



## CHAPTER 4

### THE IMPACTS OF UNDERUTILIZATION AND OVERUTILIZATION AND THE METHODOLOGY

#### 4.1 Factors affecting Underutilization and Overutilization

The theoretical framework in chapter 1 indicates that the hospital utilization depends on some factors, such as a) patient factor b) provider factor and c) organizational factor, which are responsible to determine the utilization of hospital services. The utilization, either underutilization at the Thana health complex or the overutilization at the District hospital have some impacts which has been classified and discussed in this chapter.

##### Patient Factor :

The utilization of hospital services depends firstly, on the age of the patients. Child and elderly people utilize more hospital services than the people of other age groups. Secondly, sex is a considerable factor in respect of hospital utilization. Female utilizes more hospital services than that of male. Thirdly, income is also a factor which contributes to the utilization of hospital services. The people who has less income utilize more hospital services.

Except a very few private hospitals, most of the hospitals throughout the country are public run hospitals. When people get sick, they utilize the services from the public hospitals who are the major providers of treatment facilities. Thus, the patient as a consumer has no choice.

##### Provider factor :

In developing countries, government is the main health care provider. Where a physician has a vital role to play about the treatment of the patients, whether the physician examines the patient carefully, behavior with the patients and experience of the physician are the important aspects which contribute towards hospital utilization.

Here, the physician operates both sides of the market, they are both the supplier and the demander of health care services. It is the physician who provides the consumer directly with services and determines the service he or she needs from other suppliers- hospitals and suppliers of drugs and medicines. Decisions about medications, getting well at home or in hospital, and special medical services required are all made by the physician. Consumers usually does not even determine where they will receive hospital care. The selection of hospital depends largely on where the physicians happens to hold staff

position and which hospital the physician prefers.

#### Organizational Factor :

Health or medical care depends on the organization and system of service delivery including service facilities , communication with the hospital in respect of transportation, and location of hospital. Utilization of hospital services also depends on these factors.

The short run supply curve of hospital services is the quality of hospital services that will be supplied given or holding constant the number of hospitals and hospital inputs, such as number of beds, quality of care, trained doctor, nurses and other staff, supply of drugs. The long run supply curve differs from the short run curve in that hospital investment (hospital facilities and equipments) may vary in the long run, change in hospital investment, technology and prices of inputs causes shifts in the short run supply curve.

Hospital utilization mainly depends on the organizational system, availability of service facilities, technology, equipment and infrastructure; in the short run the trained manpower, supply of drugs, quality of care and overall management of the hospital.

#### 4.2 Impacts of Underutilization and Overutilization

It is evident that there is some positive and negative impacts due to the underutilization in Thana health complex and overutilization in District hospitals. The major impacts can be broadly classified into three major components, which are as follows:

- a) Quality of care
- b) Allocation of resources, and
- c) Satisfaction level of patients.

#### Quality of Care :

Reviewing the literature and different study on hospital utilization, it is evident that there are many indexes to determine the quality of care in the hospital services. For development of methodology six indexes has been selected, in brief which are as follows:

- i) Average waiting time of the patient for admission
- ii) Average length of stay
- iii) Doctors spending time per patient
- iv) Nurses spending time per patient
- v) Cost of treatment per bed
- vi) Discharge rate

#### Allocation of Resources :

The people prefer to utilize District hospitals with the belief that these hospitals are bigger, having modern diagnostic and treatment

facilities which involves high opportunity cost as an input in the form of transportation cost of patient and attendants, time cost or wage lost, cost of food, accommodation and drug cost to get the services.

If patient utilize Thana health complex, the involvement of cost components are more or less similar as District hospital, but the input i.e., the cost of the patient is lower, as because the hospitals are nearer to the patients house they do not have to pay the cost for food, accommodation etc.

Due to the utilization of District hospital the cost incurred are high, which is a wastage. If the patient utilize Thana health complex, it incurs the cost is low, which is the saving for the patient.

#### **Satisfaction of Patient :**

Patients satisfaction with particular resources of medical care depends on the quality of doctor-patient communication and not solely on education of the patient.

The dissatisfaction often takes on special significance as a barrier to failure utilization, the reasons for dissatisfaction is cost ineffectiveness of treatment, lack of physicians interest and concern and unnecessary x-ray or treatment procedure (Were et al, 1984)

#### **Impacts of Underutilization :**

The Thana health complex having 31 beds each and are situated at the rural areas where most of the people live, but the rural people do not prefer to utilize the services at the Thana health complex, rather they prefer to go to the District hospital and the Thana health complex remains underutilized. Due to the underutilization of hospital services at the Thana health complexes the expenditure for salary of manpower, cost of drug, administrative cost, power and fuel consumption, maintenance cost of building and equipments do not decrease, rather this expenditures remain more or less unchanged. As a result expenditure per bed becomes high, which is an wastage from the provider side.

