberculosis, it was unlikely that any further substantial reduction of tuberculosis could be brought about by further improvements in their socioeconomic levels, though such improvements were of course still desirable for other reasons. However, within these countries of overall low prevalence there were still local areas of high prevalence, sometimes associated with adverse local socioeconomic factors: in these areas, and in countries with relatively high tuberculosis levels and low socioeconomic levels, the possibility of obtaining reductions in tuberculosis by improving socioeconomic conditions should still be considered.

5.2 Effects of tuberculosis on socioeconomic factors

Not only are changes in socioeconomic levels a cause of change of tuberculosis rates, but the occurrence of tuberculosis in a community must

itself also cause socioeconomic effects, though this aspect of the relationship has received comparatively little attention. The socioeconomic effects of tuberculosis can be considered in a number of ways, and several suggestions along these lines were made at the Symposium, for economic effects and social effects, separately.

Since economics is concerned with the production of goods and the provision of services and can be expressed in financial terms, the economic costs and losses due to tuberculosis, and their reduction by an effective control programme, can also be evaluated in financial terms (see section 5.3).

The loss of production through disability is measurable as an economic loss: the prevention, or reduction, of such disability is equivalent to an economic gain, and the prevention or reduction of disability achieved by a tuberculosis control programme may thus be expressed in financial terms as a gain. Setting this against the cost of providing the control programme would enable a cost/benefit analysis to be made. Because of the complexity of the problems involved this will rarely be possible, but studies of the relative cost/effectiveness of various components of a control programme in achieving their objectives are possible to some extent.

Social effects are concerned with the standard of living and general wellbeing of individuals and society as a whole. It is possible to measure some social effects of tuberculosis, for example as loss of life expectancy or loss of opportunity to work or to take part in leisure activities or duration of hospital stay as an index of social deprivation (see section 5.4). There are other aspects of the social effects of tuberculosis which participants at the Symposium felt it was impossible to evaluate in any meaningful terms at the present time. The personal human suffering of the patient and his family, and the human suffering associated with the premature loss of human life are examples of those aspects which are not susceptible of measurement, and they are accordingly not further considered here.

5.3 Economic criteria

The criteria for the economic effects of tuberculosis can be divided into the direct costs of providing case-finding, treatment and preventive services, and the losses of production caused by absence from work because of tuberculosis, either as a period of disability, temporary or permanent, or because of death from tuberculosis before normal retirement age. It was explained at the Symposium that the payment of social insurance benefits is not an economic loss or cost, but a transfer within the economy. It may, however, have to be taken into account by those responsible for drawing up a budget to provide services for tuberculosis patients.

5.3.1 *Costs of tuberculosis control services*

Economic costs of providing services for the control of tuberculosis are clearly capable of being measured, though detailed costing has rarely been carried out. The evaluation of these economic costs is more complicated when tuberculosis control activities are integrated with the general health services.

The elements that need to be considered in arriving at a financial costing for the provision of a tuberculosis control programme may be listed as follows:

(1) capital costs of buildings and equipment, and their maintenance and replacement;

(2) the running costs of:

(a) diagnostic services, in clinics, radiological departments and laboratories;

(b) treatment services, including the costs of drugs and of inpatient care, and the supervision of outpatient therapy;

(c) preventive services in terms of personnel, equipment and vaccine;

(d) active case-finding procedures in high-risk groups (or in the whole population if so used);

(e) research and administration.

While it was felt to be not too difficult to list the direct costs in this way, few attempts have been made to measure them; where they have been evaluated, they have been expressed as a total financial cost to the country, or, better, related to the population as an annual expenditure per head of population. They have also been expressed as a proportion of the total health budget.

Comparison of the relative magnitude of the various elements can be of great importance in planning control programmes, especially in considering how to obtain maximum benefit from a limited total expenditure. The high cost of treating patients in hospital or in a sanatorium for long periods is of special importance in this respect, particularly as there is no evidence of any benefit in terms of better results from inpatient than from outpatient treatment.

At the other end of the scale, the relatively small cost of a programme of protection by BCG vaccination was noted by participants.

