Reviews and reports

Assessing the need to establish new hospitals

Saeed Assefzadeh[1]

A health system based on primary health care cannot, and I repeat, cannot be realized, cannot be developed, cannot function, and simply cannot exist without a network of hospitals functioning in a manner I have tried to describe. But hospitals have to change their ways so that they become one of the main flag-bearers of the most daring yet the most promising health movement in the history of humanity, the movement for health for all by the year 2000.

Dr H. Mahler, 1981 [1]

Introduction

Numerous factors have to be taken into account before establishing a new hospital in a certain area. Unfortunately, in many developing countries, new hospitals are built and equipped with sophisticated plant, without conducting the thorough investigation that is necessary before such a project is laid down.

A hospital at any level, whether serving an urban or a rural population, is an integral part of the health system, with a key role to play in achieving health for all [2]. Important variables such as geographic, demographic, economic, sociocultural and epidemiological factors, as well as health status, can affect the role and performance of a hospital. Therefore, the relevant data have to be gathered, reviewed, analysed and evaluated in order to assess the real need of a population for inpatient services.

In recent decades, it has been frequently observed in developing countries, that modern or large hospitals and other health facilities are mainly concentrated in capitals or metropolitan areas—leaving other parts of the country with poor access to medical services. Many different organizations often provide inpatient services in the same vicinity. This leads to duplication and overlap, which in turn leads to waste of capital resources, where there is already serious lack of funds. Once built, hospitals are extremely difficult to close down [3].

It is rational that a body of health policy-makers, health strategists, hospital planners and health economists discuss current inpatient problems, the demand for inpatient services, major obstacles and the most likely alternatives to tackling the difficulties in the region, before any design is made or put into action.

[1] *Hospital Administrator, Director of Research, Qazvin University of Medical Sciences, Qazvin, Islamic Republic of Iran.*

Conceptual framework

As part of a unified approach to socioeconomic development, the aim of health policy is to secure a fundamental change in the health status, both to help break the cycle of poverty and to enable the population to effect the changes they have chosen and in which they participate. Sound health strategies and policies aim to distribute all accessible resources and facilities among the various groups of people living in different geographical areas of the country; the ultimate goal is to secure the health of individuals as part of social justice; as stated by WHO:

> *The tendency towards more democratic forms of government will lead to increasing calls by the people for more equitably distributed, better quality services, for a strong voice in decisions on priorities and for the means of obtaining health services. The spread of education in combination with the trend towards more democracy and participation in decision-making will intensify demands for more objective and understandable information about health, health technology and necessary health services, and pressure to complement the role of the health professions in health care decision-making [4].*

A hospital—an expensive health resource—is a combination of human and other resources, such as buildings, hardware, technologies, materials etc. This resource is presumably established to satisfy the needs of the people. In recent decades developing countries have invested heavily in health. They have constructed hospitals and other buildings and purchased equipment to fill them. Worldwide, the number of hospital beds rose between 1960 and 1980 from 5 million to almost 17 million, which more than doubled per capita supply.

Such investment has also led to new problems. In virtually every developing country, facilities, equipment, human resources and drugs are skewed towards the tertiary (specialized) hospitals—at the top of the health system pyramid. Yet cost–effective public health and clinical interventions are best delivered at the level of district hospitals or below. That they are often delivered through specialized hospitals simply increases costs and consumes a large proportion of the resources available for health, without improving quality [3].

More effective and efficient utilization of the limited resources leads to the establishment of economic hospitals in order:

- to cover the optimum inpatient treatment needs of the people, especially those at risk;
- to locate them in the best catchment area;
- to avoid parallel or overlapping services produced by other hospitals or health centres in the region, so that costs can be minimized;
- to involve them in the training of health human resources;
- to involve them in conducting health and medical research;
- to support the referral health network:
- to support the health of the community.

Assessment by the health authorities to determine the needs of the population should begin with questions formulated by the health decision-makers, such as the following.

- What are the health priorities of the people?
- What are the objectives of establishing a new hospital?

- How many hospitals are functioning in the geographic area?
- Do they cover the target populations effectively?
- What is the bed-occupancy rate? If it is low, what are the reasons?
- Do the existing hospitals work economically?
- Do they have the potential for development? Are their functions in line with the goals of the health system, especially primary health care and the referral system?
- How can their services be optimized?
- What geographic areas are supposed to be covered? Can the hospital be reached in a timely fashion?
- Are there outpatient services working effectively enough to replace unnecessary inpatient services?

These questions and others, especially those concerning the socioeconomic status, should be addressed to evaluate and predict both the present, future and long-term hospital needs of the population.

Population-based socioeconomic, cultural, demographic and epidemiological information is vital for defining priority areas for action, planning public health interventions and evaluating progress [5]. So, prior to any other step, gathering reliable information on all factors related to hospital planning is essential.

Materials and methods

The availability of reliable and comprehensive data on socioeconomic and health status of the population varies from country to country. However, ad hoc or routine data collection may be used in this respect. Where information is doubtful, as in most developing countries, cross-sectional studies within the target population and existing health organizations would be helpful. Trend studies are also possible by referring to existing data such as medical records, epidemiological reports and periodical censuses, to predict the future hospital needs of the people. The depth of the surveys depends on the dimensions of health programmes.

Where the procedure of data collection encounters restrictions or difficulties, such as shortage of time or money or lack of qualified personnel, estimates by experts can be helpful and are much better than having no information. However, the method of data collection pursued should be appropriate to the conditions prevailing. Data collection programmes require the collaboration of a team consisting, say, of a health administrator, a doctor, a statistician, a data analyst and a health economist. The collaboration of academic staff, in public health schools or universities, in harnessing information is quite useful.

