



CHAPTER 3

LITERATURE REVIEW

One of the problems facing in health care system today is the inappropriate distribution of high medical technologies. To reach the goals of Health For All by the year 2000 health care sector must be implemented cost- effectiveness, especially given the optimal scale of medical technology in developing countries (Creese and Parker, 1993).

The WHO Regional Office for Europe defined target 38 as: "... all member state should have established a formal mechanism for the systematic assessment of the appropriateness use of medical technologies and of their effectiveness, efficacy, safety and acceptability, as well as reflecting national health policies and economics restraints."

In general, modern medical technology is upgrading medical technology for better diagnosis and treatment of disease is an ongoing world wide endeavor. The motivation is tempered by rising health care cost over 7.5 % per capita per year in the industrially developed countries (Canada , France , The Netherlands , UK and USA). (Side man ,1993)

The rapidly rising costs of health care become the most impossible health policy issue in many countries during the 1980s and early 1990s. The definition of health care technology - the drug , devices and medical and surgical procedures used in medical care for better prevention, diagnostic, treatment and rehabilitation. (OTA, 1988).

3.1 The diffusion of medical technologies.

Diffusion is the state of adoption and use of technology. As a new technology appears to be of value, clinician begin to use it and patient begin to ask for it. Diffusion may culminate with the technologies attainment of an appropriate use or with the technologies abandonment, either because it was of no value or because a more effective technology as be developed. The technology also used too much or too little, as often seem to be the case.

In many countries , new medical technology are rapidly adopted and put into widespread clinical practice on the assumption that they will improve the capacity to diagnose and treat some disorders less invasively, more quickly , and with better outcome. At the same time, health care expenditure in developing countries have increase at twice the rate of their respective gross domestic product (GDP) in the last 20 years. (Lazaro, 1995).

Health care technologies assessment - the application of the field of technology assessment to health care. Health care technology assessment is particularly concerned with efficacy (benefit) and safety of health care technology. Financial costs are also often evaluated in health care technology assessment. (Brook ,1990).

Health care technology and health care assessment are international issues, not only because of the globalization of markets but also for many other reason. Stoddard and Feeny 1986 have provided summary of the existing behavior pattern . with decision determine how technology will be use.

Technology is also associated with system issues and problems (Serpa Florez , 1993). New technology leads to specialization. X-rays led to the specialty of radiology. The ophthalmoscope led to the specialty of ophthalmology. Specialists tend to practice in hospitals, grouped in their own department. They may pay little attention to the patient as a person on the entire illness situation.

Thus, as medical care become more technical, it may also become more fragmented and more impersonal. Needs for training increase. More resources go to address specialized problems , and fewer are available for such activities as prevention and primary care. To the present, technology also been associated with centralization of the health system into large hospital. (Fitch ,1995)

3.1.1 Medical technology diffusion in developing countries

Developing countries do not develop their own technology. One important reason that their investment in health-related research is low. A study in 1979 found that one of third of the world's research and development budget was invested by the USA and about one-third by Western Europe and Japan combined. Six countries - the former Federal Republic of Germany , France , Japan , the United Kingdom , the USA and the former USSR employed nearly 70 % of the world's research and development man power and spent nearly 85 % of research and development funds.

Furthermore, development of pharmaceuticals and medical equipment is now dominated by giant multinational firms based mostly in the United States , Japan , and Western Europe. For example, 70 % of the world's pharmaceuticals are produced in the industrial capitalistic countries.

The process of transferring technology from the place in which its originated to the place where it is applied is referred to as technology transfer. Technology transfer takes place between government, academic and private institutions, and producers. In the case of health care technology, the point of application is the health care system. The health care technology may be a procedure in which knowledge and skill are the critical elements. It may, on the other hand, be a machine or a drug, but the important point to remember is that technology always includes a "software" element; a machine is of limited value when personnel are not trained in its use.

Effective technology transfer has been described by Teece, in an article by de Bettignies, as "a process of transferring from one production entity to another the know-how required to successfully utilize a particular technology".

