PART ONE

Health manpower - supply & demand

A CRITICAL APPRAISAL OF THE USUAL

METHODS OF HEALTH MANPOWER PROJECTION

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1. Overview of the usual methods of projection of health manpower supply.

2. Overview of the usual methods of projection of health manpower requirement.

3. Shortcomings of the usual projection methods from a general point of view.

4. Inadequacy of the usual projection methods for primary health care manpower.

I. - OVERVIEW OF THE USUAL METHODS OF PROJECTION OF HEALTH MANPOWER SUPPLY

1.1 - A distinction is usually made between three types and three methods of supply projection

Projection of health manpower supply consists of estimating the number (or the number and age-sex structure) of health workers at some future date. From the theoretical point of view, a distinction is made between three types of projection -- baseline projection, alternative projection, and forecast. Baseline projection is the estimation of manpower supply at a future date, assuming no new policies or actions will be taken to modify the manpower system; that is to say, things will be left as they are. Alternative projection is the estimation of manpower supply at a future date on the basis of certain assumptions regarding actions which could be taken to modify the magnitude of manpower recruitment and/or attrition. Forecast is the estimation of the most probable manpower supply at a future date according to our available information on the spontaneous trends of recruitment and attrition in the manpower system and the policies which will be implemented to affect them.

From the operational point of view, there are by and large three generic methods for health manpower supply projection: the method of total number, that of in-and-out-moves (also called the method of gains and losses), and the demographic method. Each type of projection can make use of one operational method or another, provided the data required by the method used are available. The three methods become gradually more sophisticated; the simplest one is that of total number, and the most complex is the demographic method.

1.2 - The three methods of projection of supply lead to results of various kinds

The method of total number consists of observing the total number (or global size) of health manpower in a health manpower category at various dates in the past and then estimating the total number for future dates. The method is based on time series observation and trend extrapolation, as described hereafter (see 1.3). Its relevance takes origin in the inertia of human phenomena, at least for short-term periods, i.e. 2 to 5 years. This inertia is called statistical permanency when one takes up the numerical perspective.

The method of in- and out-moves, or gains and losses method, is based on the renewal process of population. Population size variation between two dates results from its renewal process, i.e., its in- and out-moves. If in-moves or gains are numerically superior to out-moves or losses, there is an increase in population size; in other words, the number of individuals becomes greater. If, on the contrary, out-moves exceed in-moves, population decreases. Therefore, observation of the trends of in- and out-moves in the past and extrapolation of them into the future make it possible to determine the development of population size. Instead of projecting the total number of health manpower as referred to in the previous method, one makes a projection of its two components, the inflow and the outflow. This second method is more analytical than the previous one, but both are basically built up from time series observation and trend extrapolation (1).

The two previous methods require, *inter alias*, having information on the total number (or size) of health manpower at the base date (starting date) of the projection. As a projection result, one obtains a good estimate of the total health manpower which will exist on the target date. The demographic method, now envisaged, requires having at the starting date information on not only the total number of health manpower, but also on its age distribution. In other words, data at the starting date have to provide information on the size of the health manpower category and also on the number of individuals in each age group. Moreover, information from the past is needed for estimating the total number and age structure (or composition) of the newcomers (constituting the in-moves) and the leavers

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(1) An example of this method is given in:

HORNBY, P., RAY, D.K., SHIPP, P.J. and HALL, T.L. (1980) Guidelines for health manpower planning - A Source Book for learning - Experimental Version, Geneva, WHO, p. 4.13.

(constituting the out-moves) during the time between the starting date and the target date. The projection result of this method provides an estimation of the number in each age group at the target date. By summing up, one obtains the estimated total number (2). If the relevant information is available, age-structure could be replaced by age-sex structure. This method is called the demographic method because demographers make use of it for estimating the size and age-sex structure of the general population at future dates.

1.3 - Trend observation and extrapolation are the bases of supply projection

Any of the three methods referred to above requires, to some extent, trend determination and extrapolation, or projection. Trends are drawn out from time series. A time series is a set of chronological data which records change in the size of some variable at successive dates or during successive periods. An example of the former case is provided by the total number of X-ray technicians on December 31st of 1972, 1974, 1976, and 1978; an example of the latter case is given by the number of leavers from the nursing profession during the successive triennial periods 1970-1972, 1973-1975, and 1976-1978. Trend of a time series is the pattern it follows more or less closely in the long run. Trend determination can be performed statistically or graphically. Trend extrapolation is determining the value of the scrutinized variable in the future by presuming that the past trend will continue in the years to come and/or by taking into account facts (decision to create a new medical school, for example) that could modify this trend. An hypothesis on the possibility for the trend to accelerate or decelerate can be made, giving rise to a set of many projected, or extrapolated, values of the examined variable at a future date.

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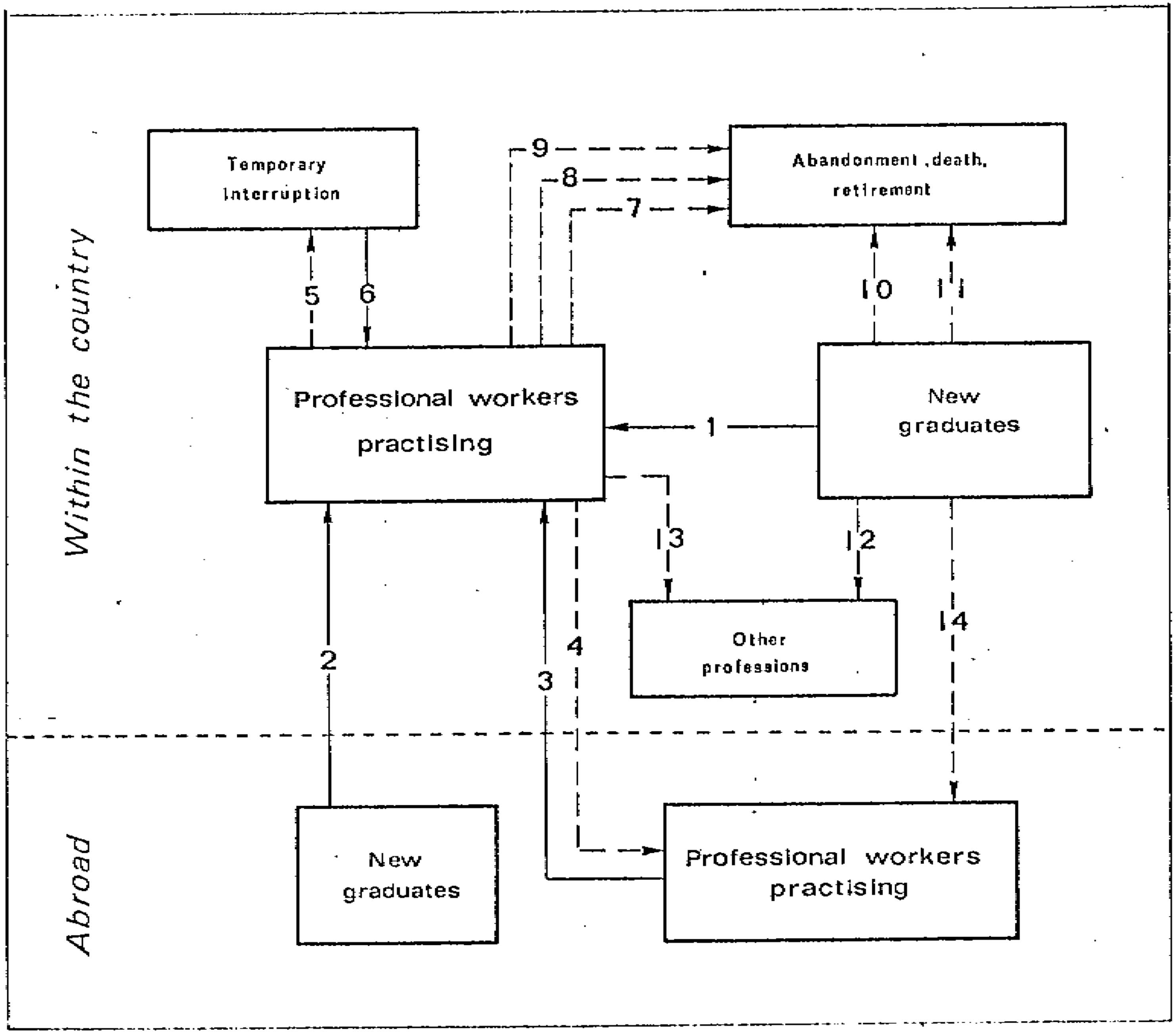
(2) An example of this method is given in:

LY, Viviane (1979) Perspectives pour deux populations professionnelles: la population agricole et la population médicale, Population (Paris) 34(3): 549-565.

Projection of health manpower supply requires some statistical skill, but above all, a full understanding of the various components of the dynamics of health personnel, as outlined in Fig. 1, is necessary. Newcomers in a health manpower category originate from different sources, and those who leave do so for various reasons. The different in-moves and out-moves have neither the same numerical importance nor the same impact on health manpower supply. The first step of a projection is to identify those moves which are the most significant in the matter.