Due to the underutilization of hospital services patients consume more drugs and services, the drugs allocated for 31 beds are consumed by the lower number of patients than the bed capacity, which is also a wastage in comparison to average allocation.

#### **Impacts of Overutilization :**

The consequences of overutilization is low quality of care of the patient by the doctors, nurses and other staff, long duration of stay which limits the health facilities for others, chance of secondary infection is high and inadequacy of drugs.

The District hospitals are generally 100 bedded, but most of

the times and in almost all the hospitals the number of patients occupy the beds more than the bed capacity and thus overutilized. The patients are staying on the supplied beds and the overutilized patients are staying on the floor, which is unhygienic, dusty and in these places aseptic measure is not possible.

Doctor, nurses and other staff have limited time to work in the hospital, when the patients are more than the bed capacity the doctors and nurses cannot pay due attention and spend less time per patient.

The cleanliness and aseptic measures deteriorates due to overutilization and consequently the patient with wound may develop secondary infection and the patient is to stay longer in the hospital, if a patients stay longer, the less people get the benefits of treatment and the people have to wait for longer time to get admission in the hospital.

The people who do not utilize the Thana health complex and come to the District hospital from the rural area which involves some cost for himself or herself in the form of transaction cost, such as transportation cost for patient, his relatives or attendants, cost for food, cost for accommodation. If they could get the treatment and utilize Thana health complex, in that case they could save these costs which they spend while staying in the District hospital.

### 4.3 Methodology for Assessment of the Impacts

#### 4.3.1 Quality of Care :

The quality of care in hospital services is the most vital aspect for assessment. It is known from the literature review that the quality of care can be measured, but different authors described different indexes of measurement, out of which we choose some of them and try to find out a methodology for measurement of quality of care as an impact of underutilization and overutilization of hospital services. In this thesis, for the measurement of quality of care the following indexes can be choose to measure:

- a) Average waiting time of the patient for admission.
- b) Average length of stay at the hospital.
- c) Doctors spending time per patient.
- d) Nurses spending time per patient.
- e) Discharge rate of patient.
- f) Cost of treatment per bed

The quality of care might be the impact of utilization. To optimize the quality of care, the indexes are to be measured for any type of hospital services, depending on the utilization of hospitals. The indexes a,b,c cannot be generalized for any type of hospital.

However, different indexes on quality of care can be used to measure the impacts of utilization. The following methods can be

applied to measure the indexes to ascertain quality of care.

The impact of overutilization can be determined by measuring the quality of care. When the hospital is 100% utilized and when a hospital is overutilized than what is the quality of care. The difference between the quality of care of overutilized hospitals and the 100% utilized hospital could be considered as the impact of overutilization. Similarly, the impact of underutilization can be determined by measuring the quality of care when the hospital is 100% utilized and when a hospital is underutilized that what is the quality of care, the difference between the quality of care of underutilized hospital and the 100% utilized hospital could be considered as the impact of underutilization.

The relationship between utilization and the indexes a,b,c can be determined by regression analysis. The utilization or bed occupancy can be considered as dependent variable, while a,b,c indexes are independent variables.

**Average waiting time of the patient for admission:**

Thana health complexes are underutilized where the patients do not need to wait for admission, but in the District hospital which are overutilized need to measure the average waiting time as an indicator for assessment of the quality of care. The average waiting time varies from one District hospital to another, but "0" waiting time is the most desirable. With an increase in the number of days the patients who are waiting for admission will not get the service in time. This indicate the quality of care. The average waiting time per patient can be measured using the formula given below:

$$\text{Average waiting time} = \frac{\Sigma \text{Waiting time of each patient}}{\text{Number of patients}}$$

**Average Length of Stay :**

The length of stay of patient depends on the nature of sickness, such as in case of a patient with wound the length of stay will be longer and in the case of a diarrhoeal patient the length of stay will be shorter. Technology has some influence on average length of stay, for example, Laparoscopy cholecystectomy reduces the length of stay in the hospital.

Since there is no national or international standard about the average length of stay per patient for general hospitals or other hospitals for measurement of quality of care. In consultation of hospital records for last few (3-5) years, the data on average length of stay can be measured by using formula:

$$\text{Average length of stay per patient} = \frac{\Sigma \text{Each patient's day}}{\text{Number of patients}}$$

This can be measured by types of illness, chronic and acute, etc. In the overutilized hospitals the patients admitted are beyond the bed capacity stay in the floors, which are dusty and unhygienic, consequently develop secondary infection, or disease like,  
 a) Thrombosis / Embolism  
 b) Drug resistance to Staphylococcus pneumonia  
 c) Surgical wound infections which increases the duration of stay.

