CHAPTER 7

THE SERVICE APPROACH

I. INTRODUCTION

J. Ipsen

In this chapter, health services and health programmes are treated alike. It is possible to make refined distinctions between services and programmes, but both expressions refer to a series of activities that are focused on one or more aspects of a general health service system. Some may regard programmes as containing an experimental element such as the testing of one intervention activity against another. It is suggested that all health services should be planned in a manner that permits evaluation of their effectiveness and outcomes accurately and objectively.

The services of a regional health system must not fall into a routine that goes on for years and is justified only by tradition. Innovation comes from regular evaluations that suggest areas where there is lack of effectiveness or increasing needs. The latter may stem from changing patterns of disease or from alteration of population structure in the areas served.

It is unnecessary to go deeply into the defect of many official reports of health programmes that limit their accounts to such things as number of patient visits, supplies expended, and number of employees; occasionally, the medical outcome of programmes can be found in articles addressed solely to the medical profession but only rarely do these reach the administrative decision-making level. Here, an attempt is made to outline desirable and feasible measurements of health that may serve to evaluate services and programmes.

The objective of a service, i.e., the problem towards which it is directed, is usually defined. The service may be oriented towards a specific disease (measles or alcoholism), a group of persons (the elderly or asbestos workers), or a geographically or ethnically distinct population (an island population or migrant workers). Most of these situations can be described in a general model that is conveniently divided into four parts:

(1) the target population,

(2) the intake,

(3) the programme process, and

(4) the output.

Some indicators that are relevant to each of these four parts are given below.

The *target population* is that part of the population characterized by the problem stated in the programme objective. If this objective is curative, the appropriate measurements will consist of data for morbidity, both in absolute numbers and in relation to demographic distribution. A preventive objective will require knowledge of the attributes of groups of persons at risk, often with the intention of offering service to those at a higher relative risk. (For example, a preventive programme for cancer of the cervix may in principle limit its offer to women between 30 and 49 years of age.) Such information about the target population may not be available in official morbidity and mortality reports, and should presumably be obtained from sampling surveys that precede service planning. The purpose of obtaining data for target groups is obviously to assess resources and manpower requirements. Such data are typically preliminary and not necessarily a continuing part of the information derived from the programme.

The *intake* is the number of persons actually served by the programme. It is realistic to expect that a number of persons will not use the service offered for reasons that may stem from ethical or ethnical attitudes, geographical distance, or poor publicity for the programme. Real or alleged discomforts to the clients should be considered seriously. Measuring the number of respondents in relation to the predicted number of persons in need of services is an important feature of programme evaluation. It should be followed by a search for reasons why people do not respond, and this demands sociological and psychological investigation. Also, the basic target data may need revision from time to time. This "feedback" from the programme should help to identify nonrespondents. Great efforts should be made to bring these persons into the programme since it is almost axiomatic that nonrespondents are at higher risk than respondents.

The measurements needed for evaluation of the *programme process* are partly of a medical nature and partly related to management. The former deal with the effectiveness of the process and may be one of two types. If the programme is essentially preventive the process is presumably directed towards identification of risks through diagnostic tools, the sensitivity and specificity of which should be known and, if possible, related to the cost of the procedures. These measurements are presumably known through pilot experiments or from the professional literature.

Sensitivity and specificity may be quite different when the test is operating in the field, and programme investigators must verify the usefulness of the procedure under working conditions. If the programme is of a curative or rehabilitative nature effectiveness is related to the outcome of treatment. This is difficult to measure unless a randomized controlled trial is used to compare treatment alternatives; the circumstances of a current programme are rarely suitable for such tests of effectiveness. The time for these is when innovations in treatment or intervention are introduced. In most cases, however, effectiveness of treatment is judged by general medical experience.

The efficiency of the programme process is related to costs, resources, and manpower, as well as to consumer problems such as waiting time, distance to service site, and attitudes of the target population. These problems are dealt with in detail in other chapters.

The *outcome* of the programme is essentially measured by the ratio of expected results to observed results. The pertinent measurements are primarily indicative of phases in the natural history of disease, of signs and symptoms of the ailments that the service is intended to correct, and of levels of bodily and social function. Outcome measures of the treated population can be related to group measures made before treatment; in such cases it is important to use the intake population as a basis, rather than the preliminary estimates of the target population. More precise than group measurements are measurements of the progress of each individual treated. This permits evaluation of the effectiveness of treatment programmes at various levels of severity of a disease, or of prevention at various levels of disease risk. For the latter purpose, incidence in the intake population is a desirable measurement.

The measurements outlined above are specific to the programme approach, but obviously they are also used for other aspects of a health service system. Although a number of indicators are generated by the service itself, the information system of the overall health system can, and should, be an important source of relevant data.

The overall effect of the programme depends on all the four parts mentioned above. A mediocre, or even negative, effect may be the result of a number of links in the chain: low intake, ineffective tests and treatment, inefficient management, or poor follow-up of patients. Besides these characteristics of the programme, there is reason to watch what are called the "conjunctures" or combinations of circumstances beyond the control of programme planners. A programme may appear to have a high measure of outcome, which in fact could just as well be found in the population as a whole. General prosperity of a nation may change the whole course of disease and prevention while poor conjunctures with inflation and unemployment may have effects that outweigh any beneficial effect of the service.

II. MATERNITY AND INFANT SERVICES

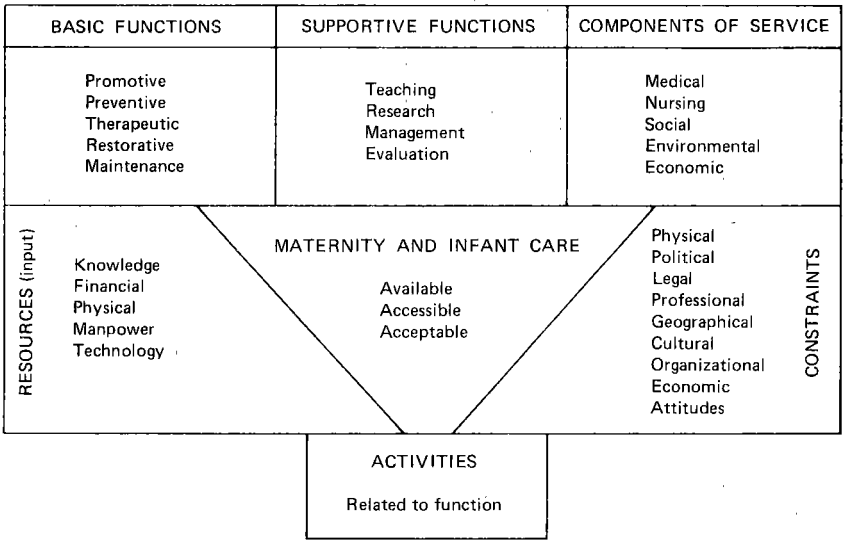
R. Glyn Thomas & L.M.F. Massé

INTRODUCTION

This section discusses the outcome of services provided for the expectant mother and also subsequently for the infant.

If we assume as a basic hypothesis that maternity and infant services should be provided for all those who desire to have a live, healthy child, it should be possible to analyse the service requirements based primarily on their function; this is illustrated in Fig. 1. Assuming that the functions of all services in the health field are comparable, the next stage is to identify particular activities related to such functions and in so doing obtain a quantitative measurement, which can then be used to identify not only the effectiveness of a service but also its quality.

Fig. 1. The process of care



It will be seen that in Fig. 1 functions are divided into two main groups: basic and supportive. The relationship of functions to resource allocation can then serve as the basis for evaluation. It is also necessary to identify those elements of constraint that apply to any service; this is also illustrated in Fig. 1.

Given, therefore, the two major elements, function and constraints, it should be possible to identify the resources necessary to develop the service in respect of each major function. The deployment of such resources can be used as the index related to the particular activity, and ultimately to the effectiveness of the total service.

For the sake of convenience it is also proposed that the measurements be related to three main periods during the care process: (1) the antenatal period, which would include the period before conception; (2) delivery; and (3) the postnatal and continuing care period, which would include both mother and infant.

Finally, measures of total services at all stages can be based on availability, accessibility, and acceptability.

(1) *Availability* is a measurement of the number of institutions and of the presence or absence of health personnel; in other words, overall service coverage related to available specific statistical indices.

(2) *Accessibility* should not only relate to the geographical situation, i.e., the presence or absence of transport, but also to any constraints placed upon service users that may be of a cultural, social, or economic nature. These measurements can be developed so that they indicate whether the service is being used as originally intended.

(3) The *acceptability* of a service is an important criterion in the sense that certain activities or procedures may well be acceptable to the professional provider but not necessarily to the receiver; as a result, use of services may be far less than intended. This may apply to certain screening services. For example, when postnatal screening for cervical carcinoma is set up it is difficult to obtain adequate coverage of high-risk groups, particularly those belonging to lower socioeconomic classes.

Returning to the antenatal period, no attempt is made here to use, or to enlarge on, many examples apart from those related to the functions shown in Fig. 1. Many other examples will occur to the reader. Each activity related to a function can, it is suggested, be quantified, and once quantified it can become an accurate measurement of the effectiveness and efficiency of a particular service.

THE PRECONCEPTION STAGE AND THE ANTENATAL PERIOD

There is a stage before the antenatal period that can be referred to as "preconception". As in other stages, there is at this time a series of activities related to service functions that can, for example, subsequently be measured in relation to the time of conception and their success or otherwise determined, bearing in mind the initial hypothesis (see p. 108). If we assume, for example, that all services relating to fertility and sex education counselling can be promotive functions, each activity, for example, use of chemotherapy or direct medical and surgical intervention, whether in men or in women, can be identified and

quantified. Cost/effectiveness tests can be applied to each process, using successful conception as the outcome measurement.

Similarly, the negative hypothesis – that a woman may wish not to conceive at a particular time – can be defined as the purpose of family planning and also of termination of early pregnancy.

In this preconception phase there is the assumption that the two major functions, promotion and prevention, are combined. (Genetic counselling should also be mentioned in this context.) The subsequent measurement is the birth of a healthy infant.

Another activity during the early antenatal phase would be specific planned examinations to determine presence of disease in mother or fetus. Identification of the rhesus factor is a good example: the presence of rhesus incompatibility requires therapeutic intervention, and adequate interventions to correct or deal with the condition found have to be developed. The outcome measurement is always the resulting healthy infant and mother.

Activities at this antenatal stage can vary from direct drug intervention to immunization, or even termination of the pregnancy, and there should also be continued monitoring and surveillance with the ultimate purpose of ensuring that a healthy child is born. Monitoring should ensure early warning of adverse conditions so that in the second stage, that of delivery, appropriate therapeutic activities can be started. Yet another important activity is the education of expectant mothers about the entire process of pregnancy and birth.

It is in the antenatal stage that predictors are important. For example, amniocentesis in late gestation can be used to determine the most appropriate time to intervene by inducing labour, so that, as far as possible, ideal conditions for delivery are available. The outcome measurement is constantly related to the ultimate objective of a healthy child, and it should be remembered that preventive, diagnostic, or therapeutic interventions should all be related to their effect on both mother and child. An element of danger may exist in these activities; for example, the use of radiology at this stage.

POSTNATAL STAGE

At this stage we are again concerned with the promotive, preventive, and therapeutic activities that will ensure the normal and healthy development of the child, as well as with the services that have a restorative function for mothers. The preventive activities for infants include ensuring that there is an adequate, clear airway at birth and prevention of infections such as tetanus neonatorum, a condition that is highly dependent on methods used at delivery. Related to the restorative function of services for mothers is the need to ensure that a child enjoys an appropriate family setting in which to develop and in this context services must be related to the social and economic situation; this is particularly relevant to births outside marriage.