Fig. I

General outline of the renewal process of health manpower



1. Arrival of graduates trained in the country
2. Arrival of graduates trained abroad
3. Immigration of professional workers
4. Emigration of professional workers
5. Temporary abandonment of activi
6. Re-entry into activity
7. Abandonment before the age of retirement
8. Departures into retirement
9. Death
10. Definitive abandonment by new graduates
11. Deaths of new graduates
12. Change of profession by new graduates
13. Change of profession by practising professional workers
14. Emigration of new graduates trained within the country

II. - OVERVIEW OF THE USUAL METHODS OF PROJECTION OF HEALTH MANPOWER REQUIREMENT

2.1 - Four approaches to health manpower requirement projection have been singled-out

Many methodologies have been designed for estimating the requirements of the various health manpower categories. T.L. HALL (3) gives a systematic classification of these methodologies as follows: (i) the health manpower/population ratio method; (ii) the service targets approach; (iii) the health needs approach; (iv) the economic effective demand approach. Each method or approach has its own advantages and short-comings. As a matter of fact, no method appears as the ideal one at the present time; many studies are based on more than one method. A description of each individual method is presented hereafter.

A) The health manpower/population ratio method

This method is the simplest in the field of estimation of health manpower requirement. Its formula is:

$$R = N \times r$$

where:

R is the total number of workers in a specified health profession who are required

N is the total number of the population served

r is the health manpower/population ratio which is desirable

In general, estimation is made on a geographical basis, i.e., that R, N, and r, are related to a country, or a region within a country. For instance, a recent study estimated that the physicians/population ratio of Saudi Arabia, which was 2.9 per 10,000 in 1974, has to reach

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(3) Hall proposed his classification at the 1st Pan American Conference on Health Manpower Planning, Ottawa, Canada, September 1973 (the proceedings of the conference were published by PAHO in 1974). This classification scheme has been adopted in two Manuals:
- KRIESBERG, H.M. et al (1976) Methodological approaches for determining health manpower supply and requirements: Vol. I: Analytical perspective 74 p.; Vol. II: Practical planning manual, 197 p. Washington, D.C. (DHEW Publications).
- HALL, T.L. and MEJIA, A. (1978) (eds) Health manpower planning: Principles, methods and issues, Geneva, WHO, 311 p.

8.5 per 10,000 by 1990 (4). At this date, the population of Saudi Arabia will number 10,480,000; therefore; the required number of physicians will be 8,908. Numerical transcriptions are as follows:

Base year 1974

R = 2,074

r = 2.9 physicians per 10,000 population

Target year 1990

N = 10,480,000

r = 8.5 physicians per 10,000 population

The value to be estimated is

R = N x r

= 8,908 physicians

In some cases, estimations are not operated on a geographical basis, but on a category basis. For instance, estimation of requirement of pediatricians can be linked with population under 15; in this case, we have the following:

R is the required number of pediatricians

N is the number of population under 15

r is the pediatricians/population under 15 ratio

Application of the health manpower/population ratio method requires information on N and r for the target year. N is obtained from demographic projections which are usually performed by national statistical offices, demographic research institutes, or central bureaus of economic planning. The factor r , which is the desirable ratio and the basis of the estimation, has to be collected from experts' judgment, international comparison, or the judgment of the analyst himself.

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(4) SEBAI, Z.A. and BAKER, T.D. (1976) Projected needs of health manpower in Saudi Arabia, Medical Education, 10 : 359-361.

B) The service targets approach

The service targets approach takes into account the amount of services of a given kind to be rendered, as well as manpower staffing (or mix of personnel) and manpower productivity. First of all, the analyst considers the kinds of services to be rendered and calculates the amount needed in relation to population size or other factors. Secondly, he observes or decides which categories of health manpower have to share in producing the calculated amount of services needed, and respectively, in what proportion. Thirdly, by means of a productivity index, he estimates the required number of health workers for each category.

The first step implies the determination of norms or standards and, consequently, requires experts' judgment, international comparisons, or norms set up by an institutional body. The second and third steps require empirical observation, collection of past information, task analysis, and experts' judgment as well. The service targets approach is mainly used when there is a need for assessing health manpower requirement in some neglected sector of the health care delivery system. This is the case of preventive medicine in many countries (5).

C) The health needs approach

The health needs approach is an extension of the service targets approach but differs from the latter in its perspective. The health needs approach does not consider specific kinds of health services to be rendered but seeks to determine what kinds, amounts, and quality levels of services are required to maintain the health status of the population served at a maximal (or acceptable) level. From a practical viewpoint, the approach is performed through the following steps: (i) the analyst tries to determine the number of people with incidences

(5) From the operational viewpoint, the service targets approach is similar to the health needs approach. To some extent, the case study mentioned hereafter, which illustrates the health needs approach, is also applicable to calculations in the service targets approach.

or prevalences of illness; (ii) he tries to quantify the treatment appropriate to each illness; (iii) he calculates the duration of the services provided by the relevant health workers; (iv) on the basis of the average working time, he calculates the required number of the relevant health manpower.

The following example, extracted from a recent manual (6), shows how the approach could be followed. It deals with pediatricians treating acute conditions of children in a given community and is based on the following set of hypothetical data: (i) the population served is composed of 10,000 children; (ii) on the average, each child visits a pediatrician for two acute conditions per year (we are in a developed country); (iii) experts' judgment is that the average amount of services required by each acute condition (diagnosis and treatment) is two visits; (iv) the average duration of each visit is 20 minutes; (v) the annual working time of pediatricians is, on the average, 48 weeks per year and 48 hours a week, that is,

$$48 \times 48 \times 60 = 138{,}240 \text{ minutes.}$$

On the basis of the above data, the analyst is in a position to estimate the number of pediatricians required for treating acute conditions of children:

$$\frac{10{,}000 \times 2 \times 2 \times 20}{138{,}240} = 5.8 \text{ pediatricians}$$

The overall required number of pediatricians is obtained by adding up all the results, each calculated on a specific task of pediatricians: acute conditions, well-baby care, chronic conditions, and so on.

D) The economic effective demand approach

The economic effective demand approach is based on measurement and projection of the health services which the users are willing to buy (in a market context) or are asking for, for example, by going to

(6) See KRIESBERG, H.M. et al, op. cit. in (3), Vol. II, p. 53-54.

the health center or to the physician's office (in a no-market context), regardless of their objective need for these services.

The implementation of this approach is usually performed through the following stages:

(i) observation and quantification of the present demand -- this implies the choice of a measurement unit, patient visit, bed-day, working time of each health profession, monetary expression of these services, etc.

(ii) projection of the demand for health services to a target year in the future -- this projection can take two directions: (a) the analyst tries to determine what the demand will be at the target year on the basis of the most probable development of each factor of the demand; (b) as an alternative, the analyst makes a conditional projection in order to see what the demand will be at the target year if the price of services steadily increases, if users' incomes sharply diminish, if insurance coverage is generalized to all the population, if the tempo of population ageing becomes faster, etc. The two directions are based on a careful examination of the factors of the demand and their development.

(iii) demand for health services is translated into demand for health manpower on the basis of manpower staffing (or mix of personnel) and manpower productivity. In other words, the analyst, having calculated the amount of services which will, or would, be demanded by users, tries to see what professions will participate in producing these services and what will be the output per worker in each profession. Through examination of these elements, the required number of workers in each profession can be calculated (7).

2.2 - A basic feature is common to all the methods of requirement projectic

At some stage, each of the four methods of requirement projectio leads to an acceptance of norms or standards. There is sometimes a great

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(7) An example of this approach is given in:

BUI DANG HA DOAN (1965) Besoins et ressources en médecins pour 1980, Le Concours Médical (Paris), 87(18): 3170-3179.

arbitrariness in building them up. But even when they are carefully selected on the basis of a large consensus, as when the Delphi method is utilized (8), they remain, explicitly or implicitly, the expression of some ethical or philosophical adhesion. When, for example, the analyst calculates the additional number of health workers who will be needed to satisfy the growing demand of health services during the next decade, he implies that the advantages that users can gain from the utilization of the services provided by health manpower far exceed the disadvantages which can occur. But a contrary assumption could be (and effectively has been) professed (9). The estimation of health manpower requirement cannot, by its nature, be a simple operation of fact-finding, nor can it have the virtue of an irrefutable statistical analysis.

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(8) The opinions of a panel of experts are sought through a mail survey or by direct interviews. Several rounds of questionnaires are sent out, followed by feedback on the views expressed. Each succeeding round allows the individual expert to discover the gap between his opinion and that of his colleagues and then to modify his opinion in light of the ideas his colleagues have expressed or to explain the reasons for his divergent view.
See: BROWN, B.B. (1968) Delphi process: A methodology for elicitation of opinions of experts, Santa Monica, Calif., Rand Corporation.

(9) See, for example: ILLICH, I. (1975) Medical Nemesis: The Expropriation of Health, London, New York, Calder and Boyars.