This will help the policy maker, if they can ascertain the length of stay and try to reduce the number of days by reducing the secondary infection, the quality of care will improve.

#### Doctor Spending Time per Patient :

Doctors has limited time to examine and to treat a definite number of patient, but when the number of patients are more than the bed capacity, doctor can spend less time per patient, which also influences the quality of care, though how much time the doctor will spend depends on the nature of sickness and the time required for diagnosis. In general we can assume that each doctor spends eight hours a day.

$$\text{Doctor spending time per patient} = \frac{\text{Total time available of all doctors}}{\text{Total number of patients}}$$

The time spent by the doctor per patient from the last few (3-5) years record and can fix a policy for future that how much time a doctor should spent in average to see a patient and can set a standard as the policy maker think fit.

#### Nurse spending time per patient :

Nurses take care of the patients, in this case also the nurse have limited time to attend for a particular number of patients, but the patients need care round the clock. When the number of patients are more than the bed capacity, the nurses can pay less attention to the patients, as a result the quality of care of the hospital services decreases. Similar to doctors, we can assume that each nurse also works for eight hours a day.

$$\text{Nurse spending time per patient} = \frac{\text{Total time available of all nurses}}{\text{Total number of patients}}$$

If patients need more care by the nurses, the number of nurses required can be determined and the requirement can be refixed.

#### Discharge Rate of Patients :

Patients are generally discharged when they recovered, the discharge rate may indicate the rate of cure at the same time, which

by:

$$\text{Discharge rate of patients} = \frac{\text{Total patients discharged} \times 100}{\text{Total admission}}$$

#### Provider Cost of Treatment per Bed :

Cost of treatment is also an important indicator to assess the quality of care. Because of resource scarce, hospital has to manage the cost of treatment per bed in the inpatient department. Hospital administrator / manager should know the average cost of treatment for the purpose of i) making budget for future, which can be determined by consulting the previous records of last few (3-5) years; ii) assess the cost of treatment in comparison to quality of service, iii) measure the effect of quality with an increase or decrease in the cost of treatment. The cost of treatment per bed can be measured by:

$$\text{Cost of treatment per bed} = \frac{\text{Total recurring cost}}{\text{Bed occupancy}}$$

The cost of treatment indicates the cost of drug ( both supplied by hospital and the market), laboratory investigation, cost for food, administrative cost and cost for manpower (salary of staff).

The cost required per bed may be determined as per following formula:

$$C_{tr} = ( D_{cb} + L_{cb} + F_c + C_m + A_c )$$

Where,

- $C_{tr}$  = Average cost for treatment required per bed per year.
- $D_{cb}$  = Average drug cost (supplied by hospital).
- $L_{cb}$  = Average laboratory examination fee per bed (in hospital).
- $F_c$  = Average cost of food provided by hospital per bed per year.
- $C_m$  = Average cost of manpower (salary of staff) per bed per year.
- $A_c$  = Average administrative cost per bed per year.

If government budget allocation match the actual cost, it is good, otherwise bad.

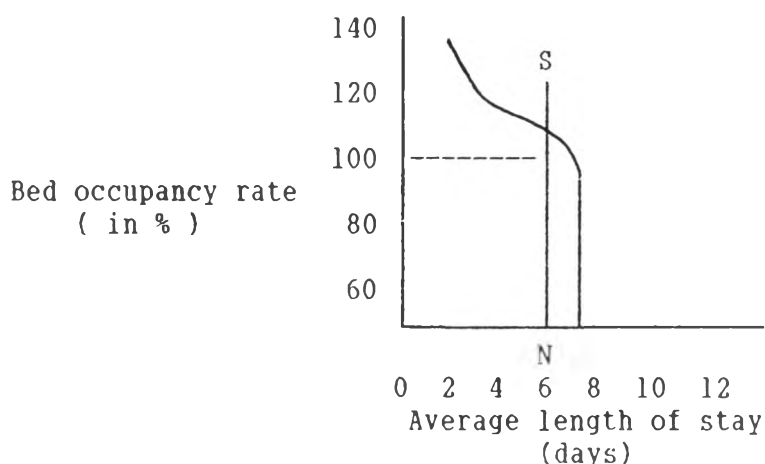
#### Need for Quality of Care :

The quality of care of the hospital services, which can provide and boost up efficiency, is related to utilization. Based on the availability of data, a researcher can compare the quality of hospitals with different utilization rates. This may indicate the most desirable level of each index for quality of care as determined by, a level of

utilization e.g., 100%.

The medical aspects of the indicators are to look into whether there is any relation between different medical indicators such as, average length of stay and bed occupancy rate. This can be quantified through empirical study by collecting data from the hospitals.

Figure 4.1 Hypothetical Relationship Between Bed Utilization and Average Length of Stay.