Services for infants have two main purposes: to provide the best conditions for normal growth and development and, where it is not possible to

Table 1. Infant mortality and population statistics for selected countries

Country or area	Population[a]	*Per caput* income (US$)[b]	Infant mortality per 1 000 live births[c]	Population per physician[d]
Argentina	25 383 000	1 922	58.9	450
Bahamas	204 000	—	32.6	1 430
Barbados	245 000	617	33.1	1 530
Bolivia	5 634 000	299	77.3	2 120
Brazil	107 145 000	723	—	1 660
Canada	22 831 000	5 672	15.5	600
Chile	10 253 000	647	78.0	2 420
Colombia	29 717 000	478	62.8	2 180
Costa Rica	1 968 000	799	44.8	1 580
Cuba	9 330 000	—	27.5	1 150
Dominican Republic	4 697 000	480	38.6	1 870
Ecuador	6 733 000	474	75.8	2 840
El Salvador	4 007 000	373	59.1	4 070
Guatemala	6 080 000	470	79.1	4 430
Guyana	791 000	360	42.3	3 270
Haiti	4 584 000	158	25.8	13 050
Honduras	3 037 000	306	39.3	3 360
Jamaica	2 029 000	1 066	26.2	3 510
Mexico	60 145 000	632	51.9	1 440
Nicaragua	2 155 000	650	46.0	1 720
Panama	1 668 000	935	33.3	1 240
Paraguay	2 647 000	457	30.0	2 220
Peru	15 839 000	444	65.1	1 800
Surinam	422 000	970	30.4	2 030
Trinidad and Tobago	1 080 000	927	24.4	2 380
Uruguay	3 064 000	717	48.6	910
USA	213 611 000	5 949	17.6	610
Venezuela	11 993 000	2 052	46.6	870

[a] Source: *United Nations Demographic Yearbook, 1975.* New York, 1976.

[b] Source: *United Nations Yearbook of National Accounts Statistics, 1975.* New York, 1976.

[c] Source: **World Health Organization.** *World health statistics annual, 1973–1976. Vol. 1. Vital statistics and causes of death.* Geneva, 1976.

[d] Source: **World Health Organization.** *World health statistics annual, 1973–1976. Vol. 3. Health personnel and hospital establishments.* Geneva, 1976.

prevent physical or psychological impairment, to ensure that disability resulting from such impairment is kept to a minimum. Since the ultimate objective of such services is to allow and ensure progressive normal development, available indices of development related to critical times of the infant's life can be used as an indicator of service outcome.

At a slightly later stage in the infant's development it will be important to provide facilities such as day-nurseries, and perhaps even foster families, to care for the child. As discussed under the preconception stage and the antenatal period, it is important to relate the particular interventions to the required function, whether preventive, curative, or simply caring. To quantify these interventions they should again be related to the stated objective of providing an infant with an appropriate environment for healthy development.

CONCLUSIONS

As already mentioned, any measurement of outcome must be related to the original objective of a service or to the underlying hypothesis. It is recognized that there are many outcome measurements that can be related to how services are used, but in this sense consumer satisfaction is rather subjective and difficult to quantify. For this reason it is proposed that function, and hence activity, should always be related to the main hypothesis. An example can be drawn from the fact that infant mortality may not always indicate the effectiveness of a service but rather its actual use, and whereas an inventory of institutions is important provision of the facility does not necessarily reflect the service. Consequently, a measure of ultimate effectiveness should be the actual services provided and not the number of institutions that do or do not exist.

Finally, it should also be recognized that provision of any service results from a known or perceived need in a population; therefore, the ultimate measure of the service's effectiveness and efficiency is whether or not it fulfils these needs. Careful study of Table 1 should reveal a number of inequalities and may even suggest particular problems and areas for future study.

III. ACCIDENTS

R. Glyn Thomas

INTRODUCTION

The main purpose of any health care system should be to improve the health status of individuals, but accidents can alter the health status of individuals to a great extent. The measurement of levels of health resulting from accidents can best be dealt with by investigating the causes of accidents and by designing services concerned not only with accident prevention but also with mitigating the consequences. Ideally, even if accidents occur they should cause no handicap or disability affecting the individual's level of health. Service interventions in the past have often taken place only after the accident, which is unfortunately true of many other service interventions.

Industrialized countries have introduced sophisticated procedures for providing services for the victims of all types of accidents. This paper shows how we can measure the results of accidents in different ways and gives examples suggesting that the results of accidents should be quantified rather than the accidents themselves. For example, if it were possible to ensure that no injury occurred to individuals involved in an accident, from a purely health point of view we should be satisfied. For example, if two cars collide but the occupants of these cars suffer no injury, then there is clearly no health problem but only a legal/economic one to deal with.

PROPOSAL

Data should be collected for measuring the consequences of accidents through epidemiological methods to identify the complete cycle in the natural history of accidents in the same way as the natural history of certain diseases has been identified. In this way, points of intervention can be defined for breaking the cycle. The basic hypothesis should be that we are concerned not with the accident itself but with the consequences, beginning with injury and going on to loss of function, impairment, disability, and eventual dependence on special services.

The type of injury is of considerable importance, and hence the study and measurement of different types of injury result in changes being made. For example, as a result of chest injuries suffered by car drivers after impact with the car's steering wheel in road traffic accidents steering wheels have been redesigned to be collapsible upon impact. Tragically, however, information on this type of injury was available for many years before any modifications were made. Similarly, information was available about the

causes of cases of burns suffered by children long before the necessary intervention appeared in the form of nonflammable clothing.

The development of medical care technology referred to in other sections of this publication can, in fact, drastically reduce mortality from head injuries, for example, but the increased morbidity of survivors in the form of disability and handicap is only now being recognized as a major problem. Any collection of information and data should therefore be used with a defined objective and purpose in mind, rather than as an academic exercise. Services should continually evaluate their own results.

A specific example is the particularly high incidence of scalds in children that occurred at one time in one European country. It was not until all the circumstances were fully investigated that the solution was shown to be the redesigning of a coffee filter rather than provision of additional burns units. This redesign was a simple procedure but the complete disappearance of this form of injury in children took many years. Similarly, electrical burns in children resulted in the redesigning of electrical sockets and this eliminated the need for services for this type of accident. Had the solution been to provide more and more services based on demand the result would have been more hospital beds and additional personnel to deal with these cases.

It is necessary to identify those likely to be involved in accidents in order to define "at-risk" groups in given situations. This has been done in the field of industrial accidents although application of the findings has in many instances been limited. The at-risk group for road traffic accidents is aged between 18 and 24 years, and victims can also be divided into motor-car users and pedestrians, and so on. Countermeasures such as the use of seat belts in motor-cars, while not preventing accidents, can certainly alter the consequences.

The imposition of speed limits does not in itself alter the incidence of accidents, but changes the character of injuries sustained. Again, the study and quantification of the nature of the accident might be the most effective way of ultimately measuring the level of health, but the consequences of the accident should be measured rather than the direct result. While every accident may be an emergency, not all emergencies are the result of an accident. The severity of injury, not the accident itself, is the controlling factor for service intervention, although at the time there may well be an emergency situation. Also, it must be remembered that health status is not always influenced in a positive way by service intervention.

To summarize, we should consider the various levels at which services can be provided, the first being the primary care level. Here, we are likely to find the greatest number of minor consequences of accidents, which, unless recognized and measured, might lead to handicap. Also at this level there is need to set standards and identify criteria for measurement. For example, the term "minor injury" is inadequate, at least in traffic accident situations, where it can apply to a range of injuries from minor abrasion to multiple injuries; the consequences of these are obviously different.

Measurement procedures at the secondary level, traditionally the hospital, are usually well defined, but again more attention is focused on the injury than on the functional consequences. Does the injury reduce mobility? Does it prevent the individual from earning a living? Are there social changes or changes

in the household situation? These consequences can all be measured but if the case record shows only that the individual has a fractured tibia, this information is lost.

The measurements required at the tertiary level, which could be described as the rehabilitative phase, are necessary for measuring not only the physiological healing processes but also the functional adjustment of the individual and his return to the health status he enjoyed prior to the accident.

Three suggestions can be made as a result of this discussion.

First, we should measure the consequences of accidents in terms of the degree of trauma or injury and the extent to which ability to undertake the activities of daily life is altered. Such data should then be closely correlated with the circumstances leading up to the accident. It seems unnecessary to segregate industrial accidents, accidents in the home, and road traffic accidents if the consequences of those accidents are similar. Description of the location of an accident is only important for defining a preventive activity or intervention. To the individual the loss of a leg is functionally important whether it occurs at work, on the road, or during recreation. Service intervention is the same but preventive actions will differ.

Second, we should be particularly concerned with certain at-risk groups, the pedestrian and the motor-car driver being two examples in the field of traffic accidents. In the home children and the elderly are high-risk groups and attention should be focused on their total environment. Elderly people may fall at home but the direct health consequences of these accidents will be altered by environmental factors such as the presence of lighting making discovery of the accident more likely, or health conditions such as osteoporosis or malnutrition. Hence, effective interventions may be hormonal, environmental, or nutritional, not simply medical.

Third, and perhaps most important, we should develop records giving the whole accident profile with linkages between the cause of the accident, the accident itself, and the consequences. Without such records it will not be possible to develop truly effective intervention methods enabling prevention of the majority of accidents, especially those resulting in injury.

IV. ALCOHOLISM

M. Sanecki

INTRODUCTION

Attempts to construct a universally applicable and operationally useful definition of an alcoholic satisfying both physicians and sociologists have been largely unsuccessful. The WHO Alchoholism Subcommittee (*1*) defined alcoholics as:

> "Excessive drinkers whose dependance upon alcohol has attained such a degree that they show a noticeable mental disturbance or an interference with bodily or mental health, interpersonal relations, smooth economic and social functioning, or the prodromal signs of such development; they therefore require treatment".

The lack of clear definitions is an obstacle to the application of epidemiological methods in problems related to alcohol. To classify a particular drinker may not be easy, either for the clinician or the public health worker. However, using sociological methods it is possible to distinguish between: (1) total abstainers ("teetotallers"), who do not drink alcohol at all; (2) social drinkers, who drink moderately, and may occasionally become intoxicated, but there is nothing "abnormal" in their drinking; and (3) excessive drinkers, who drink to excess with observable consequences in their health, social life, and work (*2*).

In relation to the medical consequences of excessive drinking alcoholics are people with a disease that can be medically defined and which requires appropriate therapeutic procedures. According to the *International Classification of Diseases* (ICD), eighth (1965) revision (*3*), **Alcoholism** (303) is subdivided as follows:

303.0 *Episodic excess drinking,*

303.1 *Habitual excessive drinking,*

303.2 *Alcoholic addiction [this includes chronic alcoholism],*

303.9 *Other and unspecified alcoholism [this includes Alcoholism (acute) NOS[a]].*

Many attempts have been made to construct a classification that distinguishes, on the basis of both sociological and medical criteria, abstainers, social drinkers, and excessive drinkers. Here we should focus attention on the last group; their excessive drinking may be measured either by the frequency with which they become intoxicated or by the social, economic, and medical consequences of their abuse of alcohol.

[a] Not otherwise specified.

It is possible to distinguish three subgroups of excessive drinkers.

(1) *Symptomatic or problem drinkers* (Jellinek's alpha and beta alcoholism (*4*)). For these alcohol is a stress-releasing remedy; they often get drunk in order "to forget" the problem.

(2) *Alcohol addicts* (Jellinek's gamma and delta alcoholism (*4*)) are unable spontaneously to give up drinking; they often require a "booster" and they feel "hungry" or "unwell" while sober. They often realize that they have to stop drinking but are unable to do so.

(3) *Chronic alcoholics.* These show full dependency on alcohol and are "psychodegraded" or physically damaged by alcohol. Their brains and bodies are so harmed by alcohol that the effects persist even when they are not drinking. Alcohol psychoses and other mental disturbances are frequent.

MEASUREMENT OF DRINKING PATTERNS

These are concerned with questions concerning the *who, what, when, where, how much,* and *why* of drinking at a particular time. Alcoholic beverages may serve various purposes – religious, ceremonial, pleasurable, and utilitarian (obtaining some form of relief, reducing hunger, or getting warm). Since alcohol is a socially accepted drug special attention should be paid to everyday drinking behaviour. Such background studies are necessary for an understanding of the complex relationship between alcohol consumption and the alcohol-related problems experienced by members of the general population.