5.3.2 *Costs in terms of production losses*

The economic losses due to tuberculosis include those caused by loss of production through absence from work. Absence from work needs to be evaluated for three categories.

(1) *Temporary absence or disability.* This may be evaluated as the number of absences from work, related to the total work force, or to the total number of episodes of disability due to all diseases. This enumeration of the number of absences is of limited value, because of the variable duration of disability, which tends to be long for tuberculosis. A more useful index is the total number of days of work lost ("man-days"), again related to the size of the working population, or the total losses due to all causes of disability.

(2) *Permanent disability.* The losses in years subsequent to that in which the disability starts, up to normal retiring age, need to be assessed, in a similar manner to those for temporary disability.

(3) *Death.* Finally, there is the loss of production resulting from deaths due to tuberculosis before reaching normal retiring age. This also needs to be calculated and included in the economic loss due to tuberculosis.

Such measurements of economic losses have not been made on a systematic basis, though it is probable that much of the data required for this is available in the files of organizations responsible for the provision of social insurance or sickness benefits, whether state organizations or private companies. The losses have clearly been very large in the past, but by now must be falling rapidly in most countries of the European Region.

5.4 **Social aspects**

The effect of tuberculosis on the enjoyment of life by the individual concerned is clearly difficult to measure, as also its effects on his family and friends. Some indices based on "severity" in terms of duration are discussed below. There are other aspects which are less susceptible of measurement, and it was pointed out that it was in general desirable to use those methods of treatment which involved least interference with the individual's normal mode of life, rather than those which caused serious disruption. The social disadvantages of prolonged hospital stay, in addition to its high economic cost, were quoted as an example of a method of treatment which tended to be perpetuated for administrative convenience, sometimes without due consideration of the social disadvantages to the individual.

While the social loss of the death of an individual can hardly be measured, the overall loss to the community can be assessed to some extent by

consideration of the excess mortality within the community due to tuberculosis, separately by age and sex. These losses can be summarized in terms of the increase in expectation of life that would result if tuberculosis were eliminated as a cause of death. It was shown that at the beginning of this century the loss of life expectancy in some countries due to tuberculosis amounted to two to four years. By 1964, the loss of life expectancy due to tuberculosis had been reduced to less than 10 days in some countries, though amounting still to more than 200 days in a few.

The social relationships of tuberculosis are also affected by the type of organization in the given society, and the availability of resources for medical care. In nonegalitarian societies, the group of persons most likely to develop tuberculosis because of their lower social levels are those who experience greatest difficulty in obtaining help from preventive, diagnostic and treatment services. In more egalitarian societies, those who have the greatest risk of tuberculosis would have at least equality of access to the services they require, and the really high-risk groups may actually require more than the generally available level of social resources as part of the efforts to control tuberculosis among them.

In an attempt to make an approach to evaluating some of the social effects of tuberculosis, the following criteria were suggested. It is apparent that these criteria show a considerable degree of duplication of those recorded under the headings of epidemiology and economics. They are presented here to emphasize their social content.

(1) Number of days lost from work because of tuberculosis. The total number of days lost is an index of the loss to the community. The mean number of days lost from work for each patient is an index of the severity of social loss. The loss of time from work was divided for assessing economic losses into temporary disability, permanent disability and that due to premature death. The social losses from absence from work can be divided into similar components.

(2) Mean duration of hospital stay can similarly be regarded as an index of social loss, as well as a component of the economic cost of tuberculosis.

(3) The loss of time from work caused by tuberculosis can be related to the total loss of time from work due to all diseases, to give an index of the relative social loss due to tuberculosis. A similar calculation can be made for hospital stay, as an expression of social loss.

(4) Excess mortality from tuberculosis. This can be calculated for separate age- and sex-groups to give a sociodemographic index of tuberculosis. It can be summarized in terms of the life expectancy due to tuberculosis, measured for social purposes to the end of the normal life-span.