For example, the above Figure 4.1 indicates the target of bed occupancy is 100%. When the bed occupancy is more than 100% i.e., the hospital beds are overutilized than the average length of stay decreases; the explanation might be the provider is releasing the patient before they are fully cure, with a view to accommodate the new patients waiting for admission.

When the occupancy rate is 100% i.e., the hospital beds are utilized, than the length of stay in hospitals may be reasonable, of course it depends upon the nature of illness of individual cases.

When the bed occupancy is below 100% i.e., the hospital beds are underutilized, than the length of stay is comparatively high. The possible explanation is that, since there is no patient waiting for admission the provider is relaxed to release the patient and the patient waits until the hospital release them.

From the hypothetical data a researcher can come to a conclusion about the relationship between average length of stay and the utilization of different hospitals.

#### 4.3.2 Allocation of Resources :

The Thana health complexes are the nearest hospitals for the rural people, the people get the service at a free of charge in the sense that, the patients do not pay for the service. The government provides doctors, nurses, drugs, laboratory facilities. Still then the Thana health complexes are underutilized, as a result the people do not need to wait for admission, patient over consume the drugs with respect



to average allocation, services of doctors, nurses and staff are underutilized, but the government is to pay the salary of doctors, nurses and other staff in full, the allocation of drugs, administrative cost, cost for maintenance of building and equipments are fixed, which results the high expenditure per patient. It is a wastage for the provider.

The District hospitals are at a distant place from the rural population. When a patient comes to the District hospitals for treatment, they accompany their attendants and relatives, which involve some transaction cost in the form of drug cost, transportation cost for the patient himself / herself, transportation cost for the attendants and relatives, cost for accommodation, cost for food etc., which is a wastage to the patient. If the patient could get the treatment at the Thana health complex, they would not need to come to the District hospital and could save the money they spend for treatment. How much they had to spend more for treatment at the District hospital can be measured by using the following formula (Sharma,1994)

Wastage of the patient is,

$$W = Tc_1 - Tc_0$$

Cost could incur by patient attending the Thana health complex, by using the formula:

$$Tc_0 = A_0 + (B_0 + E_0 + F_0 + G_0) * V$$

Cost could incur by patient attending District hospital, by using the formula :

$$Tc_1 = A_1 + (B_1 + E_1 + F_1 + G_1) * V$$

Where,

W = Wastage of the patient.

Tc<sub>1</sub> = Total cost incurs by patient attending District hospital per year.

Tc<sub>0</sub> = Total cost incurs by patient attending Thana health complex per year.

A<sub>0</sub> = Total opportunity costs of treatment before coming to Thana health complex.

A<sub>1</sub> = Total opportunity costs of treatment for patients before coming to the District hospital.

B<sub>0</sub> = Total travel costs for the patients attending the Thana health complex (per visit).

B<sub>1</sub> = Total travel costs for attending the District hospital (per visit).

E<sub>0</sub> = Total opportunity costs of time required for travel and waiting for services at Thana health complex (per visit).

E<sub>1</sub> = Total opportunity cost of time required for travel and waiting for services at District hospital (per visit).

F<sub>0</sub> = Total food costs required for patient attending at Thana health complex (per visit).

- $F_1$  = Total food costs required for patients attending District hospital (per visit).  
 $G_0$  = Total accommodation costs required for patients attending at Thana health complex.  
 $G_1$  = Total accommodation costs required for patients attending District hospital.  
 $V$  = Average number of visits per year.

Before coming to the Thana health complex or District hospital the patient incurs some cost, which can be determined by using the following formula:

$$A_0 = [ (Td_0 + Ct_0 + Lw_0) * N_0 ]$$

$$A_1 = [ (Td_1 + Ct_1 + Lw_1) * N_1 ]$$

Where,

- $Td_0$  = Average time delay in getting admission at Thana health complex.  
 $Td_1$  = Average time delay in getting admission at District hospital.  
 $Ct_0$  = Average cost of local treatment before patient come to Thana health complex.  
 $Ct_1$  = Average cost of local treatment before patient come to District hospital.  
 $Lw_0$  = Average loss of wage between onset of disease and admission in Thana health complex.  
 $Lw_1$  = Average loss of wage between onset of disease and admission in District hospital.  
 $N_0$  = Number of visit admitted in Thana health complex per year.  
 $N_1$  = Number of visit admitted in District hospital per year.