Global Studies

Alcohol consumption measurement

An indication of the amount of alcoholism in a given area is provided by measurement of the level of consumption. The average level of consumption of alcohol may be an indicator of the number of excessive drinkers, alcohol-related morbidity, or alcohol-related mortality; for example, the rates for deaths from cirrhosis of the liver are closely related to the average level of consumption (*5, 6*).

Estimates of *per caput* consumption of alcoholic beverages are usually derived from official statistics on alcohol production and distribution (Table 1). There is also a tendency to use "consumption units", i.e., *male consumers aged over 15 years.* This is based on the assumption that adult women drink much less than adult men. The use of consumption units will certainly facilitate international comparisons of alcohol consumption, provided that accurate national consumption figures are obtainable.

Table 1. Beverage preferences 1950–52, and total *per caput* consumption 1950–52 and 1968–70[a]

Country or area	Consumption of dominant beverage type as percentage of total consumption in 1950–52			Total *per caput* consumption (litres of 100% alcohol)	
	Wine	Beer	Spirits	1950–52	1968–70
Wine countries					
France	79.1	5.1	15.8	17.6	16.1
Hungary	78.5	6.0	15.5	4.8	8.9
Italy	90.8	1.7	7.5	9.4	13.7
Portugal	95.8[b]	0.4	3.8	12.9[b]	15.2
Romania	60.8[b]	6.0	33.2	4.7[b]	6.3
Spain	69.8[b]	1.8	28.4	8.1[b]	11.9
Switzerland	51.7[b]	29.6	18.6	6.6[b]	10.3
Beer countries					
Australia	13.4	73.8[b]	12.7	6.4[b]	8.2
Austria	32.7	43.5	23.8	5.4	10.8
Belgium	11.0	78.4	10.6	6.6	8.4
Canada	4.0	61.7	34.3	4.9	6.4
Czechoslovakia	10.3	63.1[b]	26.6	4.9[b]	8.2
Denmark	9.8	78.3	11.9	4.0	7.0
Germany, Fed. Rep. of	20.0	50.2	29.8	3.6	10.1
Ireland	3.5	75.0	21.5	3.4	4.4
Luxembourg	42.8	43.1	14.1	6.8	9.4
New Zealand	4.2	75.3[b]	20.5	5.6[b]	7.3
United Kingdom	2.1	87.1	10.8	4.9	6.2
USA	9.8	51.7	38.5	5.0	6.0
Spirit countries					
Cuba	12.2	34.6	53.2	2.0	1.8
Cyprus	43.7	13.0	43.3[b]	3.1[b]	3.2
Finland	6.6	33.9	59.5	2.2	4.4
German, Dem. Rep.	3.6	47.0	49.5	1.9	6.0
Iceland	15.9	37.9	46.1[b]	1.1[b]	2.8
Israel	16.4	25.3	58.3[b]	1.4[b]	2.1
Netherlands	3.8	28.2	68.1	1.9	5.3
Norway	7.2	41.6	51.2	2.1	3.5
Peru	10.2	24.0	65.8[b]	1.3[b]	2.6
Poland	4.6	24.2	71.2	3.1	5.5
South Africa	29.7	21.4	48.9	1.8	3.0
Sweden	4.5	31.8	63.7	4.0	5.8
Turkey	27.5	17.3	55.2[b]	0.3[b]	0.4
Yugoslavia	18.9	8.2	72.9[b]	2.7[b]	7.8

[a] From **Bruun, K. et al.** (*5*). Reproduced by kind permission of the Finnish Foundation for Alcohol Studies.

[b] Estimate.

Consumer expenditure on alcohol

These data can be obtained from family expenditure surveys, family budget surveys, etc. It is fairly easy to calculate the average proportion of income spent on alcoholic beverages by a particular family, household, or family member, but using this method it is difficult to obtain accurate estimates of sums spent on alcohol in "nonhousehold" populations.

However, it should be noted that Duffy (*7*) has recently expressed considerable scepticism about the reliability of using alcohol consumption measurements and consumer expenditure on alcohol. He points out that people are likely to underreport expenditure on, and consumption of, alcohol; also, a country's alcohol consumption figures will include alcohol bought by tourists, who are not members of the general population.

Individual Studies

Drinking behaviour studies in special risk groups

One of the main aims of such studies is measurement of alcohol consumption over a particular period of time. Usually, survey samples are based on official lists, pooling lists or registers, etc. Some surveys focus on special residences such as student hostels, army barracks, or boarding houses inhabited by construction workers. The methodological problems involved in conducting realistic drinking behaviour studies are substantial. Selective nonresponse, forgetfulness, or lying are common, not to mention such problems as incomplete sampling frames, imperfect coverage, and cluster effects. As in other general population studies, the collected data are based on retrospective accounts of who drinks what, when, and where. Then, drinkers are classified according to a simple quantity-frequency (*Q-F*) index, or a quantity-frequency-variability (*Q-F-V*) index. Based on the battery of questions employed the second index takes into account: *Q,* the quantity of a beverage consumed at a sitting; *F,* the frequency with which beer, wine, or spirits are usually consumed; *V,* the variability of drinking, as shown by a combination of the modal amount consumed and the greatest amount drunk occasionally (*8*). With regard to the period of time concerned, there are three alternatives.

(1) *Alcohol consumption in the previous week.* Respondents are asked about their drinking during the past week. In this way it is possible to obtain some idea of how often people drink and how much they drink. The absolute alcohol (100% ethanol) equivalent is calculated for each reported drink and then summed to give the total quantity. Type of drink, number of days when drinking occurs, alcohol consumption in terms of absolute alcohol for each sex, age, socioeconomic, and other group can be calculated, and often the equivalent amount of absolute alcohol consumed in 365 days is assessed.

(2) *Alcohol consumption in the past 24 hours.* This is particularly applicable in societies consuming mainly wine and beer because of the daily character of drinking.

(3) *Alcohol consumption at the last sitting.* This is an alternative for occasional drinking groups; respondents are asked when they last had an alcoholic drink of any kind.

SOCIOMEDICAL STUDIES ON PREVALENCE OF ALCOHOLISM AND PROBLEMS ASSOCIATED WITH ALCOHOLISM

Indirect Methods for Estimating the Prevalence of Alcoholism

The Jellinek formula

This method is based on the assumption that there is a constant relationship between chronic alcoholism and cirrhosis of the liver. This can be represented by the equation $A = \frac{PD}{K}$, where A is the total number of alcoholics in a given population for a given year, and PD is the number of reported deaths from liver cirrhosis for a given year multiplied by the percentage of liver cirrhosis deaths attributable to alcoholism (62.8% for males and 21.6% for females, based on the sixth (1948) revision of the ICD). The value of K is the percentage of all alcoholics suffering medical complications who die of cirrhosis of the liver; this is presumed to be constant.

This value was computed by the author taking into account autopsy data for 100 000 alcoholics who experienced various medical complications. On the basis of these data the proportion of deaths from cirrhosis of the liver among all alcoholics with medical complications alive in a given year is 0.69%. In order to compute the total number of alcoholics in the given population the ratio of 5.3 : 1 (all alcoholics to those with medical complications) should be used. All the components of Jellinek's formula are valid for Canada and the USA, and provide reasonably reliable indicators of the prevalence of alcoholism (*4*).

Other methods of assessing the prevalence of alcoholism are based on the assumption that there are constant relationships between indirect indicators (such as death following traffic accidents or from delirium tremens) and alcoholism.

Mortality studies have revealed significantly elevated death rates among alcoholics and other heavy drinkers. The Finnish Foundation for Alcohol Studies report (*5*) concludes that (1) the effect of alcohol explains a considerable proportion of higher mortality rates among heavy drinkers; (2) much of this excess mortality results directly from the effects of the alcohol; for example, liver cirrhosis, motor vehicle accidents, and cancer of the upper digestive tract; (3) other conditions often associated with heavy drinking, such as personal neglect, poor nutrition, heavy smoking, and emotional instability, are probably responsible for higher mortality from suicide, tuberculosis, lung cancer, etc. The conditions mentioned under (2), as well as some of those mentioned under (3) may serve as indirect indicators of alcoholism prevalence.

Interviews with service personnel

It is also possible to measure the level of alcoholism by asking a sample of general practitioners and other members of primary health teams how many alcoholics they have on their list, or perhaps on registers. Social agencies (welfare services) and courts of law in study areas may also be able to give information about persons who have experienced social, occupational, or familial consequences of alcoholism; been admitted to hospital as a result of a medical problem attributable to alcohol; or been prosecuted for drunkenness.

Direct Methods for Estimating the Prevalence of Alcoholism and Alcohol-Related Health Problems

General population studies of drinking problems

One aim of such studies is to categorize cross-sections of a given population in terms of medical and social problems associated with alcohol consumption. Such studies identify problems both in individuals and in specific groups, but they cannot really determine the cause of alcoholism. Normally, so-called problem scores are assigned to each individual; these depend on the researcher's decision about what is to be considered a particular drinking problem, or what medical problems should be taken into account.

Interviews or phsyical examinations in a study will reveal certain signs normally associated with chronic alcoholism. This type of study may also reveal *the degree of dependency* and the prevalence of individual problems, which could range from medical to legal. The prevalence study usually covers a great deal of ground on a rather superficial basis, any causal links being beyond the scope of such activities.

Prevalence studies of physical health problems in alcoholics

Morbidity studies have revealed a wide spectrum of physical health problems in heavy drinkers. The evidence is mainly derived from studies of the prevalence of physical health problems in samples of heavy drinkers. These disorders include (1) certain diseases of the nervous system (e.g., peripheral neuropathy, brain damage); (2) certain diseases of the digestive tract (e.g., chronic gastritis, peptic ulcers, also liver damage and pancreatitis); (3) certain respiratory diseases (e.g., tuberculosis, chronic bronchitis, and pneumonia); (4) certain forms of cardiovascular disease (e.g., cardiomyopathy and hypertension); (5) certain cancers; (6) injuries resulting from accidents (e.g., locomotive and others) (5).

Case-based studies of patients or offenders

Case-based studies focus on many variables such as sex, socioeconomic class, age group, and educational level, but the most critical variables are *duration of drinking* and *volume of alcohol consumed.* Studies of this kind gather

more detailed information than general population studies. They are retrospective and are based on specially selected populations, for example, patients attending clinics, hospitals or rehabilitation centres for alcoholism. Data about offenders are usually available from courts of law, probation officers, and the police.

These studies attempt to discern not only prevalence but also common situations, events, or social features of an individual's history. Information on treatment and other rehabilitative activities may also be collected.

PROGRAMME SUCCESS (OR TREATMENT EFFECTIVENESS) STUDIES

Global

The main aim of any preventive programme will be to reduce the average level of consumption in the target population. This might be achieved by various methods such as educational programmes directed at young adults, control of advertising by the mass information media, or reducing the alcohol content of alcoholic beverages. Alcohol consumption might be an important indicator of the success or failure of such preventive programmes.

Individual

(1) The success of treatment, its definition and evaluation, has until recently been tied to one goal, that of *total and lifelong abstinence.* Hence, a simple distinction could be made between the treatment goal – total abstinence, and the treatment outcome – the end result of treatment.

Edwards (*9*) described a study in which each patient was rated every month, and could earn from 0 to 2 points in each month under consideration. The scale was simple:

2 points = complete abstinence, or occasional drinking not interfering with social functions;

1 point = drinking more than occasionally, or drinking occasionally causing mild social incapacity;

0 points = heavy drinking causing considerable social incapacity (imprisonment or hospitalization).

(2) Pattison (*10*) has recently presented an outline of a *multivariate model for treatment.* It includes consideration of improvement in many "life-health" areas; for example,

– drinking health, subdivided into five outcomes: abstinence, social drinking, modified drinking, controlled drinking, and normal drinking;

– emotional health;

– vocational health;

– interpersonal health;

– physical health.