6. IMPACT OF RESEARCH PROJECTS ON TUBERCULOSIS SURVEILLANCE IN CZECHOSLOVAKIA

6.1 Introduction

At one session during the Symposium, the impact of research projects performed in Czechoslovakia in collaboration with WHO on tuberculosis control and surveillance was reported on. Among the research projects concerned were the epidemiological and clinical studies in the Kolín and Šamorín districts, the results of which have been published. Other projects are being carried out at the WHO Collaborating Centre for Standardization of Laboratory Procedures for the Diagnosis of Mycobacterial Diseases and Bacteriological Research, and the WHO Collaborating Centre for Tuberculosis Chemotherapy, both in Prague.

6.2 Impact on case-finding

Epidemiological studies in Kolín and Šamorín have shown that indiscriminate mass photofluorography of the whole population is of limited value, and that as the epidemiological situation improves, the yield falls. Selective case-finding is recommended, focussed on high-risk groups.

In 1975, 60% of the incidence of new bacillary pulmonary cases and relapses in Czechoslovakia occurred in individuals with previously negative X-ray findings, 20% came from those with evidence of fibrotic lung lesions and 20% were relapses. Taking the analyses of routinely collected data in Czechoslovakia as a basis, the impact of research projects was evaluated. Gradually mass photofluorography and its regular repetition was abandoned. Selective case-finding in middle-aged and elderly persons was adopted instead. But after repeated examinations during a five-year period, the attendance of the eligible population decreased and the yield fell from 1 active case per 430 X-rays to 1 case per 1070 X-rays. The screening of new cases in persons with fibrotic lesions, inactive tuberculosis, or with symptoms, was most effective. In 1975, the number of mass X-ray examinations needed to find one active case was about 2000, double the figure for 1967. For patients with symptoms, or with fibrotic lesions, about 300 examinations only were required, and for the symptom group this showed only a small increase since 1967. In 1975, 74% of smear-positive cases were found in those presenting with symptoms and 26% by routine photofluorography; in culture-positive cases the respective data were 56% for symptoms and 42% for mass X-ray. Yet, although in most persons with fibrotic lesions the regular examination was repeated every year, about 40% of smear-positive and 25% of culture-positive cases presented because of symptoms in between two check-ups.

The incidence of tuberculosis in Czechoslovakia compared with the data obtained in the research studies indicates that now, after the first years of intensive performance by the research projects and the translation of their conclusions into practice, similar epidemiological indices are being obtained in Czechoslovakia as were observed in the studies. The indices shown to be of greatest value in research studies are being used for the surveillance of tuberculosis in the country as a whole. The system of notification and monitoring of the data on tuberculosis in Czechoslovakia is being prepared for re-evaluation.

6.3 Impact of research projects on bacteriological diagnosis

In Czechoslovakia in 1975 one third of all new cases of bacillary respiratory tuberculosis were confirmed by microscopy. About 60% of them were confirmed by culture only; positive microscopy with negative culture results were rare.

As the epidemiological situation improved, so the proportion of positive results declined from 13% positive of 500 000 examinations in 1954 to 1.7% positive of 800 000 examinations in 1975. Between 1970 and 1974 the annual number of examinations was practically unchanged, but positive results declined from 2.2% to 1.7%.

The decline in the percentage of positive culture results is of great epidemiological significance. It has led to a situation where the yield of positives was lower in specimens from chest clinics (0.5% of 411 000 specimens in 1975) than in specimens from nontuberculosis hospitals (0.9% of 154 000 specimens in 1975). This is a reversal of the situation 20 years earlier.

Of 649 isolates between 1961 and 1971, 609 were of *M. tuberculosis*, 38 of *M. bovis* and 2 of *M. avian*. Since the eradication of tuberculosis in cattle, isolates of *M. bovis* had become very rare. Isolates of *M. kansasii* were also infrequent, except in one coal-mining area where they amounted to 10% of all new isolates.

Systematic testing for resistance of all strains isolated had shown that the frequency of resistant strains was not increasing.