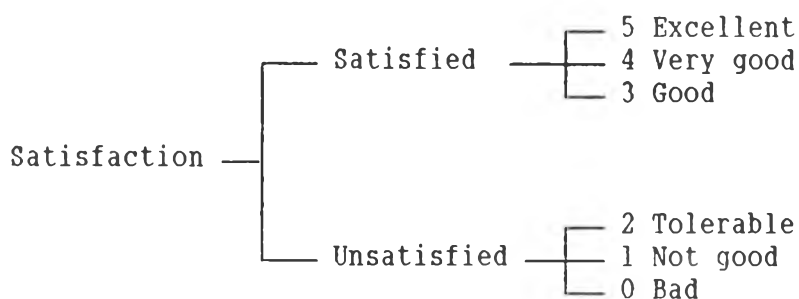
Due to the overutilization of the District hospitals the patients beyond the bed capacity are to stay on the floor of the hospitals, which have the probability of secondary infection and prolong the duration of stay in the hospitals, consequently the transaction cost of the patient becomes high and the waiting time for admission of patient becomes longer. The doctors, nurses and the staff spend less time per patient and the patients takes longer time to be cure.

#### 4.3.3 Level of Patients Satisfaction :

Patients satisfaction is the expectation of receiving attention from the provider for medical care and the proportion of fulfillment. It is quite reasonable that satisfaction brings people to utilize health services and if the situation is satisfactory, compliance result and satisfaction increases and determines the quality of medical vices. Dissatisfaction is a barrier to future utilization.

Pope (1978) has measured the overall satisfaction of hospital services by summing the mean rating for those item which include a) technical quality and competence b) access to the system for routine care c) access to the system of acute need d) cost in relation, to

Computation of these items may reflect the items available which may contribute for satisfaction, but whether the patients availed these items or facilities and become satisfied or not, it can be measured by interviewing the discharged patients through questionnaires putting some value which is described diagrammatically as:



If the value is  $< 3$  then the patient is dissatisfied, if the value is  $\geq 3$ , then the patient is satisfied.

The above parameters are cost and time related events, in addition it is necessary to have a quantifiable medical indicators relating to quality of care as a function of each time parameters.

#### 4.4 Medical Indicators and measurements

Due to the overutilization of hospital beds the excess patients are to stay on the floor, which is dusty and unhygienic. Moreover, the overcrowding, contact of nurses, common use of blankets there is every chance for cross infection. In general also, the longer the stay in hospital for whatever reason, the greater the chance of Thrombo-embolism.

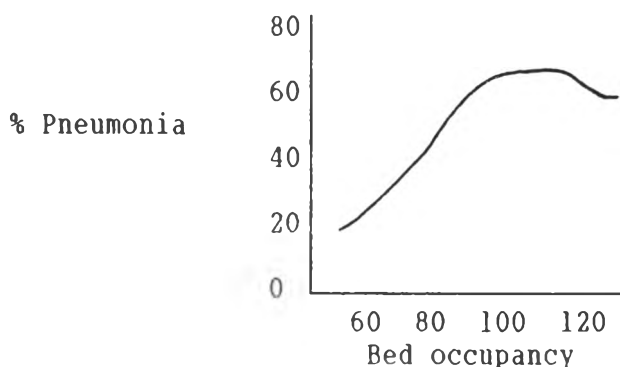
In the case of the patients with similar illness, who are staying on the floor the patient has an increased risk of nosocomial infections such as, a) drug resistant staphylococcus pneumonia b) post operative surgical infections; c) thrombosis / embolism relates primarily to length of stay, whether in bed or on the floor. These three classes of complications can thus be used as disease indicators of quality of care. For measurement of impact the methodology already discussed can be applied for both acute and chronic cases.

The impact of overutilization can be measured when the hospital is 100% utilized and when a hospital is under or overutilized, then what is the difference. The difference between quality of care of underutilized hospitals and 100% utilized hospital can be considered as impact of underutilization.

The impact can be measured and quantified by the following graphical representation based on hypothetical data.

### Drug Resistant Staphylococcal pneumonia:

Figure 4.2 Bed Occupancy and Percentage of Pneumonia

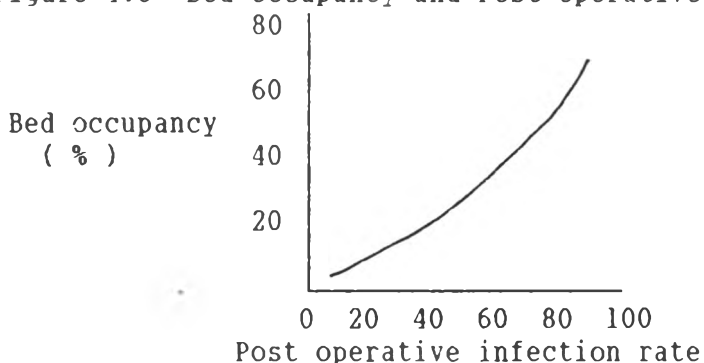


The graphical representation shows that, there is a greater chance of developing drug resistant staphylococcal pneumonia in the underutilized hospital due to increased probability of cross infection. Thus this can be used as a general indicator of quality of care in relation to utilization pattern.