III. - SHORTCOMINGS OF THE USUAL PROJECTION METHODS FROM A GENERAL POINT OF VIEW

3.1 - Various shortcomings hamper the projection of health manpower supply

As stated above, the three methods of supply projection require, by and large, trend extrapolation from the observation of time series (see 1.3). In many cases, time series were lacking and the projection had to be based solely on data at the base year and numerous assumptions made by the analyst regarding future in-moves (i.e. training intake and qualification of health personnel) and future out-moves (due to death, retirement, emigration, etc.). Needless to say, the results of such projections may be very unreliable. The same applies to projections based on time series which do not give rise to any clear trend. The trend extrapolation is then uncertain, its results unconvincing.

The situation is more encouraging where time series (of the total number of a health manpower category or of its in-moves and out-moves observed separately) reveal a clear trend in the past. Trend extrapolation through the future target date is then credible. But even in this favorable circumstance, two shortcomings are sometimes unavoidable. First, trend observation and extrapolation are only relevant when based on large numbers, i.e., on statistical permanency. The variability of statistical series is great when the sample is small in size. In this case, even if a trend was evident in the past, it is less than sure that the trend will follow the same pattern in the future. This very simple fact has often been forgotten. In other words, the larger a health manpower category, the better the quality of the projection of its future supply. Projection of the future supply of tiny professions leads to uncredible findings due to the variability of small numbers. Secondly, some remarks have to be made when projection is performed separately for in-moves and out-moves, i.e., when the method of in- and out-moves or the demographic method is used (see 1.2). As concerns the out-moves (namely deaths, retirement, and emigration), only deaths have a stable frequency. Frequency of retirement and emigration are not biologically-rooted and may vary drastically in the short term because of new policies, laws, or economic circumstances. During the last 30 years, most of the health professions in the world have experienced a steady and sustained growth. During these three decades, the number of in-moves far exceeded that of out-moves and the uncertain forecast of the latter was compensated by the good projection of the former (the good quality of the projection of in-moves originates in the fact that workers in most of the health professions have to be trained during a long period, and the careful analysis of the training systems often allows the analyst to perform good projection of in-moves). During the years to come, if health manpower growth slows down, the weight of errors due to misleading projection of out-moves will become more apparent and contribute to the worsening of all health manpower projections.

3.2 - Projection of health manpower requirement is also burdened by shortcomings of various kinds

A) General

Estimation or projection of health manpower requirement is based, at some stage, on the acceptance of norms or standards, as stated above (see 2.2). The establishment of norms or standards is not, of course, error-free, and various reasons exist for the occurrence of errors. Some thoughts are developed hereafter regarding the matter.

(a) Norms or standards vary according to the objectives assigned to all the operation. For example, the optimal nurses/population ratio of a country in 1985 - a standard to be reached - varies according to the following objectives: (i) the population will be served with a maximal amount of nursing services; (ii) the national budget devoted to nursing will be increased by 5% every year from the base year to the target year, i.e. 1985; (iii) the per capita nursing services delivered to rural people in 1985 will be equal to 2/3 of the per capita nursing services deliv· to the urban population in 1980, which will remain unchanged (or will increase by 5%) during the period 1980-1985; (iv) various other objectives. Each objective leads to a specific nurses/population ratio. When norms or standards are quoted without a clear reference to their objectives, they cannot avoid being controversial.

(b) Even if the analyst has a clear understanding of the objective assigned to the operation, it sometimes happens that he is not able to determine norms or standards because of lack of data of various kinds. In this case, as pointed out above, the Delphi method would be helpful, if rightly implemented (10). The Delphi method assumes that group opinion is superior to the views of individuals, that feeding back anonymous responses is better than holding committee meetings, and that the opinions of experts will gradually converge after they have been informed of their colleagues views.

(c) Even when all the needed information is available and the expertise is abundant, there is no doubt that the operation of requirement projection (more so than the operation of supply projection), is bound to the unpredictable, which may endanger its relevance. This is just common sense, but it deserves to be recalled.

B) A case-study of irrelevant projection

The previous thoughts are somewhat theoretical. From a more concrete point of view, there are many examples which point out the low level of relevance in projection of health manpower requirement. The following case study is illustrative.

(a) Background

In a developed country with a health system functioning mainly through market mechanisms, medical manpower available in 1970 numbers 8,256 (11). A projection has to be made in order to assess its required number for 1980. It is assumed that any development in the demand of services performed by physicians, i.e., patients' visits, has a corresponding development of the same magnitude in the number of physicians required. Variations in population size and age-sex structure are presumed to have

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(10) See note (8).

(11) State of New Jersey, Department of Health (1972) Health Manpower in New Jersey - Report of the Health Manpower Data Project, Trenton, New Jersey.

a significant impact on the number of patients' visits. On the other hand, the per capita number of visits in each age-sex group is assumed constant from base year through target year. Also, the productivity of physicians is assumed constant.

(b) Requirement estimation

At the beginning of the estimation process, three kinds of data are needed: (i) per capita number of visits in each age-sex group -- this information is available for 1969; its magnitude is assumed constant during the period 1969-1980; (ii) the age-sex structure of the population in 1970 -- this information is available from the census bureau; (iii) the age-sex structure of the population in 1980, the target year -- this information is obtained from projections by the statistical office. The three kinds of information sought are presented respectively in the following Table 1, columns 2, 3, and 5.

Data in Table 1 allow the estimation of the number of visits demanded by the population in 1970, which is 30,830,000, and the corresponding figure for 1980 (34,857,000). Demand for visits rises from 1970 to 1980 by:

34,857,000 : 30,830,000 = 1.1306

Since it is assumed that the medical manpower - which numbers 8,256 at the base year - has to increase in the same proportion, the required number of physicians in 1980 should be:

8,256 x 1.1306 = 9,334

(c) Comments

In Table 1, the total size of the population is recorded as follows:

1970 : 7,194,000
1980 : 8,087,000
Variation : 8,087,000 : 7,194,000 = 1.124

TABLE 1

ESTIMATION OF THE TOTAL NUMBER OF PHYSICIAN VISITS

IN 1970 AND 1980

Age-sex group		N° of physician visits per person and per year (1969)	Population in 1970 (1,000)	Demand for visits in 1970 (1,000)	Projected population in 1980 (1,000)	Projected demand for visits in 1980 (1,000)
(1)		(2)	(3)	(4)=(3)x(2)	(5)	(6)=(5)x(2)
MEN	Under 17	3.7	1 151	4 259	1 141	4 222
	17-24	3.0	424	1 272	534	1 602
	25-44	3.2	842	2 694	1 077	3 446
	45-64	4.1	777	3 186	810	3 321
	65 +	5.5	288	1 584	340	1 870
WOMEN	Under 17	3.4	1 108	3 767	1 101	3 743
	17-24	4.8	446	2 141	567	2 722
	25-44	5.3	906	4 802	1 141	6 047
	45-64	5.2	842	4 378	890	4 628
	65 +	6.7	410	2 747	486	3 256
TOTAL			7 194	30 830	8 087	34 857

If only the increase in the total size of the population was taken into account, the required number of physicians would be:

$$8{,}256 \times 1.124 = 9{,}280$$

The difference with the previous figure is only 9,334 - 9,280 = 54 physicians, or 0.6%. In other words, influence of change in age-sex structure is very small and can be neglected over a ten-year period. It would be more efficient for the estimation enterprise to take into account other differential patterns in the characteristics of patients who demand visits, such as income distribution, insurance coverage, or educational attainment. Demand of visits varies widely within these patterns, as it does within age-sex structure, but patterns influenced by the characterstics mentioned above change more rapidly over time and have a stronger impact on the development of demand than does age-sex structure, which is burdened with great inertia.

From a broader perspective, it must be emphasized that there is some naivety in assessing health manpower requirement by studying only the development of population size and age-sex structure. Other determinants have a more important impact during a decade. In particuliar, per capita demand for visits in each age-sex group, as well as productivity of physicians, are unlikely to remain constant over a ten-year period, as is assumed here. If it is not possible to collect relevant information on these matters, it would be more economical to base the projection on only population size in 1970 and 1980. In other words, physician requirement is calculated on the basis of a simple "constant physician/population ratio". As stated above, instead of a required number of 9,334 physicians for 1980, one would obtain a required number of 9,280. The difference is very small and can be neglected. But, in doing so, the work appears "too simple" and "not sufficiently scientific". This opinion probably led to the gathering of additional data (per capita number of visits in each age-sex group, age-sex composition of the population in 1970, age-sex composition of the population in 1980) which are costly and add nothing to the quality and accuracy of the results of the projection.