The rationale of this approach is that attention should not focus on drinking alone but also on other life functions affected by alcoholism. These are the target areas where improvement should be sought. Evaluation is therefore the process of determining to what extent the expected, defined goals in each area have been achieved.

Controlled studies of the efficacy of therapy are also an important part of evaluation. In order to select the most effective therapy for alcoholics, patients should be randomly assigned to therapy, using either an active drug or a placebo. This is the only way to see whether patients treated by a "new" method show greater improvement than those selected as controls.

REFERENCES

1. WHO Technical Report Series, No. 48, 1952 (Second report of the WHO Alcoholism Subcommittee).
2. **Robinson, D.** *From drinking to alcoholism: a sociological commentary.* London, John Wiley & Sons, 1976.
3. **World Health Organization.** *Manual of the international statistical classification of diseases, injuries, and causes of death, 1965 revision.* Geneva, 1967.
4. **Jellinek, E.M.** Estimating the prevalence of alcoholism: modified values in the Jellinek formulas and an alternative approach. *Quarterly journal of studies on alcohol,* **20**: 261 (1959).
5. **Bruun, K. et al.** *Alcohol control policies in public health perspective.* Helsinki, The Finnish Foundation for Alcohol Studies, 1975 (publication no. 25).
6. **Ledermann, S.** *Alcool, Alcoolisme, Alcoolisation. Mortalité, Morbidité, Accidents de travail.* Paris, Presses universitaires de France, 1964 (Institut national d'Etudes démographiques, Travaux et Documents, Cahier 41).
7. **Duffy, J.C.** Alcohol consumption, alcoholism, and excessive drinking: errors in estimates from consumption figures. *International journal of epidemiology,* **6** (4): 375–379 (1977).
8. **Calahan, D. et al.** *American drinking practices: a national study of drinking behaviour and attitudes.* New Brunswick, NJ, Rutgers Center for Alcohol Studies, 1969.
9. **Edwards, G.** Alcoholism: the analysis of treatment. *In:* Popham, R.E., ed. *Alcohol and alcoholism.* Toronto University Press, 1970.
10. **Pattison, E.M.** Drinking outcomes of alcoholism treatment: abstinence, social, modified, controlled, and normal drinking. *In: Alcoholism, a medical profile. Proceedings of the First International Medical Conference on Alcoholism.* London, Edsell, 1974.

CHAPTER 8

THE NATURAL HISTORY OF DISEASE APPROACH

I. INTRODUCTION

W.W. Holland

In the process of measuring health levels an important aspect is the "natural history", or the progression from one stage to another, of the disease. In coronary heart disease, for example, the first sign of its existence in an individual may be angina or shortness of breath; this may then be followed by a myocardial infarct and admission to hospital. The patient may recover but continue to be incapacitated by chest pain and therefore unable to return to his original occupation.

In this traditional description of the progression of a disease through care, cure and rehabilitation, the initial stage, i.e., that of the presence of risk factors involved in the development of the diseases – for example, cigarette smoking, lack of exercise, inappropriate diet, excess weight, raised blood pressure and abnormal electrocardiographic findings – has been ignored. That, however, is the stage where prevention is possible.

The natural history of an acute infectious disease such as influenza in any community will include some individuals who become ill and require nursing care, others who develop complications and need to be hospitalized and a larger group who are infected but show no signs of illness. All these groups will show resistance to infection by the particular type of influenza virus, which is thus a preventive factor affecting the natural history of future outbreaks of the virus disease.

From the above it is apparent that in measuring levels of health in a community for policy-making purposes the prevalence of, not only different diseases or disease groups, but also of different risk factors, in a community are the important measures for determining what services should be provided. The technology is still not available for curing a number of health conditions. However, appropriate caring and rehabilitative services may improve the quality of life, enabling individuals to remain active as long as possible although perhaps not actually increasing the duration of life.

To determine priorities in any health care system measurements must be developed to distinguish various stages of disease. If, for example, the objective

is to prevent mortality from lung cancer or coronary heart disease, one particular strategy would be reduction or prevention of cigarette smoking. For prevention a necessary measure would be prevalence of smoking in different age and sex groups. We should also determine the age at which smoking starts and the causes leading to regular use of cigarettes. Following such studies it might be possible to develop educational methods to dissuade people from taking up the habit.

An alternative objective to prevention in coronary heart disease might be to enable individuals to return to full-time employment in their original occupation. In this case the strategy would be different, requiring the development of treatment methods to reduce case fatality following myocardial infarction and rehabilitation methods to allow patients to resume their normal work. The measures required for this purpose are prevalence of coronary heart disease, incidence of myocardial infarction, the case fatality rate, the results of using different types of treatment and the availability of rehabilitation facilities.

For developing a strategy for control of infectious disease appropriate measures are the serological status of the population and thus the level of risk of infection. These measures should be useful in policy making in connexion with immunization and the need for isolating individual cases of a disease; the latter, of course, is also related to the severity of the disease.

Knowledge of the natural history and prevalence of any disease, measurement of the risk factors involved, the results obtained with available treatment methods, and any indications for the care of patients following an infection or in the continuing presence of the disease are all vital for the development of various strategies, depending on the objective in view, and thus for policy making in connexion with provision of appropriate services. The next three sections illustrate the measures used at different phases in a number of communicable and noncommunicable diseases.

II. CARE AND CURE

W.W. Holland & Angela H. Wainwright

INTRODUCTION

In the past those responsible for administering and providing health services have usually been content with trying to provide these services without considering the adequacy or efficiency of the output. However, we have recently begun to question whether individual services are effective in the provision of health care and, if not, how improvements could be made.

In *Measurement of levels of health* we are concerned with two parts of the health care equation. First with measurement of the level of health of a population in order to determine the facilities required to deal with the illnesses in that population; second with measuring the outcomes of services provided.

MEASUREMENTS TO DETERMINE CURING AND CARING SERVICE NEEDS

Assessment of mortality and morbidity is the commonest method used to measure levels of health, and hence the amount of disease, in a community. Morbidity data can either provide information on the *incidence* of a particular disease, which is the number of new cases of the disease occurring in a defined period of time, or about its *prevalence,* which is the total number of cases present in a population at a particular time. Incidence is not influenced by the duration of disease, and is therefore useful for measuring the level of an acute illness, but prevalence is a more appropriate measurement for chronic conditions that last for long periods.

Mortality data for different age groups may give an indication of service need. For example, a high infant mortality rate probably indicates the need for improvement in child care services and, of course, economic and social circumstances as well. McKeown (*1*) has recently attempted to divide the conditions that cause death in infancy into those existing prenatally and those related to social and environmental circumstances. Morbidity data provide various measures of service requirements; for example, notifications of infectious disease, such as tuberculosis, measles, or rubella, and school absence figures or occupational health services data, are sources of information about different age groups and activities.

Other routine information systems include hospital admissions – taking the form of the Hospital Activity Analysis in the United Kingdom. This provides reliable morbidity information for diseases that result in admission, such as obstetric or perforated ulcer cases, but not for conditions that only occasionally lead to admission to hospital. Sickness absence statistics are another

source of morbidity information, but these of course apply only to the employed population. Information may also be gathered from figures for disability pensions or premature retirement resulting from illness.

However, routine statistical systems are unlikely to provide accurate data for the frequency of psychiatric illness, mental handicap, and locomotor disability including many of the conditions associated with old age. Most of these conditions are unlikely to be cured but at least some comfort can be given by adequate caring services.

To determine the need for caring services, it is necessary to undertake field surveys. For example, Bennett et al. (*2*) studied the level and type of disability within a defined population in London; they found that in 35–74-year-olds 7.2% of men and 9.7% of women suffered from some form of disability, which in men was more likely to be a result of internal conditions and in women a result of locomotor impairment. Harris (*3*) made a nationwide survey of impaired and handicapped people living in private households in the United Kingdom. From a sample of 250 000 households she was able to estimate the proportion of the population suffering from some form of handicap. Information was collected using questionnaires on age distribution, area of residence, causes and extent of handicap, and employment situation for the handicapped population as well as health and social service use.

Some years before Densen et al. (*4*) in the USA established the use of records of the Health Insurance Plan of Greater New York as a measurement of health status in a defined population. Since a large proportion of the working population would be participating in such a plan, systematic study of records yielded valuable morbidity information.

A number of general morbidity surveys have also been conducted, the first of which began in the early 1950s in Denmark. In 1964 the first of two national household surveys was carried out in Finland to determine levels of morbidity, use of health services, and family expenditure on health before the introduction of the national health service scheme (*5*). The survey was repeated in 1968 when an increase in demand for medical care was shown in some population groups. In 1976 a third survey was performed to evaluate developments from reorganization of primary health care services in 1972.

Lastly, the National Center for Health Statistics in the USA is responsible for a series of studies on acute and chronic diseases.

These surveys show that the information required for measurement of levels of health in order to provide appropriate curing or caring services depends on the nature of the particular problem. In the United Kingdom the report of the Resource Allocation Working Party on Sharing Resources for Health (*6*) described how mortality indices could be used for such an assessment, and Kostrzewski in Chapter 3 shows how measurements of disability in the elderly could provide some idea of the level of caring services required.

It is worth mentioning here that, because much of the information gathered will rely on information given by individuals, whether patients or physicians, there are likely to be differences in need (or demand) as perceived by the patient and need as seen by the physician. For example, in Sweden (*7*) a survey of community dentistry showed that a dentist's assessment of a patient's dental wellbeing using objective indices may not correspond with the patient's

"subjective" appraisal of his dental status. It was found that satisfaction rates did not differ significantly between those with a good dental status and those whose dental status was judged to be less than optimal.

EVALUATION OF CURING AND CARING SERVICES

One rather simplified method of evaluation has always, in the past, been observation of the structure and function of health services, but there is more need now for detailed assessment of both the process of specific services and their outcome.

Measures of Process

One particular aspect of the "process" of services that has received considerable attention from researchers is length of stay in hospital following operation. Heasman & Carstairs (*8*) have described the variation in this and other aspects of inpatient management for Scotland.

A recent study by Griffiths[a] has shown that variation in length of stay following hernia repair was related to hospital size – length of stay increased as hospital size decreased. It was also found that having bilateral herniorrhaphy or complications following operation also increased the length of stay.[b] In the same study it was found that length of sickness absence following hernia repair was related to physical activity in the patient's occupation and to the attitudes of general practitioners.

In a study of admission rate and length of stay for nonspecific enteritis in paediatric departments in Sweden (*9*) it was found that admission department policy had more effect on both these factors than did demographic, geographic, social, or disease characteristics combined.

Other methods of measuring "process" have been documented, including investigations on the interval between admission and operation and on the number and type of investigations performed on a particular patient. Myers et al. (*10*) have described these methods for the Patient Assessment System in Michigan, USA. Other reviews are also of interest here (*11, 12*).

These descriptive measures of process enable assessment of certain aspects of health care. However, as part of the embracing function of a "measurement of level of health" they presuppose that if a patient undergoes a particular investigation or is admitted to hospital his or her prognosis is altered. Treatment does not necessarily alter the natural history of a disease, improve the quality of a patient's life, or increase life expectancy. It has been shown that

[a] **Griffiths, M. et al.** *Variation in hospital post-operative stay after inguinal herniorrhaphy* (in preparation).

[b] **Griffiths, M. et al.** *Sickness absence following inguinal herniorrhaphy* (in preparation).

admission of a patient who has suffered a heart attack to a coronary care unit does not necessarily improve his chances of survival (*13*). Cochrane & Holland (*14*) have also attempted to demonstrate the inadequacy of the philosophy in their assessment of the value of screening.