### Post operative surgical wound infection :

Due to the overutilization of hospital services the quality of care will decrease and the rate of infection will increase through the blankets or unhygienic behavior of the nurses who are exposed to patients all the time. Hand washing may reduce the rate of cross infection, but under crowded conditions may be inadequate.

Figure 4.3 Bed Occupancy and Post operative infection rate



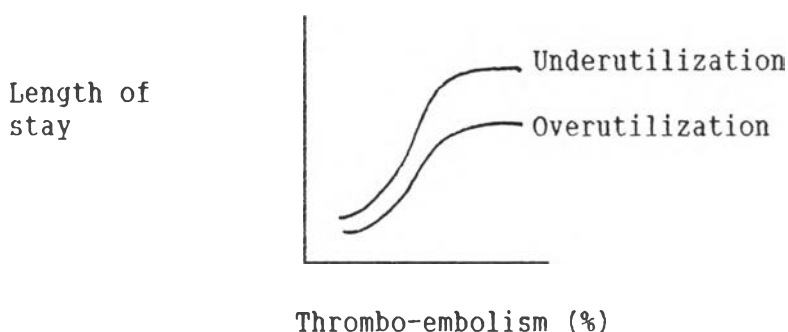
As a result of the wound infection, length of stay will subsequently be prolonged, but the rate of wound infection can be used as the measure of quality of care in relation to utilization rate.

### Thrombosis / Embolism :

In general, the longer the stay in hospital, for whatever reason, the greater the chance of developing thrombo-embolism. Thus it may be that under conditions of underutilization the length of stay is longer; the chance of this complication is increased in patients of old

age.

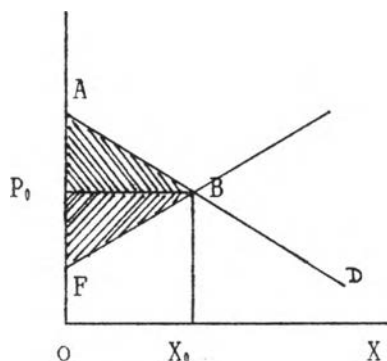
Figure 4.4 Length of Stay and Percentage of Thrombo-embolism



#### 4.5 Economic Solutions of the Problems

Consumers surplus is a very important concept in economic theory, especially in welfare economics.

Figure 4.5 Consumer Surplus and Producer Surplus.



The consumer surplus is represented by the upper shaded area, lying beneath the demand curve D, but above the horizontal line  $P_0B$ . The general intention is to show their desired units at the ruling price  $P_0$ ; when they would have been willing to pay higher prices for smaller number of units. Producer surplus is the lower shaded area, lying above the supply curve S, but below the horizontal  $P_0B$ . It shows the net gain to producer-seller of receiving a price as high as P, when they would have been willing to supply smaller number of units at lower prices.

The concepts of demanded price are useful here. For the price charged is only  $OP_0$  - hence the consumer surplus of  $OA - OP_0 = AP_0$  gained on the first unit bought. Extending the argument of all successive units suggests that, at  $X = X_0$ , the sum of successive demanded prices is roughly triangular area  $AP_0B$  is the consumer surplus. A corresponding argument applies, of course, to producer surplus which are represented by the area  $FP_0B$ .

Consumers surplus = What a consumer is prepared  
to pay - what he actually pays.

In Thana health complexes and the District hospitals the services, supply of drugs, laboratory investigations are free of charge. Most of the people are staying at the rural areas where Thana health complexes are located. Naturally it is presumed that the people will consume more services from the Thana health complexes, but in practice they do not utilize the services there and these hospital remain underutilized. Whatever might be the utilization rate, the government has to pay the salary of doctors, nurses and other staff in full, the drug cost, laboratory investigations, administrative cost, diet cost, cost for repair and maintenance of hospital buildings and equipments. All these hospitals are 31 bedded, but the occupancy rate 52% on average, that is only 16 beds are occupied on average. The budget allocation in these hospitals are uniform and irrespective of bed occupancy, as a result the total amount allocated for 31 beds are practically spending for 16 beds on average. It will indicate that, in comparison to budget, these are wastage to the government.

The District hospitals are situated in urban areas and the patients mainly come from the rural areas which are far away, involving the cost of drugs, transportation cost of the patient, his/her relatives/attendants, cost of food, accommodation etc. Moreover due to the overutilization of District hospitals, patients admitted in the hospital beyond the bed capacity are to stay on the floor, which is dusty and unhygienic, subsequently due to the stay on the floor there is probability of secondary infection. As a result the treatment cost, cost for food, cost for accommodation, wage lost of the patient and their relatives becomes high, which is a wastage to the patient. When due to the secondary infection the patient stays in the hospital for long time, in that case the hospital is to provide more services of doctors and nurses, drugs, diet, which is a wastage, to the government. This can be measured through empirical study by collecting data from the recently discharged patients.