The following data should be collected and analysed:

1. Geographical information on the region to be covered by the new hospital(s) such as:
   - area
   - population density, in urban and rural areas
   - numbers of cities, towns, environs and villages up to 60 km from the location of the hospital
   - traffic networks in cities
   - traffic networks in rural areas, and travel time
   - natural situation of the region (mountainous, plain, coastal, climate, etc.).
2. Demographic and social data:
   - number of people to be covered by hospital services in the region

- distribution of urban and rural population by sex and age
- spatial distribution of the population
- annual population growth rate
- birth and mortality rates
- literacy/illiteracy rates
- cultural values, social characteristics and political aspects which may affect the services rendered by the hospital
- migration
- ethnic groups, pressure groups and occupational associations that may influence decision-making.

3. Economic data: there is a general consensus that health and economic development are closely dependent on each other [6]. Appropriate data help planners to evaluate the economic status of the population, their purchasing power with respect to health services, the occupational health hazards, the economic resources available for developing hospital services, insurance mechanisms, and economic crises which influence hospital functions directly or indirectly. Economic data should, therefore, include:
   - number of industrial centres, factories, and manufacturers
   - agricultural and farming areas
   - business centres
   - per capita income per year
   - high-income/low-income ratio
   - employment rate
   - economic inflation rate
   - population distribution by economic sectors in the region
   - interest rate for health insurance investments.
4. Health status of the population and its trends would cover
   - basic epidemiological data
   - morbidity rates
   - major causes of deaths
   - vulnerable groups
   - vulnerability to common diseases in the region
   - life expectancy
   - inpatient–outpatient rates.
5. Health facilities and organizations include:
   - number of practitioners
   - number of rural and urban health centres
   - number of hospitals and beds (by department or ward)
   - number of clinics, polyclinics, paraclinics—private and public
   - bed-occupancy rate
   - bed index
   - rate of turn-over (admissions per bed per year)
   - average length of stay
   - turn-over intervals
   - waiting lists and waiting time
   - hospital mortality rates
   - facilities for emergency services (both community-based units and hospital-based units)
   - number of intermediate (secondary) and specialist (tertiary) hospitals in nearby regions (by capacity and distance)
   - number of referrals from/to other hospitals
   - development potential of existing hospitals
   - number of teaching hospitals

- available resources to establish new hospital departments
- available technologies
- medical schools
- number of students in health-related teaching institutions.

6. Investment data needed to evaluate the risks and benefits:
   - resources necessary for development or modernization of existing hospitals
   - cost–effectiveness analysis (preventive versus curative care)
   - cost–benefit analysis of inpatient care
   - average cost of bed/day per existing hospital per year
   - investment needs for the establishment of new hospitals
   - internal interest rate
   - methods of obtaining resources
   - health market variables (such as number of agencies which provide hospital services, number of health insurance institutions, pricing system for inpatient services, number of public and private providers).

Hospital capacity

Certain rough criteria have been developed for the general hospital needs of a population in a fairly developed or advanced country. The estimated requirements range from three to six short-term beds per 100 people. When total hospital beds (including psychiatric, chronic diseases, tuberculosis, and geriatric beds) are included, the figures range from 11 to 16 per 1000. The minimum technically efficient size for a hospital with the necessary basic services (such as operating rooms, intensive and critical care units, clinical laboratory, radiology services and delivery service) is between 100 and 150 beds.

Hospital capacity in a given region can be estimated by this simple formula:

$$\text{Hospital beds} = \frac{\text{Total population coverage}}{1000} \times \text{BI}$$

where BI is the bed index.

The bed index differs from developed to underdeveloped and developing regions. This index can be estimated as follows:

$$\text{BI} = \frac{(\text{Inpatient load in the region per 100})}{365 \times \text{Bed occupancy rate}} \times \text{ALS}$$

where ALS is the average length of stay and inpatient load is the number of patients requiring hospitalization per 1000 population per year.

For example, if the bed index is estimated at 4, then for a population of 100 000, the required number of beds is:

$$\frac{100\,000}{1000} \times 4 = 400 \text{ beds}$$

A rule of thumb suggests that it is satisfactory if the number of hospital beds provided exceeds the average level of number of beds used by three times the square root of the average [7]. Hence, if there is an average demand for 200 beds, the capacity should be:

$$N + 3\sqrt{N}, \text{ or } , 200 + 3\sqrt{200} = 242 \text{ beds}$$

The catchment area for a hospital depends on its role and services, the health system, regionalization and the radius of coverage. But normally a maximum radius of 60 km for an intermediate hospital is reasonable. Moreover, the more densely populated the region, the greater the number of beds and

the lesser the distance would be. In addition to this, transportation facilities and travel time are important factors. Thus, the number of hospital beds can be calculated as follows:

$$\text{Number of beds} = \frac{R^2 \times \pi \times P}{1000} \times \text{BI}$$

where R is the maximum radius of catchment area in kilometres and P is the population density per square kilometre.

Each hospital can cover either its catchment area or give services to referred inpatients from other areas.

Conclusion

Planning to construct a new hospital in a given region must receive much thought in all its aspects. These aspects should preferably be studied within a research proposal: a framework to clarify the bottlenecks and shortages, and to estimate effective demands in the health market. An ad hoc committee should make decisions compatible with the national health strategies. A comprehensive survey clarifies:

- what degree of priority inpatient services have in the region
- where new hospital(s) have to be located
- what capacity they should have
- what special services they should provide
- how existing hospitals can be improved or developed according to present or future changes
- how the services should be distributed and delivered within the health system
- what capital investments are needed
- how the outputs would be optimized.

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