Measures of Outcome

Since process measures do not always reflect changes in the natural history of disease outcome measures may be more appropriate in some circumstances. One such measure of outcome is case-fatality rates for a particular condition in different types of hospital. Ashley et al. (*15*) have shown that teaching hospitals in England have a lower case-fatality rate following prostatectomy than nonteaching hospitals. Since it is unlikely that this is a consequence of differences in the severity of the condition treated or in socioeconomic class it must reflect a service difference. Lichtner & Pflanz (*16*) have shown different case-fatality rates in the Federal Republic of Germany and various other countries following appendectomy.

Both prostatectomy and appendectomy can be expected to result in cure but this is not so for many conditions where treatment may lead to increased life expectancy but not to cure. In the Connecticut Cancer Registry, USA (*17*) comparision of remission rates over a 20-year period shows that life expectancy has increased, but only slightly, for some forms of cancer.

From this type of evidence it appears that we cannot consider only cure or even increased life expectancy; outcome measurement must also involve improvements in daily living activity and satisfaction with life. Katz & Akpom (*18*) have produced a definitive scheme for Activities of Daily Living.

Measures of Care

A number of measures can be used to assess different methods of care; for example, care of the chronic sick at home or in hospital:

(1) clinical outcome,

(2) admissions to hospital (patients cared for at home may require emergency admission),

(3) patient satisfaction,

(4) provision of domiciliary care (this would vary with the marital status of the patient),

(5) cost (cost difference between two types of care is only slight because hospital facilities have to be maintained in case of emergency admission).

These measures were used in a study of "responauts", who because of respiratory paralysis are either wholly or partially dependent on artificial respirators; consequently, most are cared for in special hospital units. In this study patients were discharged to their own homes and the necessary staff were recruited to look after them. Measures of care outcome as described were

performed and the experiment was judged to be a success; however, only limited conclusions can be drawn since no control trial was possible. Most of the patients were able to remain at home after a suitable assessment period had passed, which at least shows that an *appropriate* measure of care was possible for these patients (*19*). In other situations the importance attached to any particular outcome measure would depend on the specific circumstances.

Different measures of outcome were used in the next two examples. Piachaud & Weddell (*20*) in a randomized controlled trial showed that patients with varicose veins treated as outpatients by injection sclerotherapy and those admitted to hospital for stripping of varicose veins had equal complication and recurrence rates. An assessment of patients' attitudes showed that they preferred the outpatient sclerotherapy, and it was found that outpatient treatment cost less than admission to hospital. Thus, in terms of the available outcome measures outpatient treatment appears to be more cost/effective and pleasant.

Adler et al. (*21*) have reported an experiment in discharging patients from hospital after 48 hours compared with the normal discharge time of 7 days after operations for hernia or varicose veins. The outcome is considered in terms of postoperative complications and recurrences, cost to the National Health Service and to society, and the satisfaction of patients and providers of services. Patients were allocated at random to either 48-hours or 7-day discharge following operation. Varicose veins patients who were discharged early had a far more positive attitude towards early discharge than those who were discharged after 7 days. There was only a small difference in the cost to society since most of this is in the form of loss of productive work by the patient. Unfortunately, it was found that early discharge has little, if any, effect on the complication rate, costs, or satisfaction of patients or providers of services.

METHODS OF EVALUATING HEALTH IN A POPULATION

The examples given in the last section provide some idea of the difficulties that may be encountered in developing an index of health status. Coles et al. (*22*) have tested the usefulness of two such indices – that of Grogono & Woodgate (*23*) and that of Rosser & Watts (*24*). Difficulties encountered in the use of these indices, which rely on patient interviews, include poor correlation among physicians or other users who are unfamiliar with the patients. A great deal more work must be done before such indices can be used as a quantitative aid to those responsible for planning and evaluating services.

In attempting to measure the outcome or effectiveness of a service the first step must be to define or set an objective for that service, and for that purpose the natural history of a disease must be known before it can be decided if the objective set can actually be achieved. An example is the use of coronary care units: 60% of deaths from coronary heart disease occur within 3 hours of the onset of chest pain and so the service, i.e., provision of coronary care units or other interventions, is unlikely to achieve the objective of reducing mortality from coronary heart disease (*25*).

It seems that different forms of treatment for varicose vein patients achieve the same objective in terms of recurrence rate but, as we have said, the cost of inpatient operation is much greater than the cost of outpatient sclerotherapy (*20*). Similarly, the clinical outcome of staying in hospital following minor operation for 2 days compared with 7 days is almost identical, although patient satisfaction may vary (*21*). However, if short stay in hospital is to have any advantage from an economic point of view the time taken off work for minor operations must be reduced.

The difficulty of providing services is that we tend to classify people by diagnostic labels according to whether the objective of the service they require is cure, prevention, or rehabilitation and care. In order to help those responsible for administration and planning of health services at the national or local levels it is necessary to develop appropriate objectives relevant to effective delivery of all types of service in combination with one another.

It is now widely believed, for example, that raised blood pressure is one of the major sources of disease that is amenable to treatment. It has been suggested that a number of controlled studies of patients with moderately raised blood pressure be performed to determine whether, if suitable treatment is given, mortality is reduced (*26*). However, a trial of multiphasic screening in south-east London (*27*) has suggested the possible futility of such investigations within the United Kingdom.

Patients on the lists of two large group practices were allocated at random: one group to be screened, one group to receive normal medical care. The first group was re-examined 2 years after initial screening and both groups were examined 3 years later. There was no difference in mortality between these two groups. However, since one of the objectives of the multiphasic screening trial was to identify individuals with raised blood pressure and treat them, the findings in relation to levels of blood pressure are perhaps more surprising. In the final examination it was found that blood pressure levels in those screened and actually identified as having hypertension did not differ from the levels in those who received normal medical care. Consequently, it seems that the development of screening and detection and the provision of appropriate therapy is not sufficient to reduce levels of blood pressure in a population. This could have several explanations; for example, physicians may have ignored symptoms of raised blood pressure and patients without symptoms would be less likely to visit a physician regularly. Clearly, the medical practitioners involved in this experiment were enthusiastic and the effect of any treatment given was likely to be optimal.

The failure of screening programmes for hypertension just referred to raises doubts about the present methods of medical care for hypertensive patients. Perhaps changes should be introduced; for example, trained nurses could visit patients regularly to ensure that they take the prescribed drugs or patients could be taught to measure their own blood pressure and so be able to monitor the progress of their treatment. This study illustrates the need for clearly defined objectives in any scheme of health care delivery and development of appropriate methods of assessment must be encouraged.

For many conditions simple measures such as case fatality, recurrences, and complications are appropriate and often schemes of management can be

developed to satisfy the objectives proposed. But for many conditions where it is only possible to provide care measures must incorporate not only improvement in terms of function but also improvements in the quality of life, not forgetting the aspect of cost.

Two recent publications, one on research methods in medical care (*28*) and one on surveillance methods (*29*), give a simple message, which we hope is also made clear in this chapter. There is no single method of measuring health status or of assessing the process or outcome of services, and the circumstances existing for any one condition in any particular area or age group vary enormously.

REFERENCES

1. **McKeown, T.** *The role of medicine.* London, Nuffield Provincial Hospitals Trust, 1976 (The Rock Carling Fellowship).
2. **Bennett, A.E. et al.** Chronic disease and disability in the community: a prevalence study. *British medical journal,* **3**: 762 (1976).
3. **Harris, A.I. et al.** *Handicapped and impaired in Great Britain.* London, Her Majesty's Stationery Office, 1971 (Office of Population Censuses and Surveys publication).
4. **Densen, P. et al.** Medical care plans as a source of morbidity data. The prevalence of illness and associated volume of service. *Milbank Memorial Fund quarterly,* **37** (1): 48 (1960).
5. **Purola, T. et al.** *Health service use and health status under national sickness insurance.* Helsinki, Social Insurance Institution, 1974.
6. **Resource Allocation Working Party.** *Sharing resources for health in England.* London, Her Majesty's Stationery Office, 1976.
7. **Barenthin, I.** Dental health status and dental satisfaction. *International journal of epidemiology,* **6**: 73 (1977).
8. **Heasman, M.A. & Carstairs, V.** Inpatient management: variations in some aspects of practice in Scotland. *British medical journal,* **1**: 495 (1971).
9. **Smedby, B. & Sundelin, C.** Admission rate and length of stay for nonspecific enteritis in pediatric departments in Sweden. *International journal of health services,* **2**: 537 (1972).
10. **Myers, R.S. et al.** The medical audit. *Modern hospital,* **85** (3): 77–83 (1955).
11. **Sanazaro, P.J.** Medical audit experience in the USA. *British medical journal,* **1**: 271 (1974).
12. **Clarke, M.** *Evaluating the quality of medical care.* London, Annual Report of the Social Medicine and Health Services Research Unit, St. Thomas's Hospital and Medical School, 1973/74, p. 101.
13. **Mather, H.G. et al.** Myocardial infarction: a comparison between home and hospital care for patients. *British medical journal,* **1**: 925 (1976).
14. **Cochrane, A.L. & Holland, W.W.** Validation of screening procedures. *British medical bulletin,* **27** (1): 3 (1971).

15. **Ashley, J.A.A. et al.** Case fatality of hyperplasia of the prostate in two teaching and three regional board hospitals. *Lancet,* 2: 1308 (1971).
16. **Lichtner, S. & Pflanz, M.** Appendectomy in the Federal Republic of Germany: epidemiology and medical care patterns. *Medical care,* 9 (4): 311 (1971).
17. **Connelly, R.R. et al.** Central registry of cancer cases in Connecticut. *Public health reports (Wash.),* 83: 386 (1968).
18. **Katz, S. & Akpom, C.A.** Index of activities of daily living. *Medical care* (supplement), 14 (5): 116 (1976).
19. **Dunnell, K. et al.** Collaboration between health and social services – a study of the care of responauts. *Community medicine,* September 22, p. 128 (1972).
20. **Piachaud, D. & Weddell, J.M.** Cost of treating varicose veins. *Lancet,* 2: 1191 (1972).
21. **Adler, M.W. et al.** A randomised controlled trial of early discharge for inguinal hernia and varicose veins: some problems of methodology. *Medical care,* 12 (6): 541 (1974).
22. **Coles, J.M. et al.** A comparison of three health status indicators. *International journal of epidemiology,* 5: 237 (1976).
23. **Grogono, A.W. & Woodgate, D.J.** Index for measuring health. *Lancet,* 2: 1024 (1971).
24. **Rosser, R.M. & Watts, V.C.** The measurement of hospital output. *International journal of epidemiology,* 1: 361 (1972).
25. **Adler, M.W.** The effectiveness and role of coronary care units. *Update,* 8: 1453 (1974).
26. *World Health,* February – March 1978, pp. 2–35.
27. **Holland, W.W. et al.** A controlled trial of multiphasic screening in middle age: results of the South-East London Screening Study. *International journal of epidemiology,* 6: 357 (1977).
28. **Holland, W.W.,** ed. Research in medical care. *British medical bulletin,* 30 (3): 195–281 (1974).
29. *International journal of epidemiology,* 5 (1): 13–91 (1976) (Symposium on methods of surveillance in planning for health).

III. PREVENTION OF COMMUNICABLE DISEASE

J. Červenka

INTRODUCTION

Over the last decade tremendous success has been achieved in almost all of the developed countries in the control and prevention of major infectious diseases; there are, however, still a number of diseases that are of major public health importance and contribute to a varying extent to overall mortality and morbidity.

Because it is a major public health problem a variety of measurements of levels of health have been developed for use in prevention of communicable diseases. Measurements can, for example, be used in changing patterns of morbidity and mortality; surveillance activities (especially those using routine systems); cohort analyses; serological surveys; preventive vaccination; time factors (e.g., duration of hospitalization); outcome of disease; prevalence studies (e.g., prevalence of hepatitis type B surface antigen – HB_sAg); or field trials (active or passive immunization).

Better decision making in the planning of prevention of communicable diseases depends to a large extent on the amount of reliable knowledge on appropriate health and related problems obtained through different measurements.