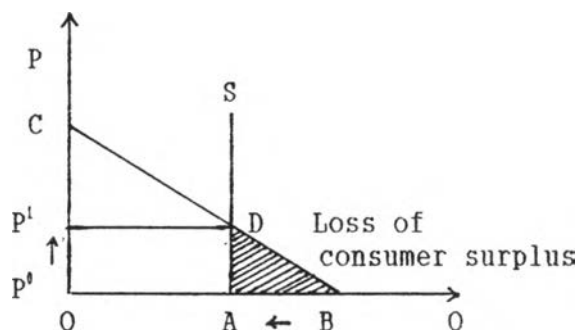
Considering the above, the problem can be solved in two ways  
a) by imposing fee for registration or drugs, which may lead to shift the utilization from District hospital to the Thana health complex, and  
b) by introducing insurance policy for the rural people, which can share the financial risk and will ultimately increase utilization rate at Thana health complex. A detailed empirical study can be done on the feasibility of these two aspects.

The first solution is based on price mechanism. The government can impose some fee in the District hospitals in the form of registration fee, or fee for drugs, which can be recovered from the patient. This fee will divert demand from District hospital to Thana health complex, and therefore, shift the demand for Thana health complex upward.

The increase in fee for District hospital services may decrease consumer surplus while the upward shift of demand for Thana health

complex increase the consumer surplus. Policy makers may choose the point at which the net gain in economic welfare, consumer surplus + producer surplus is maximum.

Figure 4.6 Increase in price and decrease in Consumer Surplus.



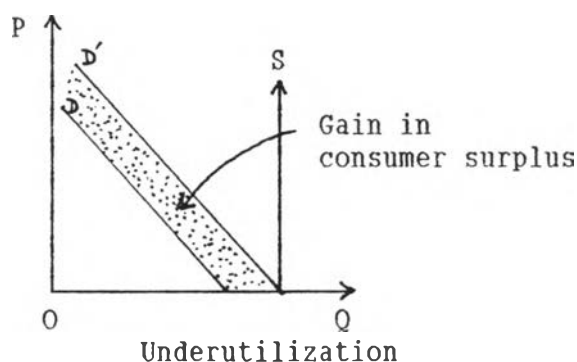
Before: No producer surplus  
Consumer surplus =  $CP^0B$

After : Producer surplus =  $P^0P^1DA$   
Consumer surplus =  $CDP^1$

$$CP^0B = CDP^1 + P^0P^1 + DAB$$

The figure 4.6 shows the increase in price and decrease in consumer surplus. When the price is  $P^0$  there is no producer surplus, but the consumer surplus is  $CP^0B$ . When there is an increase in price from  $P^0$  to  $P^1$  the producer surplus is  $P^0P^1DA$  and consumer surplus decreases to  $CDP^1$ , while the  $DAB$  portion is the loss of consumer surplus. The increase in price of services from  $P^0$  to  $P^1$  could be registration fee or higher fee for drugs.

Figure 4.7 Upward Shift in Demand an Increase in Consumer Surplus

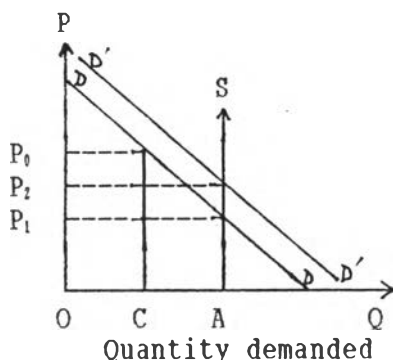


The above Figure 4.7 shows the inelastic supply of hospital services and the price is fixed. The demand for service will increase and the demand curve will shift upwards, which represents the increase in consumer surplus. The increase in consumer surplus is good for the

community, but in the case of hospital utilization it is not necessary good, when the fee is imposed in the District hospital the demand for service will increase in Thana health complex and the consumer surplus will decrease.

The second solution is equivalent to a subsidy to rural patients. The major function of insurance is to reduce financial risk. The mechanism of doing that—lowering the price of medical care—produces a side effect to increase demand for medical care. If medical care obeys the normal laws of economics, people with a health insurance policy should pay less when they utilize the service of Thana health complex and thus this would increase the utilization of Thana health complex. However, there are some people who usually do not utilize hospital services for minor illness. When the insurance scheme is applied, they pay for insurance and once they pay for insurance they take it as a matter of right to get the services. Then they utilize more services. Thus, the insurance scheme will induce more demand and will shift upward the demand curve. It will help in increasing utilization of Thana health complexes and thus will reduce the wastage for both provider and the consumer as well.