3.3 - There is a fundamental irrelevance in separating supply and demand in the projection process

A) General

When the analyst tries to set up norms of need or targets for service, he cannot avoid a great subjectivism in his work, even when he succeeds in procuring the participation of a large panel of experts. Therefore, in the matter of estimation of requirement, when information is available (or can be collected without excessive cost), a preference is often given to the effective demand from the population for health services. Of course, a large discrepancy exists between demand and need, but it is thought that, by and large, the satisfaction of demand is equivalent to that of the minimal need of the users, at least in developed countries and urban areas of the Third World. The usual practice then follows three successive stages: (i) assessing the demand for health services and subsequently for health manpower; (ii) assessing the health manpower available; (iii) resolving the mis-match between demand and supply of health manpower.

Such a three-stage approach seems logical. Nevertheless, it could be misleading since there is a close interrelationship between supply and demand; they are not independent of each other. By its availability, supply is a strong determinant of demand; people cannot demand what does not exist. Also, when a good or a service is available, it has a "demonstrative effect" on demand. Moreover, by counseling, informing and/or inciting people to make use of additional health services, health workers raise the amount of services required. This, in turn, may overburden health manpower, make the waiting period longer for patients and, finally, diminish the demand for services. Declining demand may then incite health workers to counsel patients to request additional services, and we again find ourselves at our point of departure. The observation of such a circular causal chain gave rise to an attempt at simulating the interaction between supply and demand in dental care (12).

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(12) HIRSCH, Gary B. and KILLINGSWORTH, William R. (1975) A new framework for projecting dental manpower requirement, Inquiry (Chicago, Illinois), 12(2): 126-142.

A simplified presentation of this work is made hereafter.

B) A case study on the interrelationship between supply and demand of health manpower

(a) Presentation of concepts

The patient population is divided into two groups displaying different dental care-seeking patterns, preventive and symptomatic. Preventive patients are assumed to see a dentist at more or less regular intervals, mainly motivated by a desire to prevent dental disease. Symptomatic patients, on the other hand, only visit a dentist in response to a specific symptom such as a toothache. Preventive patients are, therefore, in better oral health, with fewer decayed or missing teeth -- on the average, fillings needed per person are lower amongst preventive patients than symptomatic patients. On the other hand, at each visit, a preventive patient requires fewer services than a symptomatic patient, if the latter elects to receive treatment for his complete needs.

The distribution of the population between these two groups is influenced by the availability of dental practices, viz, dentists and their supporting personnel. Moreover, dental practices have a great influence on the behavior of patients within each group, in particular by counseling and/or persuading symptomatic patients to accept complete care for their dental needs, i.e., to enter the preventive group. Aggregate (or total) patient behavior is, in turn, a major determinant of the workload of dental practices. The workload can be stated by the concept of "busyness", which is expressed by the number of months it would take to care for those needs at the actual practice's average of providing dental care. The workload, in turn, is a strong factor of behavior of dental practices towards patients, informing them about their complete needs, encouraging their preventive behavior (by using reminders or arranging future preventive visits when patients have completed treatment) or, on the contrary, delivering only what the patients ask for.

(b) Simulation of interaction between demand and supply of dental care

A simulation model is developed on the basis of what has been described above. Empirical data and the quantitative relationships between the various parameters are collected, or approximated, for the beginning of 1970. At this date, 33% of dental patients are in the preventive group, and 67% in the symptomatic group. Each month, there are 6.1 million arriving preventive patients and 5.3 million arriving symptomatic patients. Dental "busyness" reaches 1.35 months of backlog. The average number of fillings required per patient is 3.76. Out of 100 symptomatic patients, 55 accept complete care.

A simulation is developed about what will happen at the beginning of 1980, under four hypotheses:

(I) : dental manpower increases more slowly than population during 1970-1980; dental insurance coverage remains at the 1970 level, i.e., 20% of population insured;

(II) : dental manpower increases more rapidly than population during 1970-1980; dental insurance coverage remains at the 1970 level;

(III) : dental manpower increases more slowly than population; dental insurance coverage rises from 20% to 60% at the end of the first year of simulation;

(IV) : dental manpower increases more rapidly than population; dental insurance coverage as in (III).

Increases in manpower and insurance coverage (hypotheses II, III, and IV) will provoke, at an early stage, an upsurge in demand which, in turn, will cause a circular chain reaction, as described in Table 2 hereafter.

The following additional comments will explain the significance of the data in Table 2.

Table 2

Simulation on effects of supply and insurance coverage on the dental system

			% of population		N°.of patients arriving per month (in millions)		Dental busyness (measured in months of backlog)	Number of fillings needed per capita	% of symptomatic patients accepting complete care
			P.G.	S.G.	P.G.	S.G.			
Base date (January 1970)			.33	.67	6.1	5.3	1.35	3.76	.55
Target date (January 1980)	No change in dental insurance coverage (20% of population insured)	Moderate increase of dental manpower (I)	.33	.67	6.8	6.1	1.41	3.79	.54
		Rapid increase of dental manpower (II)	.38	.62	8.3	5.7	1.05	3.63	.59
	Dental insurance coverage rises from 20% to 60% at the end of the first year of simulation	Moderate increase of dental manpower (III)	.21	.79	3.9	7.6	2.46	4.04	.47
		Rapid increase of dental manpower	.23	.77	4.7	7.6	2.21	3.93	.52

Note : P.G. = Preventive Group; S.G. = Symptomatic Group

Hypothesis (I)

As population grows faster than dental manpower, dental "busyness" increases from 1.35 months of backlog to 1.41 months and creates a slight worsening in the population's oral health, as measured by the per capita need for fillings, which rises from 3.76 to 3.79. The reasons for this worsening of oral health are: (i) a slight decrease in the fraction of symptomatic patients seeking complete care; (ii) a change in the interval between visits of preventive patients (not recorded in Table 2) due to the heavier workload of dental practices. The numbers of both preventive and symptomatic patients initiating treatment during a month increase as a result of population growth. There is no shift between preventive and symptomatic groups.

Hypothesis (II)

The supply of manpower and, therefore, of care grows faster than population and, as a result, there is a decline in dental "busyness" (from 1.35 months of backlog to 1.05 months). But the circular causal chain comes into play and prevents "busyness" from declining further. There is a shift from symptomatic to preventive groups and a decrease in the interval between preventive visits (not recorded in Table 2). Both contribute to a sharp increase in the number of preventive patients initiating treatment (from 6.1 million in January 1970 to 8.3 million in January 1980). The reduced "busyness" favors proactivity behavior of dental proactices and, as a result, there is an increase of acceptance of complete care amongst symptomatic patients (from 55% to 59%). The number of symptomatic patients arriving for treatment is smaller than in Hypothesis (I), simply because the symptomatic patient population itself is smaller as a result of the shift to the preventive group. Greater acceptance of care also makes a small contribution to the reduction of symptomatic patients arriving for care, since patients accepting complete care are not expected to develop symptoms for a period of time after they have received care. Oral health is better at the end of the simulation; the average number of fillings needed per patient is 3.63, compared to 3.76 at the beginning.

Hypothesis (III)

In this hypothesis, insurance benefits are suddenly instituted without a commensurate increase in dental manpower. Oral health undergoes a worsening process: the average number of fillings needed reaches 4.04 at the end of the simulation. In fact, the situation is worse during the first year after the new benefits go into effect (not recorded in Table 2). At the end of the simulation, the dental system is dominated by symptomatic patients receiving care for needs that have been neglected by overburdened dental practices. The number of preventive patients initiating care each month is much smaller than at the beginning (3.9 million compared to 6.1 million in January 1970), as a result of the high level of dental "busyness".

Hypothesis (IV)

The results are somewhat better than in Hypothesis (III). "Busyness" is less and the number of fillings required per capita is lowered, but it remains higher than at the beginning of the simulation (3.93 compared to 3.76).

(c) Comments

This simulation study does not fit into any generic methodologies presented above (see 2.1). It constitutes a very innovative and promising approach for the future. In fact, modeling has the advantage of integrating many more parameters and relationships amongst parameters than do the usual methodologies and it is, therefore, more reality-oriented. It remains that modeling has to be based on various kinds of data which are sophisticated and the collection of which is time- and resource-consuming. From another point of view, this work clearly demonstrates the limits of demand as an index of performance of a health system. According to this study, oral health, as expressed by the number of fillings needed per patient, is worse in the case of extension of dental insurance coverage than when there is no extension at all. As a matter of fact, in the process, oral health status is not worsening, it is simply showing its actual needs, previously camouflaged by the lack of users' resources for care. The number of fillings needed per patient is not growing, it is simply appearing in its real size. We must distinguish between need and demand in health matters even though we have no universally acceptable criteria at present for determining need. This crucial point leads us to the problems and issues of primary health care.

World Health Organization
Regional Office for Europe
Meeting of the Steering Group on Projections of the Future Health Situation in Europe -- 17-19 September 1980

PROJECTION OF EUROPEAN HEALTH MANPOWER AND FACILITIES DURING THE TWO COMING DECADES

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SOME BRIEF REFLECTIONS ON PAST TRENDS AND FUTURE RESEARCH

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The present document is aimed at examining in an overview the past trends and future perspectives regarding the projection of health manpower and facilities in industrialized societies. It is hoped that it will pave the way to a large discussion of the matter.