TYPES OF MEASUREMENT

Mortality and Morbidity Measurements

Influenza remains one of the great uncontrolled plagues of mankind. Data for influenza mortality and morbidity have therefore been collected and analysed for many decades and isolations of influenza virus and identification of the virus strains are carried out all over the world in connexion with the development of vaccines (*1*).

An indirect indicator of influenza morbidity is absenteeism from schools or places of work, or excessive consumption of specific drugs (which often takes place before an epidemic is recognized). Measurement of excess mortality from influenza, especially among the elderly, was once used to indicate where efforts to prevent mortality should be directed (e.g., by vaccination of persons at high risk).

Sensitivity to tuberculin can be measured by means of standard or non-standard tuberculin (the Mantoux test, and the Monrad patch test, respectively). High levels of tuberculin allergy can be considered as a sign of infection or disease (*2*). Tuberculin testing can reveal differences in the allergicity of different BCG vaccines: Czechoslovakian, Danish, Swedish, etc. (*3*).

Gregg (*4*) in 1941 found a higher number of neonates with congenital cataracts in those whose mothers had had rubella in the first trimester of pregnancy. Morbidity data for rubella are often unreliable because of the mildness of the disease, the lack of specificity of its clinical symptoms, poor reporting, and a large proportion of indefinite cases. Measurements should be concentrated on disease morbidity among pregnant women and vaccination coverage and serological surveys of females before childbearing age.

Surveillance Activities

In poliomyelitis surveillance, for example, measurements include the vaccination coverage of the susceptible population (especially infants and toddlers); the frequency of circulation of vaccine – and wild poliomyelitis strains in the environment (on the basis of samples taken systematically throughout the year from different places that would reflect different types of virus in the population); the frequency and distribution of poliomyelitis-type diseases (e.g., on the basis of a compulsory notification system); and the longitudinal follow-up of the dynamics of antibodies against all three types of polio viruses, especially in those vaccinated (*5, 6*).

The following tabulation gives figures obtained from Slovakia, Czechoslovakia (population 4.5 million) on reported poliomyelitis-like diseases during the period 1968–71.

"Polio-like" diseases reported as:	*Cases*	*Percentage*
Poliomyelitis	0	0.0
Facial nerve palsy	250	49.1
Other paresis	72	14.1
Serous meningitis	70	13.8
Other meningitis	72	14.1
Viral encephalitis	45	8.8
Total	509	99.9

Information Systems

Information systems on communicable diseases can combine a number of measurements that are useful in preventive activities; for example, morbidity and excess morbidity, mortality and excess mortality, as well as unusual increases in the number of cases of a disease that is monitored continuously.

Information systems on infectious diseases and on immunization of children have been operating in Czechoslovakia for several years. On the basis of such information systems decisions are made concerning better and more efficient measures in infectious disease control and prevention.

Cohort Studies and Analyses

Over the last 20 years (1957–76) a series of cohort studies (*7*) on morbidity from viral hepatitis has been carried out in Czechoslovakia; cohorts of children born in 1954, 1959, and 1964 were analysed in detail. These cohort studies were aimed mainly at measuring changes in the incidence of viral hepatitis type A in children and they enabled:

(1) estimation (prognosis) of how the epidemiological situation will develop in the near future;

(2) estimation of the "expected" viral hepatitis incidence in various cohorts throughout their lifespan;

(3) improved planning of hospital beds, manufacture of gammaglobulin, and epidemiological measures of foci of infections;

(4) better decisions on general policy for prevention and control of viral hepatitis.

Variation in Morbidity with Age Structure and Time of Year

Great changes in the general morbidity from viral hepatitis have been widely observed during the last decade. For example, in Czechoslovakia the last year of overall high morbidity was 1964 (*8*). About 10 years before an important change in the age structure of the population resulted from a sharp decrease in the number of births. Nowadays there is a steady, though moderate, increase in the number of births with a possible consequence in the rise in the general, and especially children's, morbidity from viral hepatitis.

Seasonal and Cyclic Variations

There are seasonal differences in the frequency of viral hepatitis in younger (5–7 years) and older (12–14 years) children. The younger the children, the later in the year the maximum morbidity from viral hepatitis (*9*).

A close, consistent, and highly significant ($P = 0.0001$) negative correlation between age and season ($r = -0.92$) has been found in viral hepatitis (*8*). This can be partly explained by increased risk of infection during summer vacations. The season/age association can be measured in children but not in adults, in whom viral hepatitis does not display seasonal variation.

Cycles of high viral hepatitis morbidity can be observed every 3–6 years in moderate climates (*8*). In some diseases such as typhoid seasonal and temporal variations are disappearing along with the steep decrease in general morbidity from these conditions.

Case Fatality Rate

In diphtheria accurate measurement of case fatality depends on the adequacy of, and coverage by, the notification and reporting system. The more

reliable the notification, the more consistent the case fatality (*10*). If only severe cases are notified case fatality will appear to be higher when compared with places where all cases are reported. However, even where there is some control of morbidity case fatality from diphtheria cannot really be reduced.

Overall case fatality rates appear to be increasing in some diseases because of changes in age distribution. For instance, there is a long-term shift in viral hepatitis morbidity towards older age groups in whom the clinical course of the disease is more severe; the case fatality of the disease therefore seems to increase over the years (*8*). The case fatality of some communicable diseases such as typhoid can be influenced by adequate treatment (*11*).

In the past the overall case fatality from pertussis was chiefly a result of the disease in infants (*12*). More than 70% of deaths from pertussis occurred in infants. Widespread vaccination coverage has reduced case fatality substantially.

Time Intervals

Measurements of time intervals, e.g., the number of days elapsed between onset of disease and the call for medical assistance, can be used as a measurement of disease severity, or of health service availability, or of the level of health education in the population. The number of days between diagnosis and hospitalization can be used as an index of the promptness of health care services. The number of days elapsed between onset of disease and discharge from hospital may be used as a measurement of the severity of the clinical course of the disease (*8*).

Time interval measurements can be particularly useful in epidemiological study of acute episodes. Measurement of hour of infection and incubation period in a typhoid fever outbreak in Žarnovica, central Slovakia, in 1958 (*13*) enabled construction of a model and hence early control of a waterborne outbreak of the disease.

Prevalence of One Disease as an Index of Health Level

Prevalence data on hepatitis type B surface antigen (HB_sAg) are important in the prevention of spread of hepatitis type B, particularly for epidemiological and blood transfusion purposes.

HB_sAg prevalence has been measured in different subgroups of a general population (*14, 15*) and values from 0.2% to 0.7% have been found (Table 1). Special populations exposed to an increased risk of hepatitis type B infection may, of course, display a considerably higher proportion of HB_sAg positivity (e.g., tuberculous patients and those suffering from diabetes or cholecystitis) (*16*).

Serological and Immunological Tests

Some serological and immunological tests can be used as indicators of absence or presence of infection or disease. Schick testing in children has been used as an indicator for antidiphtheria vaccination for many years.

Table 1. Prevalence of hepatitis type B surface antigen (HB_sAg) in population subgroups in Czechoslovakia (Slovakia only)

Type of population	Year	No. of observations	Percentage of HB_sAg positives
General (controlled study)	1974	2348	0.6
General (controlled study)	1976	3155	0.3
General (multipurpose serological survey)	1973	3304	0.7
Acute cases of hepatitis B	1973	128	62.6
Persons with history of viral hepatitis (follow-up study — 9 years after acute stage)	1974	826	0.0
Mothers, healthy, aged 20—29 years, and their newborn babies (controlled study)	1976	1380	0.5
	1976	1380	0.2
Tuberculous patients from three selected districts of Slovakia (controlled study)	1976	591	2.5

Measuring tuberculin allergy is an important index for the adequacy of BCG vaccination and for tuberculosis infection. Tuberculin allergy induced by vaccination of children fades gradually over a period of time (see Table 2) (*16*).

Table 2. Tuberculin allergy following BCG vaccination in children

Mantoux text (2 TU) in children vaccinated with BCG	Percentage of children with a changed allergy after 3 years		
	increase	same	decrease
Czechoslovakia	7.0	61.0	32.0
Denmark	7.0	43.0	50.0
Sweden	13.0	47.0	40.0

Vaccination Coverage

High coverage with smallpox vaccine was until recently one of the most important measurements predicting the likelihood of spread or control of this disease.

In the majority of infectious diseases that can be prevented by immunization vaccination coverage of 80% or more is essential for the control of infection.

Serological Surveys

Serological surveys can be carried out as a measurement of the immunity status of the population or to indicate the need for mass immunization. Before the introduction of the successful mass poliomyelitis vaccination in Czechoslovakia (*18*) a large-scale serological survey revealed the most susceptible populations.

Serological surveys can also be used as a method for active former case finding, as in typhus fever (*19*), and also as a contribution to early diagnosis and efficient prevention.

Controlled Trials on Passive Immunization

Several controlled field trials have been conducted with gammaglobulin in the prevention of viral hepatitis type A (see Part III, Example 5). The protective effect of gammaglobulin has been repeatedly demonstrated (*8, 20*) and proved in a series of controlled epidemiological field trials. About 400 000 young schoolchildren participated in these trials, which lasted from 1 year to over 3 years. Morbidity from hepatitis type A in nonprotected children was 5–15 times higher than in those protected. In the trials gammaglobulin was administered "without direct epidemiological indications", i.e., not in foci of infections but in nonexposed children during the seasonal incidence minimum at the end of June (i.e., before the end of the school year).

The selection of suitable populations (*8*) for controlled gammaglobulin trials requires measurement of the viral hepatitis experience in certain age groups (cohorts) over 5-year periods, and the size of population groups for use in trials is determined accordingly.

Mass gammaglobulin administration has been introduced as an epidemiological preventive measure in several regions of Czechoslovakia, and the resulting decrease in viral hepatitis incidence in protected groups was even more favourable than that obtained from controlled trials (*8*).

Measurement of Economic Factors

Economic factors that can be measured are, for example, duration of hospitalization and absenteeism from school or work. Such measures can be applied to influenza and other infectious diseases. Another economic factor is the cost of preventive measures such as vaccination or passive immunization.

The economic cost of a disease can be divided into the cost to the community and the cost to the individual (*21*). For instance, in viral hepatitis 94.6% of the expense is incurred by the community and only 5.6% by the individual. Cost to the community can be divided into expenses for health care, transportation, laboratory tests, preventive measures, insurance benefits, and loss of productivity, while cost to the individual can be expressed as expenses on dietetic meals and loss of wages.

CONCLUSIONS

Different types of measurement can be used successfully in the prevention of infectious diseases, in planning of control measures, and in health service management. Measurements of levels of health oriented towards prevention of communicable diseases will help to improve the health status of the population.

REFERENCES

1. **Evans, A.S.**, ed. *Infections of humans: epidemiology and control.* London, Wiley, 1976.
2. **Ďurišová, H. et al.** [Results of an epidemiological analysis of tuberculosis incidence in a selected area of Slovakia.] *Rozhledy v Tuberkulose a v Nemocech Plinich,* **25** (4): 227–232 (1965).
3. **Červenka, J. & Tlučková, I.** Tuberculin allergy in infants vaccinated with Czechoslovak, Danish, or Swedish BCG vaccine. *Bulletin of the World Health Organization,* **35**: 603–607 (1966).
4. **Gregg, N.M.** Congenital cataract following German measles in the mother. *Transactions of the Ophthalmological Society of Australia,* **3**: 35–46 (1941).
5. **Červenka, J. & Straka, Š.** [Epidemiological problems of poliomyelitis and polio-like diseases after mass vaccination campaigns.] *Lekarsky Obzor,* **14**: 477–489 (1965).
6. **Červenka, J. et al.** [Analysis of reported polio-like diseases in Slovakia during 1968–1971.] *Bratislavske Lekarske Listy,* **65** (6): 645–651 (1976).
7. **Červenka, J.** [Longitudinal follow-up of morbidity from viral hepatitis in Czechoslovakia.] *Bratislavske Lekarske Listy,* **60** (3): 531–540 (1973).
8. **Červenka, J. & Masár, I.** Epidemiologie der Virushepatitis. *In: Beiträge zur Hygiene und Epidemiologie.* Leipzig, J.A. Barth, 1971, vol. 20, pp. 1–96.
9. **Červenka, J.** Age and seasonal incidence in viral hepatitis. *Journal of hygiene, epidemiology, microbiology, and immunology (Prague),* **12**: 55–69 (1968).
10. **Červenka, J.** [Analysis of incidence of diphtheria in Slovakia during the last 40 years.] *Čs. zdravotnictvi,* **9** (11): 683–692 (1961).
11. **Červenka, J.** [Incidence of typhoid fever in Slovakia from 1920 to 1958.] *Československa Epidemiologie, Mikrobiologie, Immunologie,* 8 (6): 413–420 (1959).
12. **Červenka, J.** [Incidence of pertussis in Slovakia from 1939 to 1957.] *Lekarsky Obzor,* **9** (1): 11–21 (1960).
13. **Cervenka, J. et al.** [Typhoid fever outbreak in Žarnicova, 1958.] *Československa Epidemiologie, Mikrobiologie, Immunologie,* 8 (2): 126–131 (1959).