6.4 Impact of research projects on chemotherapy

Following the introduction of standardized chemotherapy into routine practice, a cure rate of 95% was achieved during the period 1967-74 in association with a 37% reduction in the duration of hospital stay (to 105 days in 1974), and a 17% reduction in the duration of chemotherapy (to 18 months in 1974). There was an 18% increase in the number of patients aged over 65, who now formed 44% of all adult patients treated.

Between 1967 and 1974 there was in Bohemia and Moravia a 28% decrease in new bacillary cases, with a rate of 21 per 100 000 in 1974. Relapses decreased by 44% in the same period, with a rate of 5 per 100 000 in 1974. Chronic sputum-positive cases decreased by 80% to 1 per 100 000 in 1974. The best index of the efficiency of chemotherapy is the very large fall in the number of chronic excretors of bacilli. This was confirmed by the absence of an increase in cases with drug resistance.

In line with the increasing age of patients, routine chemotherapy became more difficult as shown by studies identifying unfavourable, complicating factors, such as those observed in patients with serious concomitant diseases, alcoholics or uncooperative patients. For patients with complicating factors (35% of the total) the duration of hospital stay was greater: 136 days as compared with 105 days for the 54% of patients who had no complicating factors. Of patients diagnosed in 1972-73, 11% died in 2 years, but only 2% of these deaths were due to active tuberculosis.

6.5 Impact on socioeconomic aspects of tuberculosis control

In the Šamorín study, special attention was given to tuberculosis in the gipsy population, who form 7.5% of the population of 48 190 in the district. Their age structure was different, with children accounting for 51% whereas, in the rest of the community, children make up 32% of the population. The average annual incidence of tuberculosis in the gipsies was 1.82 per 1000, compared with 0.92 per 1000 in the other inhabitants. The rate of decline of tuberculosis was also less among the gipsies than in the rest of the population, and the research project showed the need to give special attention to the gipsy population.

With regard to economic factors, attempts were made to measure, on the national scale, some of the economic consequences of the decline of tuberculosis. The average daily number of persons unable to work declined for males from 214 per 100 000 employees in 1960 to 51 per 100 000 in 1974. For females the decline over the same period was from 135 to 20 per 100 000 employees. The average duration of incapacity fell from 171 days in 1960 to 150 days in 1974. In 1960 there were 7743 newly granted full invalidity pensions, compared with only 718 in 1974.

The total number of beds in chest hospitals had declined from more than 20 000 in 1960 to 12 000 in 1974: in 1960 only 3.6% of the beds were used for nontuberculous patients, but in 1974 this proportion increased up to 37%.

Full economic evaluation is a difficult problem. However, some of the criteria mentioned above serve as economic indices in Czechoslovakia.

6.6 Evaluation of the impact of research projects on the present magnitude of the tuberculosis problem

The epidemiological studies showed which epidemiological indices were of the greatest importance, and the trends of these indices in the population were observed, in association with the systematic implementation of standard control measures. The most important indices were the prevalence of cases of smear-positive respiratory tuberculosis and the ratio of newly detected smear-positive cases to their total prevalence.

The prevalence of chronic excretors showed the greatest decline between 1967 and 1973, falling by an average of 20% per year. Smear-positive relapses showed a smaller reduction of 6% per year, while new smear-positive cases declined by 2% annually. Similar results were shown by cases positive on culture only.

6.7 Discussion

The present policy of photofluorography was further discussed, and it was indicated that the policy is under continuous review for early case-finding purposes. However, the yield of sputum-positive cases is a poor index of its usefulness.

The reduction of chronic sputum-positive cases occurred largely in the period 1960-64, and was therefore mainly due to reorganization of chemotherapy programmes, rather than the use of newly introduced drugs.

7. EXPERIENCE WITH SYSTEMS OF SURVEILLANCE IN COUNTRIES OF THE EUROPEAN REGION

7.1 Introduction

In this section, contributions by some of the representatives of countries of the Region are briefly summarized, emphasizing matters concerned with surveillance, and concluding with a comment on the major differences in control programmes as revealed at the meeting.