Figure 4.8 Increase in utilization due to Insurance.



This Figure 4.8 is a diagrammatic representation of the effect of insurance on the underutilization of hospital services at the Thana health complex. Initially the price is  $P_0$ , and the underutilization is CA. If price of service decreases from  $P_0$  to  $P_1$  through insurance, the utilization will rise from OC to OA, where AS is the supply of hospital services. The upward shift in demand from D to D' is produced by the secondary impact of insurance scheme which leads to a higher price at  $OP_1$ .

#### 4.5 Estimation of Demand and Supply

The previous section discusses the economic solution of the problem. This requires the estimation of the demand and supply of health care services. The quantity demanded for hospital service may be determined by using the model:

$$Qx = \beta_1 + \beta_2 Px + \beta_3 p_0 + \beta_4 wt + \beta_5 y + \beta_6 d + \beta_7 s + u$$

Where,



$Q_x$  = Quantity demanded.  
 $\beta_i$  = Regression coefficient,  $i=1,2,3,\dots,7$   
 $p_x$  = Price of hospital services.  
 $p_o$  = Price of other hospitals.  
 $w_t$  = Expected waiting time.  
 $y$  = Income.  
 $d$  = Distance or Transportation cost.  
 $s$  = Satisfaction.  
 $u$  = Error term.

The quantity demanded in respect of hospital services depends upon the price of hospital services, price of other commodities, expected waiting time, income of the consumer, distance or transport cost and satisfaction of the patient. When the price of hospital services, price of other commodities, expected waiting time increases there will be a small decrease in demand and the relationship is negative. When income and the satisfaction of service increases, the quantity demanded will also increase, there is a positive relationship. When the distance of hospital increases, it is predicted that the people will demand less quantity but in hospital services the people goes to the distant hospital and demands more service.

Where  $\beta_0$  is the intercept and  $\beta_i$  ( $i=1$ ) is the slope which determines the impact of an increase or decrease in the value of the independent variables on demand and supply. For example, quantity demanded ( $Q_d$ ) depends upon the price of hospital services ( $P_x$ ). A one unit change in the price of hospital services ( $P_x$ ) will change the quantity demanded by  $\beta_1$  units. If the value of  $\beta_1$  is positive the quantity demanded also increases with the increase in  $P_x$ . When the value of  $\beta_1$  is negative the quantity demanded will decrease, when the price of hospital service increase.

Therefore,  $\beta_1$  explains the impact of the changes in other variables on quantity demanded.  $\beta_1$  explains a movement along a demand curve, i.e., the impact of the price of hospital services on demand for hospital services. All other  $\beta_i$  ( $i=1$ ) explain how the demand curve shifts upward or downward.

While the sign of  $\beta_1$  explain the direction of the change the absolute value of  $\beta_1$  explain how sensitive is quantity demanded to the change in price. For example, if  $\beta_1 = 100$ ,  $Q$  is very sensitive to price change and when  $\beta_1 = .001$ ,  $Q$  is not very sensitive to price change.

Similarly the supply of hospital care services can be determined by using the model :

$$S_x = \beta_0 + \beta_1 P_x + \beta_2 T_x + \beta_3 n_x + u$$

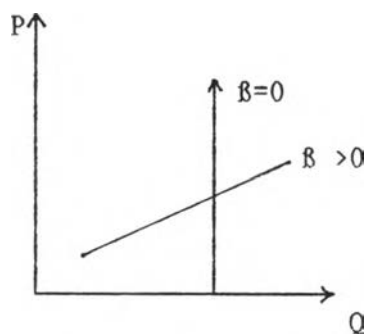
Where,

$S_x$  = Supply of service.  
 $\beta_i$  = Regression coefficient,  $i=1,2,3,4$   
 $P_x$  = Price of hospital services.  
 $T_x$  = Technology of service.  
 $n_x$  = Number of health care providers.  
 $u$  = Error term.

The supply of hospital services depends upon the price of hospital services, technology of services, and the number of health care providers. When the price of hospital service, technology of service, and the number of health care providers increase the supply of hospital services will increase, it has a positive relationship.

The role of  $\beta_1$  and  $\beta_i$  ( $i \neq 1$ ) is similar to that in the case of demand. Moreover, the absolute value of  $\beta_1$ , which explain the sensitivity of a change in price on the change in supply, can also indicate whether the supply is a short run or a long run. While in the long run the hospital bed may be increased because of an increase in price, but in the short run the beds cannot be increased. These two situations can be explained by figure 4.6.

Figure 4.9 Long run and Short run Supply.



The upward sloping supply curve with high value of  $\beta_1$  explains long run supply curve. The vertical line, of which  $\beta_1 \rightarrow 0$ , explains the short run supply curve.