14. **Getlíková, K. et al.** [HB_sAg findings in the population of a village with sporadic incidence of viral hepatitis.] *Bratislavske Lekarske Listy,* **67** (2): 208–216 (1977).
15. **Zacharová, M. et al.** [Longitudinal follow-up of patients with viral hepatitis history.] *Bratislavske Lekarske Listy,* **65** (4): 424–435 (1976).
16. **Mruškovičová, L. & Červenka, J.** [Analysis of incidence of viral hepatitis type B in a selected area.] *Lekarsky Obzor,* **26** (6): 357–362 (1977).
17. **Červenka, J. & Tlučková, I.** [Dynamics of sensitivity to standard and non-standard tuberculin in children previously vaccinated with Czechoslovak, Danish, and Swedish BCG vaccine.] *Bratislavske Lekarske Listy,* **47** (5): 257–272 (1967).
18. **Červenka, J. & Novák, A.** [Our experience with poliomyelitis prophylaxis.] *Lekarsky Obzor,* **7** (1): 1–11 (1958).
19. **Červenka, J. et al.** [A contribution to an early serological diagnosis of typhus fever.] *Československa Epidemiologie, Mikrobiologie, Immunologie,* **12** (5): 287–289 (1963).
20. **Červenka, J. & Badalík, L.** Gamma-globulin in the prevention of infectious hepatitis in schoolchildren. *Bulletin of the Indian Society for Malaria and Other Communicable Diseases,* **2**: 75–181 (1965).
21. **Červenka, J.** Economic aspects of viral hepatitis. *In: Uses of epidemiology in planning health services: Proceedings of the Sixth International Scientific Meeting of the International Epidemiological Association, in Primosten, Yugoslavia, August/September 1971.* Belgrade, Savremena Administracija, 1973.

IV. PREVENTION OF NONCOMMUNICABLE DISEASE

B.S. Hetzel

INTRODUCTION

Primary prevention has been achieved for a number of infectious diseases by vaccination, but for chronic diseases this objective has yet to be reached. The need for prevention is created by the burden of human suffering and the cost involved in maintaining health services. One particular example is coronary heart disease where 60% of deaths occur within 3 hours of the onset of symptoms, making provision of effective emergency treatment very difficult. In England the case fatality rate for this disease has not fallen significantly despite the introduction of coronary care units (*1*).

Mortality data indicate that coronary heart disease and cancer have become increasingly common in older age groups. However, recent research indicates that initiation of these diseases occurs in the young and is created by factors of life style including nutrition, alcohol consumption, and cigarette smoking (*2*). Hence measurement of levels of health in relation to these problems requires data for nutrition, alcohol consumption, and cigarette smoking as well as mortality and morbidity resulting from the specific disease.

In considering indicators for primary prevention programmes a number of different types of measurement can be made:

(1) measures of environmental inputs such as levels of cigarette smoking, alcohol consumption, and dietary surveys;

(2) host factors like weight and the level of serum cholesterol as indicators for prediction of coronary heart disease;

(3) outcome measurements such as mortality and morbidity data for deaths from coronary heart disease or deaths and injuries from traffic accidents, for example.

MEASUREMENT OF CIGARETTE SMOKING

The importance of the measurement of cigarette smoking arises from its demonstrable relationship with various forms of cancer of the respiratory tract and with coronary heart disease (*3, 4*). Extensive tabulations of cigarette smoking rates for various countries have been compiled by the Tobacco Research Council in the United Kingdom (*5*).

The effect of cessation of smoking on mortality from coronary heart disease in American men is shown in Table 1. It can be seen that mortality gradually diminishes with time since cessation, reverting to that for nonsmokers after 10 years.

There has been a slight decrease in smoking in older men in the United Kingdom, especially among physicians (*6*), but in the USA smoking has continued

Table 1. Mortality ratios for coronary heart disease in men aged 40–79 years in relation to the length of time elapsed since they ceased smoking[a]

Length of time	Smoked 1–19 cigarettes a day			Smoked > 20 cigarettes a day		
	Observed deaths	Expected deaths	Mortality ratio	Observed deaths	Expected deaths	Mortality ratio
Stopped < 1 year	29	17.9	1.62	62	38.6	1.61
Stopped 1–4 years	57	46.6	1.22	154	101.9	1.51
Stopped 5–9 years	55	43.7	1.26	135	116.5	1.16
Stopped 10–19 years	52	54.1	0.96	133	106.1	1.25
Stopped > 20 years	70	64.7	1.08	80	76.4	1.05
Current cigarette smokers	1 063	559.5	1.90	2822	1 104.7	2.55
Never smoked regularly	1 841	1 841.0	1.00	1 841	1 841.0	1.00

[a] From **Hammond, E.C.** (*4*).

to increase. More women and teenage girls are smoking in both the United Kingdom and the USA, and they are now starting earlier. Lung cancer and coronary heart disease have increased in women in England in association with the substantial increase in cigarette smoking.

It might be expected that a fall in cigarette smoking (*7*) would lead to a diminished risk of cancer and coronary heart disease but a recent analysis by Wald (*7*) of the changes in the type and quantity of cigarettes smoked in the United Kingdom from 1956 to 1971 in relation to changes in mortality rates from cancer of the lung and coronary heart disease indicates that the situation is more complicated. There has been a decrease of lung cancer mortality in men associated with the change to filter-tipped cigarettes despite there being little change in the number of cigarettes smoked. In contrast, there has been an increase in mortality from coronary heart disease in men; this may be because filter-tipped cigarettes produce increased quantities of carbon monoxide (*7*), and it has been suggested that carbon monoxide or other gaseous constituents are involved in the development of coronary heart disease while tar may be the principal etiological agent in lung cancer (*7*).

Hence, although determination of smoking rates will continue to be an important indicator of the risk of coronary heart disease, changes in the nature of cigarettes should be carefully monitored as well.

LEVEL OF ALCOHOL CONSUMPTION

An indication of alcoholism and alcohol-related health problems is provided by measurement of consumption. The apparent average level of consumption

is readily derived from excise revenue. Substantial rises have been reported in many countries over the past 25 years (*8*). Detailed data are available on the various beverages – wine, beer, and spirits. In general, wine-drinking countries have the greatest alcohol consumption rates (*8*).

Mortality rates from cirrhosis of the liver are closely related to the average level of consumption (*8*). For example, there is evidence of a substantial reduction in the incidence of cirrhosis of the liver in France between 1941 and 1946 associated with restricted availability of alcohol during the Second World War (*8*). The same was true of the USA and other countries during the periods of prohibition (*8, 9*). Since the Second World War there has been a steady rise in the incidence of deaths from cirrhosis of the liver in a number of countries associated with steadily increasing alcohol consumption. In England in the period 1880–1960 there was concomitant variation in alcohol-related deaths and drunkenness offences with the level of consumption (Fig. 1) (*9*). Similar relationships were shown by Ledermann for Bavaria over the period 1865–1910 using male/female mortality ratios (*8*).

Measurement of alcohol consumption would therefore be an indicator of alcohol-related morbidity and mortality, and the aim of a preventive programme would be to reduce the average level of consumption. This might be achieved by measures such as restriction of availability, control of advertising, better education, and reducing the alcohol content of liquor. Data for consumption could be used to evaluate the effects of any of these measures if they were introduced with appropriate controls.

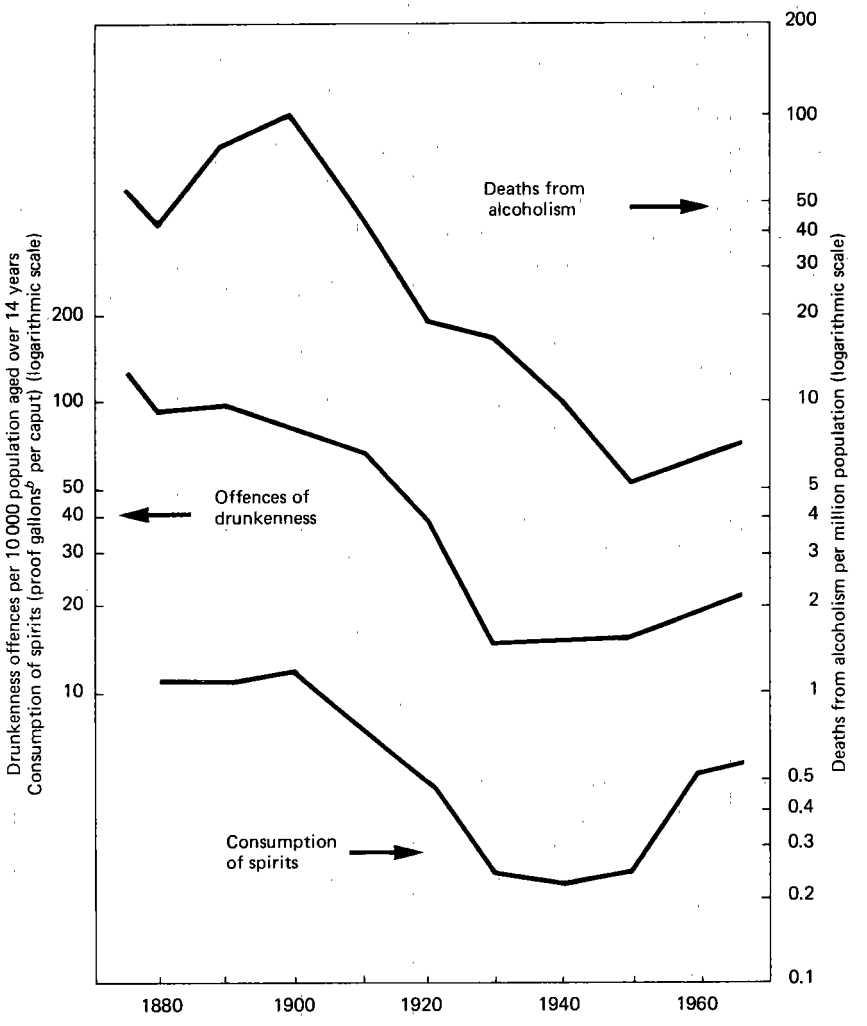
MEASUREMENT OF SERUM CHOLESTEROL

Many epidemiological studies have shown that the serum cholesterol level, which is influenced by dietary intake, is the best predictor of coronary heart disease and that elevated levels create a major risk (*10*). As a predictor of coronary heart disease the level of serum cholesterol is as good a determinant as more refined measures of lipoprotein fractions and is superior to measures of triglycerides (*10*).

In people such as Papua New Guineans, living in a subsistence economy and having a low cholesterol intake, serum levels are as low as 3.87 mmol/litre (150 mg/dl) and there is no rise with age. But in most industrialized societies serum cholesterol values range between 5.17 mmol/litre and 8.27 mmol/litre (200–320 mg/dl) in men in the 30–50 year age group. There is a continuous rise with increasing age so that it is difficult to assign "normal" levels, but values of up to 6.2 mmol/litre (240 mg/dl) for individual adult males tend not to be associated with coronary heart disease in the short term (*10*).