7.2 Contributions from some countries

7.2.1 *Algeria*

There is a centrally organized system of tuberculosis control. Only passive case-finding methods are used, with diagnosis based on sputum

examination. Treatment is by standardized chemotherapy. Evaluation is based on simple criteria through a central organization. The annual infection rate is not measured, but the annual incidence of smear-positive cases is recorded, and from the reduction in this it is suggested that the annual infection rate is declining by about 5% per year. Operational surveillance of the programme is carried out. The main objectives at present are the reduction of hospital stay and the reduction of the cost of drugs.

7.2.2 Scotland

This report was based on a study made on tuberculosis notification in Scotland in 1968. The results will be published, and are to be used as the basis for a continuing system of monitoring tuberculosis control in Scotland from 1977.

Some points of interest were that though 13.3% of patients died, only about one third of the deaths were due to tuberculosis. Treatment was generally successful, and it was noted that bacteriologically negative patients received as much chemotherapy, and spent almost as long in hospital, as those with positive sputum. The main problems found were the occurrence of early deaths, and difficulties arising from neglect of treatment by uncooperative patients.

7.2.3 Belgium

The organization of a special commission in 1972 to coordinate tuberculosis control measures was reported. Information for earlier years is available in terms of mortality and morbidity. While the main function of the commission is to coordinate tuberculosis control measures, it is also collecting information on a uniform basis to assist this work. It is not yet possible to assess the value of the work of this commission in terms of recognized criteria.

7.2.4 Denmark

Tuberculosis control has for long been established through lung clinics, with central collection of information through the Danish Tuberculosis Index. It had been found that the proportion of new smear-positive cases was highest in those presenting with symptoms (300 examinations to find 1 case, compared with 4000 routine examinations to find 1 case). The programme was therefore being modified by a 70% reduction of routine examinations, and it was expected there would be little or no effect on case-finding. The use of BCG at the age of 7 is being continued. The work of the lung clinics is being extended to include other chest diseases.

7.2.5 *France*

There is central collection of routine data, but there are great difficulties because of lack of homogeneity. For several years, special studies have been made in two pilot areas, with the collection of more detailed information including prevalence as well as incidence. As control improved, the ratio of prevalence to incidence of sputum-positive cases fell from 2:1 to 1.3:1.

Efforts are now being made to collect well-organized data centrally in order to develop a surveillance system which would be integrated with surveillance of other diseases.

7.2.6 *Federal Republic of Germany*

Experience showed that the methods used for surveillance prior to 1973 were no longer appropriate, when a revised system was adopted. The emphasis now is on the collection of data on incidence, not prevalence, because, with modern treatment, so few patients enter into prevalence data. Priority is given to bacteriologically positive cases, especially those which are smear-positive. A special record is maintained of chronic sputum-positive cases. Surveillance is maintained through existing organizations which deal with other diseases as well.

7.2.7 *Netherlands*

There is a general downward trend in all the epidemiological indices, which are routinely recorded. The annual infection rate is routinely measured and it is now about 2 per 10 000 per year. Monitoring is based on an individual record card for each patient, covering the period from first symptom to some years after completion of effective treatment.

An increasing relative importance of cases presenting with symptoms had been noted, especially of patients positive on sputum smear. There is some concern at the interval between first symptom and the start of treatment, due partly to delay by patients and partly to delay by the doctors first consulted.

The great value of this monitoring system is that it shows exactly what is in fact happening during programme implementation.

7.2.8 *Hungary*

A central institute is responsible for tuberculosis control, operating through a system of district controls. Statistical information is collected centrally, the most important index used being based on the occurrence of sputum-positive cases.

Mass radiophotofluorography had been, and still is, extensively used as the main method of case-finding, though the proportion of new cases found by this method had fallen to 61% from 69%. Increasing attention is being given to risk groups. BCG is used routinely. Chemotherapy gave good results, and chronic cases had been reduced by 90%. In the future, surveillance of tuberculosis would be integrated with that of other diseases.