1. - The "requirement-resource" approach of the 1955-1975 period

After recovering from the 2nd World War, the industrialized countries experienced an unprecedented economic growth during more than two decades, from 1950 through 1973, which in turn led to a great deal of achievements in the social field: the ages of compulsory schooling were increased, social security was expanded to cover the people who were not previously protected, the age of retirement was lowered, etc., in many countries. There was a considerable expansion of education, health services, cultural activities, etc., towards the previously under-privileged groups. Moreover, all social groups increased their *per capita* social and economic consumption. Of course, the tempo of growth was not regular and drawbacks were noticeable from time to time in one country or another. But by and large, there was undoubtedly a tremendous increase of wealth in all the industrial world, including the European countries, and the growth in social expenditures seemed everlasting.

All this historic move was creating a growing demand for health services and subsequently for health manpower and facilities. In many countries it was felt that, for the first time, shortage in health manpower could become a reality and that the health facilities available might not be suitable. This was the origin of the "requirement-resource" approach in dealing with management of health facilities and, more specifically, in conducting health manpower studies. The approach consisted of estimating the needed volume of manpower or facilities at a future date and comparing it to the resources available at the same target date. Given the trend in demand for health services, these two sister projections - of requirement and resource - usually showed a gap; in most cases, the requirement exceeded the available resource, and this situation called for decision-making in order to bridge the gap. Consequently, resource in manpower and facilities had to be increased.

As a matter of fact, health manpower and facilities grew everywhere in Europe faster than the population and/or national wealth during the period 1950-1975. In other words, in each industrialized country, the health manpower/population ratio and the hospital bed/population ratio were drastically increased. Moreover, equipment became more sophisticated, personnel became more carefully trained, and both became more costly.[1]

2. - The turning of the tide: 1975-1978

The crisis of the world economy reached the European national health systems during the years 1975-1978. At this time, in nearly all the developed countries, the implementation of the social security or similar systems put the demand for health services out of reach of the regulating mechanisms of the market: as people do not have to pay or have to pay only a small part of the health services and products they want, the demand for these services and products rises steadily; each national economy has to pay more and more for health. Health is then competing with other national expenditures, such as defence, education, transportation, and other sensitive areas. From another viewpoint, it is thought that in the field of social expenditures, supply is a powerful determinant of demand, e.g. the more nurses available, the higher the demand for nursing services, other things being equal.

Two schools emerged at this turning point. First, many economists thought that at this point in time, the rising health expenditures were not being compensated by a proportionate increase in the level of people's health. In other words, as a system of production and consumption, the health sector was entering the stage of decreasing return. It was then questionable that more and more resources should be devoted to this sector.

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(1) A glance at the various annual issues of the Volume III of the World Health Statistics Annual published by WHO, gives proof of such trends.

The other school was illustrated, *inter alia*, by Illich's book, "Medical Nemesis"(2) which called for an end to the progressive move which had deeply "medicalized" the human society. The reason behind such a desire was not economically-oriented but philosophically-oriented. Nevertheless, both schools were against the growth of the health industry and implicitly rejected the "requirement-resource" approach of the previous period.

3. - The need for a new outlook

The "requirement-resource" approach, as pointed out above, postulates that resource has to follow requirement. Since, in most cases, requirement exceeds current resources, the latter has to be increased. Whatever judgments we may have on the thoughts of the two schools briefly evoked above (see 2), the approach appears unrealistic for the next 10 or 20 years, given the foreseeable economic constraints. A new outlook is therefore needed in the matter.

First, a better knowledge of requirement is needed. Second, projection in health manpower and facilities has to aim primarily at adjusting future available resource to future requirement in the best way. Emphasis is no longer placed on resource growth but on resource distribution and utilization. This does not mean that we exclude increase in manpower and facilities during the next two decades. The basic problem is one of perspective: we no longer look at the growth of resource as the panacea for resolving health problems.(3) Instead, we try to better define requirement and to see how we can make do with available resources to meet the requirement.

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(2) Illich, I. (1975) Medical Nemesis : The Expropriation of Health, London, New York, Calder and Boyars.

(3) Given the upward trend during the previous decades, health resources will increase during the years to come, but probably at a decreasing rate.

From a concrete point of view, three fields, among others, can be singled-out and explored by prospective studies. They are enumerated here below.

a) A better determination of future requirement of health manpower and facilities by a disintegrated approach

During the previous decades, requirement was in most cases calculated globally, on the basis of econometric models or aggregated indexes such as the bed/population ratio, the personnel/population ratio, etc. Needless to say, these global methods were not able to point out sectoral problems. Moreover, requirement was often overestimated for many sectors by these methods. It now seems of interest to break down the calculations in order to adjust them to each specific health sector. Sectorization of the health system may be operated on the basis of morbidity types (acute illness, chronic disease, mental disorder, etc.) or places of delivery of services (private practice, health center, general hospital, specialized hospital, etc.) or categories of manpower and/or facilities (various health professions, different kinds of facilities, etc.). Such a disintegrated approach has been performed in the past but was not successful because of the lack of two elements: (i) it was done only for some sectors instead of being systematically carried out for all segments of the health system; (ii) it was not summed up in a synthesis which could provide a global view covering the requirement in all the health system. If these two elements are now brought in, it can be hoped that better results can be harvested.

b) A better determination of future requirement of health manpower and facilities by taking into account probable changes in the health system

During the last decades, some changes in the health system of the industrial countries have drastically transformed the requirement pattern for manpower and facilities. Two examples can be singled-out. The first one was related to change in tuberculosis treatment, which reduced considerably the need for manpower and hospital beds in this sector. The change was not foreseen, and when it became obvious, its implementation was delayed in many countries. There was, therefore, a continuous building-up of sanatoria and a wide-spread training of sanatoria's personnel, both constituted an important wastage. The second example was related to mental health prevention and treatment, change of which led to a progressive reduction of the requirement for beds in psychiatric hospitals. The change was perceived too late, and decision-makers could not stop in time the building of big mental hospitals, which appeared useless after their completion. Such wastages, which could be easily absorbed during the period of rapid economic growth, might become too heavy a burden in the future.

c) Better distribution and utilization of available resources will be the best way to meet future requirement

This idea is self-evident. The problem is that, so far, we are badly lacking in experience in the matter. Sectoral action does not seem very fruitful. What is needed now is a global view of the field which would allow the implementation of selective action in the sensitive segments of the health system. Such a global view cannot be obtained without systematic studies.

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REVIEW OF AVAILABLE METHODOLOGY OF PROJECTIONS OF FUTURE TRENDS IN CANCER RISK

Matti Hakama

Actual applications of projections in cancer epidemiology are relatively rare. In the following different methods used for predicting cancer incidence in Finland are described and some of the purposes of making such predictions are mentioned. This paper is largely based on an article which will be published in the World Health Statistics quarterly in 1980 (1).

The different predictions will be classified into three types: direct extrapolation of past trend (type I), using data on risk factors (type II) and evaluating the effects of intervention (type III).

Type I model: extrapolation of trend

The simplest way of making predictions of cancer incidence or mortality is to assume that the past trend will continue into the future. However, in actual fact past trends indicate little about future risk of disease and therefore it may be advisable to be conservative in the specifications of the model in order to prevent gross differences between predicted and observed values.

Using the 1957-68 data from the Finnish Cancer Registry, projections were made for the incidence of cancer of different anatomical sites for the year 1980 (2, 3, Fig.1). The incidence rates were adjusted for the 1980 sex-specific population forecasts; the linear extrapolation for different cancers with an increasing trend and exponential extrapolation for types of cancers with decreasing trend were assumed. Exponential trend prevented negative values for the predicted incidence, and linear increase in trend usually leads to more conservative estimates than do, for example, higher order polynomials. Fig. 1 shows the total cancer incidence and incidence of various cancers in Finland and predicted incidences for the same for 1980 in terms of a 90 % confidence interval.

Later, the analysis was extended to cover the period 1955-70 and separate predictions were made for each of Finland's 16 central hospital districts (4). In addition to the predicted incidence for 1980 and 1985, the actual number of cancer cases was projected by multiplying population projections (5) by the predicted incidence. This was done at the request of the National Board of Health. The predictions (by central hospital district) were used for planning of oncological facilities and for the allocation of services and resources.

Cancer incidence predictions for the past few years were compared with the recorded incidence rates for the same years. Prediction curves showed a good fit with the observed rates for most cancers of different anatomical sites. However, lung cancer incidence in females and the incidence of melanomas showed a more rapid increase than was predicted. On the other hand, the incidence of lung and laryngeal cancers in males was less than predicted. The deviations from the predicted incidences were in agreement with changes in etiological exposures (6, 7).

For cancers of several anatomical sites the age/incidence curves are of similar shape for each birth cohort. For the cohorts that will make the most contribution to the incidence in the future, the levels can already be estimated and the trends in incidence rates by age may be used to improve the prediction. This is especially true for cancers where the etiological exposures affect early in life. For example, Haenszel & Correa (8) have postulated that premalignant transformations occur early in life which may lead to stomach cancer at a later age.