The methodology for measuring cholesterol is somewhat imperfect since estimation is difficult. Kits employing manual methods have been shown to be unsatisfactory, hence analysis should be done in a reputable laboratory with adequate quality control (*11*). For cholesterol estimations (but not for triglyceride measures) it is unnecessary for the patient to fast. Since there is

Fig. 1. Deaths from alcoholism, offences of drunkenness, and consumption of spirits, United Kingdom, 1875–1967[a]



[a] From *Alcohol abuse* (*9*). Reproduced by permission of the Office of Health Economics, London.

[b] 1 proof gallon = 2.59 litres of pure ethanol.

evidence that the process of coronary heart disease is initiated in adolescence, or even earlier (*12*), determination of serum cholesterol in adolescents and young adults is both interesting and important.

Promotion of a healthy life style for the individual by dietary modification and other measures such as encouraging physical exercise is now being actively pursued by public health departments in Canada and the USA (California). Measurement of serum cholesterol in these populations will be a useful indicator of likely benefit in the form of prevention of coronary heart disease.

DEATHS FROM ROAD TRAFFIC ACCIDENTS

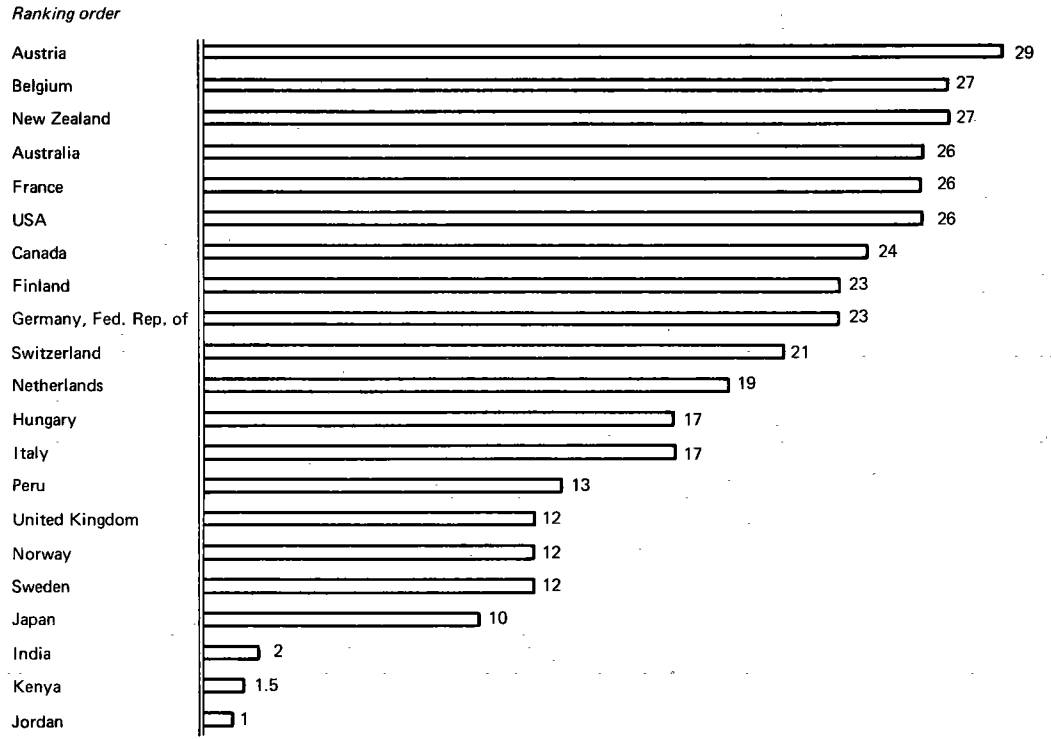
The effects of road traffic accidents can be measured by determining the mortality rate or injuries per unit of population. A series of figures for different countries is shown in Fig. 2 (*13*); 10 countries have fatality rates above 20 per 100 000 population, and these are all developed industrial societies. It is noticeable that Norway, Sweden, and the United Kingdom have lower rates (12 per 100 000). However, when the rates take into account the number of vehicles and the distance travelled a different picture emerges (Fig. 3) (*13*). Here rates of 5 deaths or fewer per 10^8 vehicles per kilometre are found in a group of industrialized countries while the highest levels are found in India, Jordan, and Kenya followed by Austria, Belgium, France, Italy, and Hungary. The USA has the lowest fatality rate by this measure in contrast to a high rate of fatalities per 100 000 (Fig. 2).

Comparison of these statistics from different countries assumes similar criteria for a traffic fatality, but this is not the case. In Belgium death is not considered to be a traffic fatality unless it occurs at the scene of the accident but in most countries a traffic fatality is counted if death occurs within 30 days. However, in the USA a traffic fatality is registered if death occurs within a year (*13*).

Despite these limitations the statistics available do give an indication of the situation for this particular cause of death and injury. The problems mentioned do not apply within a country where traffic accident mortality and morbidity can be adequately monitored by annual measurements on a population basis.

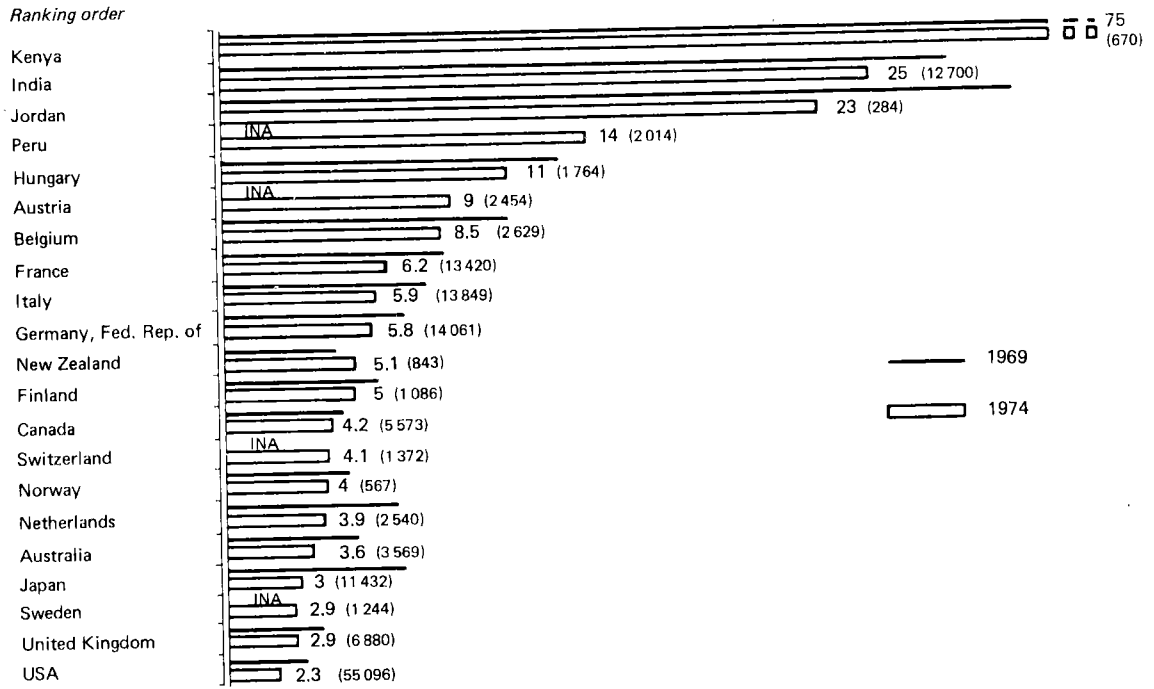
The value of such measurements can be shown by reference to the introduction of legislation in Australia in 1970–72 making the wearing of seat belts compulsory. The legislation was first introduced in the state of Victoria at the end of 1970 (*14*), and a significant reduction in deaths and injuries could be demonstrated in the first 9 months in 1971 by comparison with the rest of Australia (Table 2). This quickly led to the other states adopting the legislation in early 1972 and apparently the benefits have continued since that time. Other countries (Belgium, the Netherlands, and Sweden) have now introduced similar legislation.

Fig. 2. Road traffic accidents: fatalities per 100 000 population in 21 selected countries, 1974[a]



[a] Adapted by R.F. Borkenstein (*13*) from International Road Federation, *World road statistics* (*15*) and international census statistics (United Nations Demographic Yearbooks).

Fig. 3. Road traffic accidents: fatality rates per 10^8 vehicle kilometres in 21 selected countries, 1969 and 1974[a, b]



[a] Adapted by R.F. Borkenstein (*13*) from International Road Federation, *World road statistics* (*15*).

[b] Numbers in parentheses are total fatalities for 1974; INA = information not available.

Table 2. Effect of compulsory seat belt legislation in Victoria, Australia, 1971[a]

	1970	1971	Percentage change	P
1. Occupant fatalities (first 9 months)				
Victoria	564	464	− 17.7	< 0.01
Rest of Australia	1 426	1 429	+ 0.2	
2. Occupant injuries (first 9 months)				
Victoria	14 620	12 454	− 14.8	< 0.01
Rest of Australia	39 980	40 396	+ 1.0	

[a] From **Vulcan, P.** (*14*).

REFERENCES

1. **Rose, G.** The contribution of intensive coronary care. *British journal of preventive and social medicine,* **29**: 147–150 (1975).
2. **Hetzel, B.S.** The improvement of health. *In:* Holland, W.W. & Gilderdale, S., ed. *Epidemiology and health.* London, Henry Kimpton, 1977, pp. 29–52.
3. **Doll, R. & Hill, A.B.** Mortality in relation to smoking. Ten years' observations of British doctors. *British medical journal,* **1**: 1399 (1964).
4. **Hammond, E.C.** Smoking in relation to diseases other than cancer. Total death rates. *In:* Richardson, R.G., ed. *Second World Conference on Smoking and Health.* London, Pitman, 1972, p. 24.
5. **Beese, D.H.** *Tobacco consumption in various countries.* 3rd ed. London, Tobacco Research Council, 1972.
6. **Royal College of Physicians (London).** *Smoking and health now.* London, Pitman, 1971.
7. **Wald, N.J.** Mortality from lung cancer and coronary heart disease in relation to changes in smoking habits. *Lancet,* **1**: 136–138 (1976).
8. **Bruun, K. et al.** *Alcohol control policies in public health perspective.* Helsinki, The Finnish Foundation for Alcohol Studies, 1975, p. 25.
9. **Office of Health Economics.** *Alcohol abuse.* London , 1972.
10. **Dawber, T.R. & Kannel, W.B.** Current status of coronary prevention. Lessons from the Framingham study. *Preventive medicine,* **1**: 499–512 (1972).
11. **National Institute of Health.** *Manual of laboratory operations. Lipid Research Clinics Program. vol. 1. Lipid and lipoprotein analysis.* Bethesda, MD, National Heart and Lung Institute (US Department of Health, Education and Welfare Publication No. (NIH) 75-628).
12. **Connor, W.E. & Connor, S.L.** The key role of nutritional factors in the prevention of coronary heart disease. *Preventive medicine,* **1**: 49–83 (1972).

13. **Borkenstein, R.F.** An overview of the problem of alcohol, drugs and traffic safety. *In: Proceedings of the Seventh International Conference on Alcohol, Drugs and Traffic Safety. Melbourne, Victoria, 23–28 January 1977.* Canberra, Australian Government Publishing Service, 1977.
14. **Vulcan, P.** Australia's safety belt use laws: the results of the law. *In: Proceedings of the National Safety Belt Usage Conference. Washington, DC, November, 1973.* Washington, DC, National Highway and Traffic Safety Administration, US Department of Transportation, 1974, p. 31.
15. **International Road Federation.** *World road statistics, 1972–1976.* Washington, DC, 1977.