7.2.9 Romania

There is a central system of data collection in Bucharest making possible comparison between regions, which has revealed large differences. Members of the Central Tuberculosis Research Institute staff have been going out into the regions to read mass radiography film and to check on the fulfilment of control programmes, including BCG vaccination, drug administration, and quality of bacteriological examinations. The main index is the prevalence of bacillary sources, and this has been falling. There is continuing evaluation of programme delivery.

7.3 Comments

From discussions, it became apparent that there are now substantial differences in the tuberculosis control programmes as performed in the different countries of the European Region. Some of these differences have arisen as the result of active policy decisions based on experience. Passive case-finding based on symptomatic presentation, and the use of effective chemotherapy regimens for an adequate period are accepted as essential in all countries, and are not further discussed.

The following methods of tuberculosis control now show substantial differences in the extent to which they are practised. Attention is drawn to them as it seems probable that the benefits and costs of these items of the control programme should be the subject of special scrutiny in individual countries as part of the surveillance programme.

(a) *Active case-finding.* Mass radiophotofluorography is in routine use in some countries, but not in others. Some countries have never used this method, others have abandoned its use, mainly because of evidence of low yields, especially of smear-positive cases. In all countries there is increasing emphasis on high-risk groups, and especially on patients with symptoms.

(b) *Duration of hospital/sanatorium stay.* Some countries rely almost entirely on ambulatory treatment, while in others the majority of even sputum-negative patients still spend long periods in hospital. The high cost of hospital treatment was repeatedly emphasized. The only country for which

overall cost figures were given was Finland, where total expenditure on tuberculosis amounts to \$7 per head of population per annum; more than half the expenditure is on hospital care, although hospital stay averages only about 2 months.

(c) *Mass BCG vaccination.* This is practised in most but not all countries of the Region; in some, routine vaccination is repeated on a number of occasions during childhood. There does not as yet appear to be an example of a country discontinuing routine vaccination, though it was implied during the Symposium that some countries were considering the matter.

(d) *Separated or integrated tuberculosis services.* In most countries tuberculosis control services have developed independently of other services; in some countries they are still separate, although in others, usually those with quite low prevalence, their work is being integrated with diagnostic and treatment services for other chest diseases. Surveillance of tuberculosis has also tended to be carried out independently of surveillance of other diseases, but is now being increasingly integrated.

8. CONCLUSIONS

8.1 Present situation of tuberculosis in the European Region

Available information shows that tuberculosis is still a major problem in the European Region. For 1972, deaths from tuberculosis in the European Region are estimated at 67 860 and new cases at 446 160. There are large differences in the levels of tuberculosis among the countries of the Region, but in most, if not all, there is a downward trend – though this trend also varies from one country to another.

8.2 The concept of tuberculosis surveillance

Participants at the Symposium noted that:

(1) The object of control programmes is to accelerate this downward trend; the planning of such programmes requires the collection and evaluation of information about the tuberculosis situation on a continuing basis.

(2) Surveillance of tuberculosis has therefore to be undertaken involving collection of information, so that control programmes can be planned and implemented and their effectiveness monitored at the health policy planning

level. Surveillance is a continuous process and can be regarded as an iterative process of data collection and evaluation ("situational analysis") → planning and programming → action (i.e., implementation) → data collection and evaluation → and feedback to modify the programme, if needed.

(3) In data collection after programme implementation, a distinction exists between:

(a) evaluation of programme delivery, which involves assessment of the technical efficiency of its components, its operational effectiveness and its cost; and

(b) evaluation of programme impact, which involves assessment of any change in the tuberculosis situation brought about by the programme, *in addition to* the pre-existing downward trend, including assessment of change in social and economic factors.

(4) It is important to concentrate on a selective collection of data that is significant for planning purposes and for the formulation and reformulation of programmes.

(5) Surveillance of tuberculosis needs to be organized on a national scale, and has functions other than planning and implementing specific control programmes. Sufficiently detailed information should be collected to make possible useful comparisons between subgroups of the population, and hence to define high-risk groups.

8.3 Criteria for epidemiological surveillance

The conclusions of the meeting under this heading were as follows:

(1) Criteria for epidemiological surveillance must be based on measurements of infection or disease or death. All may be used positively to give rates, but some now have a greater value as indicators of failure of some part of the control programme.