The age/incidence curve for epithelial cancers closely follows the Gaussian distribution. Fig. 2 shows selected age-specific incidence rates for stomach cancer among Finnish males for 1962-65 and cohort incidence curves based on extrapolation of the Gaussian distribution (9). It was assumed that the shape of the distribution was the same but the level of the incidence rates changed between different cohorts. In order to show the accuracy of the extrapolation as well, rates for 1953-57 and for 1958-61 are also shown in Fig. 2. The fit was relatively good and the observed rates did not show any systematic deviations from the expected curve.

For the cohort born at the end of the 19th century the risk of stomach cancer was estimated at about 3 in terms of unit risk for the cohort born 20 years later (9). It was possible to verify this prediction by means of observed incidence rates in the 1970s and it was found that the prediction was very accurate for the cohorts born between 1885 and 1920. The age-adjusted cross-sectional rates in Finland were 71 in 1953 and 26 in 1976 per 100 000 person-years.

Type II models: utilization of risk factors in the prediction of cancer risk

If the latent period between first exposure and the diagnosis of cancer is long (for epithelial tumours it is likely to be of the order of 20 years), use of risk factor's trends sometimes make it possible to predict the incidence. The length of the period for which the prediction is made is equal to the length of the latent period. However, for most types of cancer preponderent risk factors have not been established.

Two examples of using data on risk factors in incidence prediction are considered below:

1 prediction of breast cancer incidence on the basis of geographical correlations between different provinces in Finland (10);

2 and prediction of lung cancer incidence for Finnish males based on the prevalence of tobacco smoking (11).

Breast cancer is the leading type of cancer in most western female populations. Risk factors associated with viruses, heredity, standard of living, female hormones, and reproduction have been proposed (12); however, the standard of living and hormonal or reproductive factors seem to be the most important. For example, females with their first pregnancy at the age of less than 30 years have a relative risk equal to the 3 as compared to females with their first pregnancy at less than 20 years of age. A threefold risk of breast cancer is also found between extreme social strata (e.g. women with academic degrees on the one hand and unskilled labourers on the other).

Variables describing fertility and standard of living for the period 1954-58 were correlated with breast cancer incidence during the period 1967-73 for Finland's provinces. A latent period of 15 years was chosen for practical reasons and because different latent periods had only minor effects on the correlation.

The variables "percentage of industrial population", "percentage of urban population" and "taxable income per inhabitant" were selected to describe the standard of living within each province. It was found that taxable income correlated best with the breast cancer incidence.

Fertility rates were available for each of Finland's provinces. Since age at first pregnancy is a strong risk factor it was hypothesized that age-specific fertility rates at 15-19 years or at 20-24 years were the best indicators of breast cancer risk.

However, the general fertility rate proved to have the highest correlation with breast cancer incidence.

When these results were combined and a simple regression model was applied, the following relationship was seen between the risk indicators and the incidence rates:

$$\log(\text{incidence, 1969-73}) = 3.6 - 0.002\,(\text{general fertility, 1954-58}) + 0.00007\,(\text{taxable income, 1954-58}). \quad (1)$$

The above equation had a multiple correlatión of 0.90. Using the parameters estimated in this equation and the risk indicators for 1969-73, breast cancer was predicted for the period 1984-88. Fig. 3 shows observed mean annual age-adjusted incidence rates of breast cancer for 1954-58 and 1969-73 and predicted rates for 1984-88 for each of Finland's provinces.

The purpose of the analysis was epidemiological. The significance of the different types of risk factors was analysed from geographical correlations (excess weight and the size of the woman were found to be unimportant). The prediction was only a by-product of the study.

For lung cancer, the most important risk factor is tobacco smoking (13). Cigarette smokers have a lung cancer risk ten times that of non-smokers, and it was estimated that 80 % of all lung cancers among Finnish males were due to cigarette smoking.

In Finland, there is a long tradition of cigarette smoking (14). The first industrial plants manufacturing Russian-type cigarettes were founded in the 1880s. In the 1920s, the annual consumption was about 1000 cigarettes per adult. In recent years this figure has been about 1800. The time series of the consumption of manufactured cigarettes is available from 1920 and the most recent figure used in the present analysis is for 1978. Lung cancer incidence rates from the Finnish Cancer Registry were available between 1953 and 1975.

Lung cancer incidence for males in Finland was predicted (11) by means of a dynamic linear model (15). The incidence of lung cancer and number of cigarettes smoked per adult were correlated with different time-lags. The correlation was significant for several time-lags of about 10 and 20 years. The following model serves as an example of the results:

$$\underline{y}_{\underline{t}} = 24.2 + 17.6\underline{x}_{\underline{t}-9} + 10.6\underline{x}_{\underline{t}-10} + 10.3\underline{x}_{\underline{t}-21} - 14.3\underline{x}_{\underline{t}-23} \qquad (2)$$

where $\underline{y}_{\underline{t}}$ is the lung cancer incidence rate and $\underline{x}_{\underline{t}}$ is the consumption of cigarettes in year $\underline{t}$.

This equation allows the prediction to be made of lung cancer incidence for 9 years without any prediction of the cigarette consumption. Fig. 4 shows the predicted incidence rates up to the year 2000 assuming that the consumption of cigarettes will remain in the future at the same level (1800 per adult) as in 1978. The purpose of this analysis was methodological, and the analysis was not carried out in order to devise tools for administrative or scientific purposes.

Type III: Models for predicting the effects of intervention

For purposes of administration and planning it is desirable to have an idea of the effects of intervention of risk factors or related variables on the risk of the disease. This type of prediction assumes knowledge on the natural history of the disease.

The most fruitful theory on carcinogenesis has been the assumption that carcinogenesis is a multistage process. The effect of intervention of risk factors (stopping of smoking, removing of occupational exposure) depends on whether the exposure affects early or late stage carcinogenesis in the multistage process. Cigarette smoking is likely to affect late stages in lung carcinogenesis and stopping of smoking has a relatively immidiate effect on the lung cancer risk. Hence, it is possible to evaluate, say, the results of health education campaigns on the risk of lung cancer in the next few years.

Some of the occupational exposures are likely to affect the early stages of carcinogenesis. As a consequence removing of such an exposure has a limited effect only on the risk of cancer of those workers already exposed.

Mass screenings of cervical cancer are a means of intervention aimed at detecting of preclinical stages of the disease, and the effects on the risk of frankly invasive cervical cancer should be affected relatively rapidly after starting of a screening programme. It was estimated that about 20 % of frankly invasive cases had a preinvasive stage shorter than the time lag between the repeated screenings within the organized mass screening programme in Finland. This evidence, combined with data on attendance rate, yielded an estimate of a final 60 % reduction in the incidence of frankly invasive cervical cancer (17). It was later possible to verify this prediction by the observed trends in cervical cancer in Finland. The observed incidence rates of invasive cervical cancer have been very similar in 1973, 1974, and 1975 (Fig. 5), indicating that the rates may stabilize close to the value predicted by epidemiological means.

The prediction of the effects of known or postulated intervention is an important administrative (and sometimes scientific) problem, which can be successfully handled by the presently available methodological means. The long-term prediction of cancer risk is a challenging problem without a general solution. Direct extrapolation of past trends of cancer incidence or mortality may lead to grossly erroneous results. The long latent period from the beginning of exposure to the diagnosis of cancer can be utilized in making predictions. The risk factors used as auxiliary variables have two prerequisites: (1) they should be preponderent enough and (2) they should not be subject to unpredictable intervention during the period of prediction.

Some primary sites can be thought to meet these general conditions, but it is unlikely that overall cancer risk or risk of cancer at all specific primary sites could be predicted in this way.

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Fig. 1

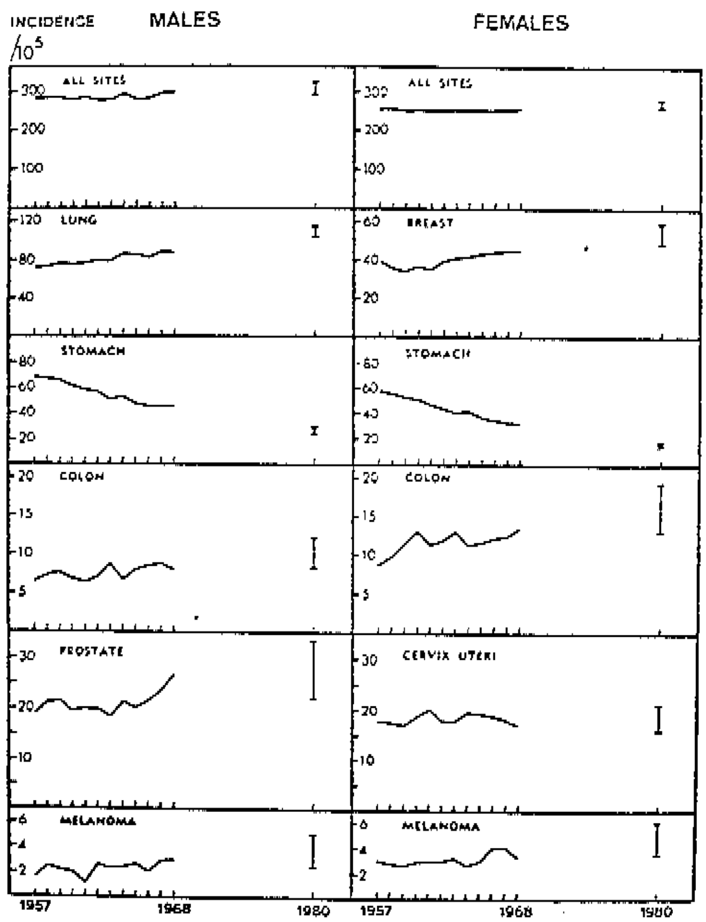
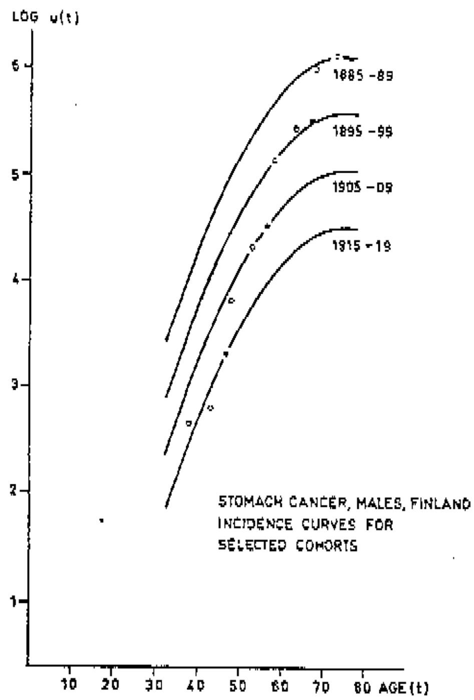
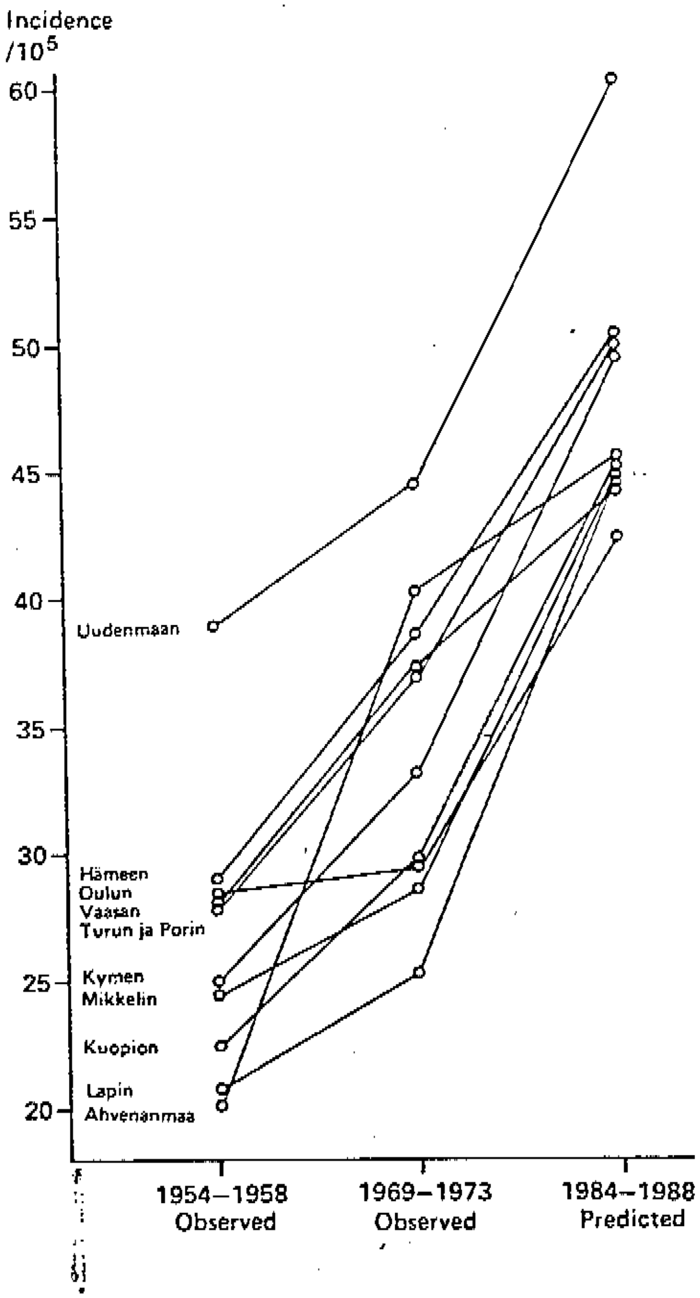

INCIDENCE /10^5
MALES
FEMALES
ALL SITES
300
200
100
LUNG
120
80
40
BREAST
60
40
20
STOMACH
80
60
40
20
COLON
20
15
10
5
PROSTATE
CERVIX UTERI
30
20
10
MELANOMA
6
4
2
1957
1968
1980

Fig. 2



LOG u(t)
6
5
4
3
2
1
1885 -89
1895 -99
1905 -09
1915 -19
STOMACH CANCER, MALES, FINLAND
INCIDENCE CURVES FOR
SELECTED COHORTS
10 20 30 40 50 60 70 80 AGE(t)

Fig. 3



Incidence
/10^5
60
55
50
45
40
35
30
25
20
Uudenmaan
Hämeen
Oulun
Vaasan
Turun ja Porin
Kymen
Mikkelin
Kuopion
Lapin
Ahvenanmaa
1954–1958
Observed
1969–1973
Observed
1984–1988
Predicted

Fig. 4

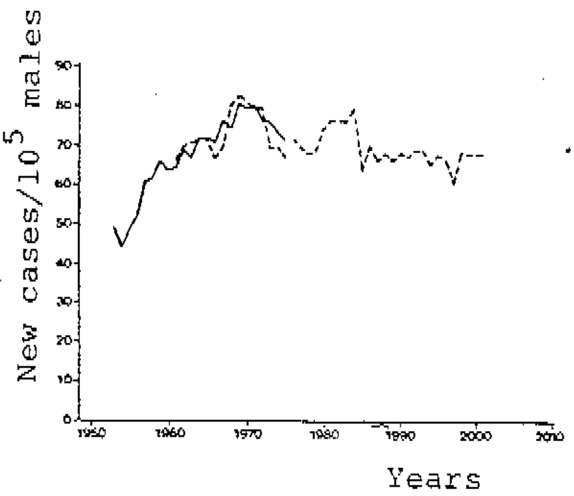
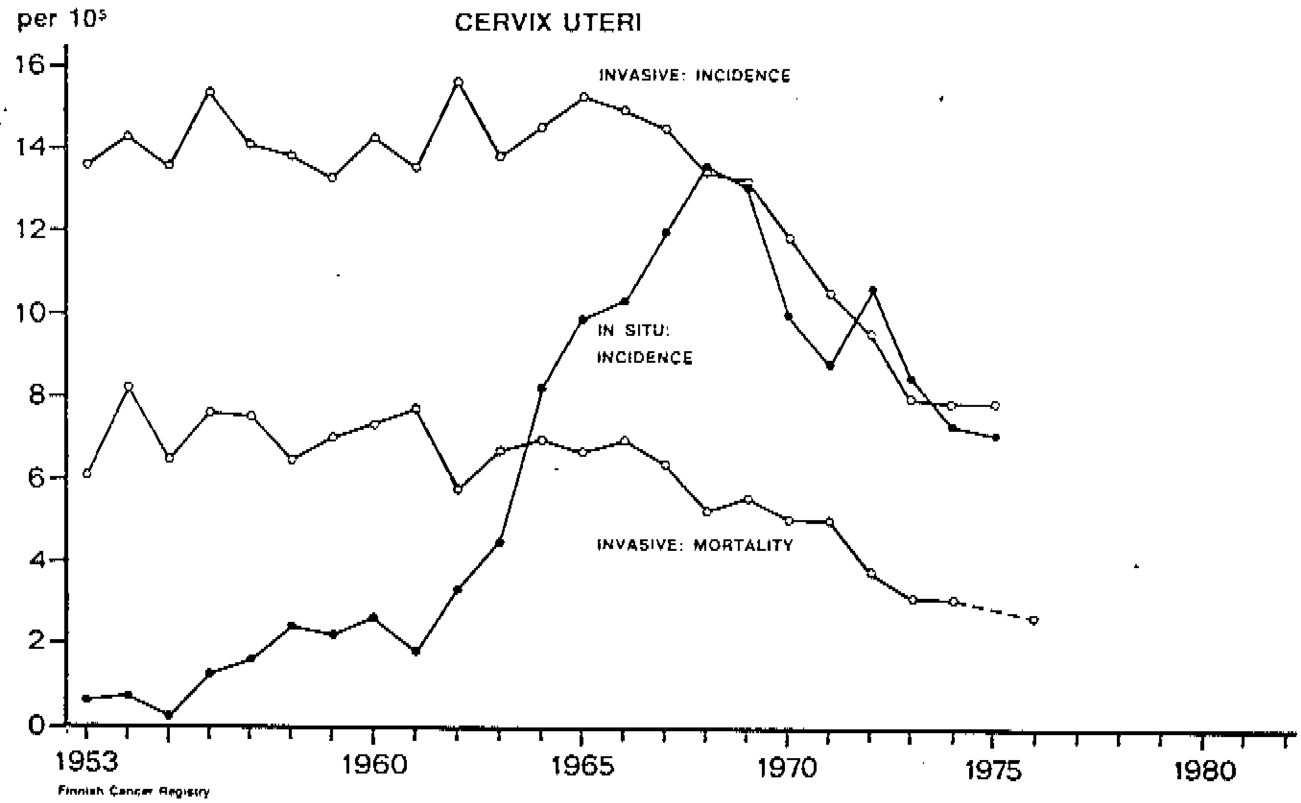