(2) The annual infection rate has come to be accepted as the best criterion of the tuberculosis situation, although there are difficulties in obtaining the necessary data on a routine and continuing basis in all countries.

(3) The following indices are based on the development of disease:

(a) *New smear-positive case rate.* A useful index which, however, is regularly obtained only in a few countries.

(b) *New bacteriologically-positive case rate.* Obtained by combining culture-positive with smear-positive results. This technique has no real advantage as an index over smear-positive case rate (a).

(c) *New case rate of bacteriologically-negative or unexamined cases* is available as a separate category from some countries but is not by itself a useful index.

(d) *New case rate, including bacteriologically confirmed and other cases,* is the sum of (b) + (c): this figure is available for most countries though it has limited value as an epidemiological index. Provided that standards of notification do not change, it has some value for showing trends within a country over a period of time.

(e) *Tuberculous meningitis,* especially in children. The occurrence of cases of meningitis in children should alert authorities to the need for corrective action and can still be a useful index in some countries.

(f) *Patients continuing to excrete bacilli* for more than a year, or relapsing after sputum conversion, indicate a failure at some stage of the control programme, and should be investigated on this basis so that the programme can be improved. The ratio of the total of sputum-positive cases to the number found positive for the first time can be used to indicate the size of the problem of persistent positive cases, and should approach unity as the programme becomes fully effective.

(g) *The occurrence of primary and secondary drug-resistant cases* should be separately recorded and monitored, as they are important indicators of failures of different parts of the control programme, and the need for corrective action.

(4) Tuberculosis mortality rate, traditionally the most important index, is not a useful index any longer. It is important to continue to record deaths from tuberculosis, so that they can be the subject of study to obtain information to improve the control programme.

8.4 Criteria for the evaluation of the social and economic aspects of the tuberculosis problem

Here, the Symposium participants' conclusions were that:

(1) *Social indices*

(a) The scale of the disability problem can be measured by the total number of working days lost, and the severity of disability

can be measured by the mean number of days or months lost per case.

(b) Temporary disability can be measured by the number of persons disabled by tuberculosis as a percentage of all tuberculous patients, or of the total working population.

(c) Permanent disability can be measured by the number of patients permanently unfit for work, as a percentage of all tuberculous patients, or of the total working population.

(d) The importance of disability from tuberculosis relative to disability from other diseases should also be recorded and analysed.

(e) A sociodemographic index can be derived by measuring excess mortality, which should be done for separate age- and sex-groups. It can conveniently be summarized as loss of life expectancy, either for the total life span, or restricted to the age of working life.

(2) *Economic indices*

(a) Financial cost to the community of expenditure on services for prevention, diagnosis and treatment. Such costs could be expressed either as a total cost to the community, or per head of population, or as a cost for each case of tuberculosis.

(b) There is also an economic loss to the community by loss of production of workers disabled by tuberculosis, either temporarily or permanently, or by premature death. Such losses can be expressed in monetary terms, though they have so far rarely been measured. It was noted that the payment of sickness insurance was not an economic loss, but a transfer within the economy.

(3) *Other socioeconomic losses*

There are other losses or costs in terms of human or personal suffering from disability or death. At this stage it is not regarded as possible to formulate a useful index, but the existence of this additional form of loss was noted.

8.5 Impact of research projects on tuberculosis surveillance in Czechoslovakia

The following were the conclusions of participants in the Symposium:

(1) The Czechoslovak research projects have shown a definite impact on the tuberculosis problem in the research areas (as well as in the whole

country) and demonstrated that some indices are useful for measuring the effect of tuberculosis programmes. The same applies to the socioeconomic indices which are already used on a national scale.

(2) Nevertheless, the present routine system of data collecting and monitoring does not give all the information needed for distinguishing between the programme delivery and its impact.

(3) The recording and monitoring system should be modified in order to meet this aim and thereby to improve tuberculosis surveillance.

Annex

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