New cases/10^5 males
90
80
70
60
50
40
30
20
10
0
1950
1960
1970
1980
1990
2000
2010
Years

Fig. 5



per 10⁵
CERVIX UTERI
INVASIVE: INCIDENCE
IN SITU:
INCIDENCE
INVASIVE: MORTALITY
16
14
12
10
8
6
4
2
0
1953
1960
1965
1970
1975
1980
Finnish Cancer Registry

K. Miltényi:

Review of available methodology of projection of future trends in the utilization of health services.

1. In the absence of a generally accepted methodology of projections in this field, I would propose in this paper

/i/ to list some basic factors which can be used as starting points for such exercise;

/ii/ to review the availability of empirical/statistical data;

/iii/ to outline the logic of the methods suggested;

/iv/ to indicate some probable, generally accepted assumptions and their implications.

2. In a simplified model utilization of health services are determined by the following factors

/i/ population; size and structure;

/ii/ morbidity;

/iii/ proportion of morbidity attended by health services.

3. Population projection. It seems evident that any realistic health projection must be based primarily on the expected size and structure of the population. In this respect especially the sex/age structure is of basic importance, considering the strong differences in sex/age specific morbidity. As most European countries do prepare population projection, using generally the component method, reliable, detailed and solid information is avaiable on this topic. This is especially true for the adult and old age groups, which are not affected by the well known uncertainties of the fertility assumptions.

4. Morbidity rates /incidence and prevalence/ by age and sex. Anticipated morbidity rates, of course, have to be based on some empirical, statistical evidence. Statistical data supply in this field seems, however, not adequate. The main sources of data are

/i/ morbidity recorded in retrospective/longitudinal sample population/household surveys;

/ii/ infectious diseases, covered by the compulsory report system;

/iii/ some particular diseases /e.g. cancer/ attended and reported by specialized institutions;

/iv/ hospitalized morbidity, recorded by hospitals;

/v/ incidence and prevalence of economically active persons on sick leave, recorded by the social insurance agency

/vi/ causes of deaths, reported in the vital registration system.

5. Theoretically, data from source 4. /i/ could be considered as most comprehensive and representative. However, in retrospective surveys recall lapse and subjectiv inter-pretation of the rather uncertain definition of "illness" may cause serious omissions and bias. In longitudinal surveys the probability of drop out may be correlated with morbidity. The inherent selectivity and/or partiality of data from sources /ii/ - /vi/ are obvious. However one general conclusion is supported by all data i.e. the "U" shaped curve of morbidity by age.

6. Apart from the difficulties of the statistical basis, extrapolating present/past morbidity trends implies making both general assumptions for socio-economic development and specific assumptions for the anticipated progress in medicine and pharmacology. The latter, of course, have to be elaborated for individual diseases, or groups of diseases, homogeonous in some respect.

7. A general and basic factor influencing future morbidity, especially as defined by the prevalence, is the aging of the population. The increased life expectancy, together with decreased fertility, will continue the aging process, experienced in the recent decades. This is irrespective of the fact, whether further increase in the life expectancy can be

still anticipated or not. Older age structure - other things being equal - will increase general morbidity.

8. Improvment in infant and child care has increased the survival ratio of handicapped children, development in medicine and surgery the survival of injured, disabled adults. This will have two probable consequences

/i/ the proportion of handicapped/disabled children/adults requiring special educational/social/medical care may increase, emphasising the need for better, more efficient rehabilitation;

/ii/ the number of old age persons requiring - in the absence of younger family members or relatives - either allocations in institutions /hospitals or special homes/pensions/ or some other forms of social care /e.g. visiting nurse, social worker/ will also increase.

Statistics on these phenomena are usually avaiable and adequate to make assumptions for future trends.

9. Access to and utilization of health services are determined mainly by the socio-economic and medical-institutional background. Social insurance has had an important role in the general use of medical/health care, providing services free of charge. The proportion of the population covered by social insurance has increased in the recent decades in Europe, especially in the socialist and Nordic countries approching 100 %. In Hungary e.g. in the 1950-ies about 50 % of the population was covered, in the early 1970-ies 97-99 %. The 1974 Health Act, declaring the right to free medical/health services by virtue of citizenship has completed this process, abolishing the red taping connected with the certification of social insurance participation, required earlier when utilizing health services.

10. Although legally and theoretically there are not obstacles to prevent somebody from the utilization of health services, there are still significant variations in this respect, influenced by the factors as follows.

/i/ type of morbidity/diseases;

/ii/ distance from and access to health institutions. In rural areas distance from the general/district practitioner may be also relevant, especially for older persons,

/iii/ anticipated time of waiting for the services;

/iv/ personal, subjectiv inclination to be attended by the doctor, nurse, hospital etc. influenced also by age, previous experiences, social and cultural background. Earlier it was generally assumed that socio-economic level, school attendance etc. have positive correlation with the disposition to utilize health services. However, some recent experiences may indicate possible changes in this respect, professionals being less inclined than strata with average educational background. Inclination by age is also more or less "U" shaped, with the exception of the oldest age group where some decrease may appear.

11. Theoretically all anticipated or planned changes in these factors have to be considered to formulate assumptions for future trends in the utilization of health services. However, statistical data for analysing the relative influence of these factors are rather scanty and fragmentary, derived mainly from small and non representative surveys.

12. So far "health services" were considered in general in this paper, withous making distinction by the type of these services. In reality three basic groups of health services, utilized directly by the population, can be distinguished

/i/ the services of the general/district practitioner

/ii/ the services of polyclinics i.e. out-patient services

/iii/ the services of hospitals and other in-patient institutions.

One crucial task of health programmes is to determine priorities in the allocation of the avaiable funds /investments, extension, modernization etc./ on the basis of the expected changes in the utilization of these services.

13. During the last decades - at least in Hungary - a general shift was observed from the general practitioner's services towards those of the specialised out-patient institutions. To some extent the decreasing prestige of the general practitioners has contributed to this process. Increasing specialization and instrumentation in the medicine has decreased the competence of the general practitioners, especially in the urban areas sometimes compelling them to daily routine, administration - and to the dispatch of the patients to the relevant specialized institution. This, however, has the inherent danger of the disintegration and dehumanization of the medical practice. Thus, it can be argued that the continuation on this process should be prevented by appropriate health policy measures e.g. making possible the free choice of doctors for the patient, i.e. revitalizing the role of the traditional "family doctor". Policy decisions on such matters may strongly influence future trends, thus they must be incorporated in the projection methodology.

14. The distribution of work between out-patient and in-patient services is a crucial part in health planning/projection. Changes in both direction can be anticipated. Innovations in the medicine and pharmacology can replace treatment - or at least shorten it - previously restricted to hospitals, by methods which can be applied to out-patients. However, the opposite may be also true; the application of sophisticated technics in diagnostic or therapic procedures may necessitate in-patient treatment.

15. It may be perhaps assumed that the general tendency will be towards out-patient services, as it happened e.g. with the TBC, and as it started, at least in some developed countries in the psychiatry. Decreased fertility will reduce the required capacity of obstrectics and gynaecology departments, especially if it is achieved by contraception, replacing the practice of the induced abortions.

16. Thus, it may be assumed that further extension of proper hospital bed capacity, labelled sometimes "active beds", will not be necessary. However, for the reasons mentioned in points 7-8, the increasing demand for "passive" hospital beds can be safely anticipated.

17. Pharmaceutical services have been growing in all European countries for the last two decades. There is no reason to assume the discontinuation of this process.

18. This paper deliberately omitted those public health aspects which are not utilized directly by individuals/households.

19. I am aware that this sketchy paper is full of uncertainties and gaps. This must be partly due to my limited knowledge in this field. However, to some extent it may be the reflection of the current practice in the health planning and projection which seems to lag behind, compared to other fields, i.e. economy or demography. In order to develop an integrated system of economic and social planning the relative backwardness of health planning should be corrected.