When technology is transferred from developed to developing countries, special problems are raised. Perhaps the most important point is that less developed countries are technology dependent. Their capability for developing technology is limited and their local industrial weak. Furthermore, and in part because of these facts, they lack the expertise and information sources to identify needed technologies. The technological infrastructure is often lacking, so the importing countries must develop the capability to absorb and productively utilize foreign technology. Finally, developing countries obviously have serious problems because they are poor.

Despite these difficulties, technology transfer for industrial countries to less developed countries is critically important. Technology

applied knowledge is the path to a healthier population, whether the technology is a vaccine, a diagnostic tool, or a surgical procedure. This is a time of rapid technological change, and health care technology is becoming both more effective and more cost-effective. Less developed countries may be left even further behind if concerted efforts are not made to assure technological change in their health services.

Because the health care resources of less developed countries are seriously limited that is importing technology needs to ask a series of questions. What technology is available and what technology is in course of development? How can the technology be acquired and what it will cost? What effect will the technology have on health and on the health care system itself? What training, supportive systems, and so forth are necessary for the efficient implementation of the technology? And, will the technology be socially and culturally acceptable?

The answers to these questions and other related questions- are available to through the work performed in the field of technology assessment. Indeed, technology assessment was developed precisely to answer policy questions.

The World Bank has proposed that decision should be based on the predicted disability-free life years in relation to the proposed investment. That is to say, decision should be based on a form of technology assessment. The Bank has correctly observed that debates about the structure of health care or the mix of services are at bottom "debates concerning the proper mixture of interventions". The proper mixture to achieve value for money in health care can be determined only by formal study if the benefits and costs of technology.

Obviously, technology assessment must be adapted to the situation of the developing country. Because of the differences between the situations of developed and developing countries, technology assessment should be less of a technology-oriented activity in a developing country and more oriented to solving problem. It should, for example, the advanced and capital intensive technology is also transferred to developing countries, especially to the larger hospital, and it too must be assessed.

Developing countries may initiate their own technology transfer activity by purchasing certain machines, sending personnel abroad for specific training, or inviting outside expert to advise them. Technology transfer, however is often carried out by non-governmental organization or through bilateral or multilateral aid.

At present, developing countries lack many important health care technology. Annual per capita expenditure for medical equipment is around \$ 18,000 in the United States, \$ 92 in Japan and \$ 53 in countries

of the European Union but only \$ 12 in Asia and less than \$ 1 in sub-Saharan Africa.

Table 3.1 compare developed and developing countries on several important hospital based technology. As can be seen, for these five technologies, from 66 % to 90 % of the world's supply is concentrated in the industrialized countries that account for only 16 % of the world's populations. Japan and the USA alone account for 70 % of the world's magnetic resonance imaging (MRI) devices. Table 3.2 present data on selected technologies and selected countries.

Table 3.1 Percentage of the world's supply of selected hospital technologies by country, 1990

	CT	MRI	ESWL	CU	LA
Japan	35.1	20.0	20.2	10.4	11.2
USA	35.0	52.5	23.2	21.1	45.3
EU	6.2	13.6	14.5	24.8	16.3
OECD	88.2	90.2	73.8	66.5	78.3
Non-OECD	11.8	9.8	26.2	33.5	21.7

Note EC = European community

OECD = organization for economic co-operation and development

the 24 OECD member countries in 1990 were Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States

CT = computed tomography scanner ; MRI = magnetic resonance imaging scanners; ESWL = extra corporeal shock wave lithotripsy; CU = cobalt radiotherapy units; LA = linear accelerators.

Source: Lazaro,P. (1992)

Table 3.2 Number and frequency of magnetic resonance imaging scanners, selected countries, 1990

	Number	Unit per million populations	Million population
Australia	11	0.6	17.086
Canada	20	0.7	26.620
China	23	0.02	NA
France	70	1.2	56.437
Germany, Fed, Rep	143	2.3	63.074
India	17	0.02	997.0
Japan	800	6.5	123.5
Mexico	16	0.2	NA
Netherlands	14	0.9	14.940
United Kingdom	55	0.9	57.408
USA	22076	8.4	259.60
Sweden	12	1.5	8.566
Thailand *	27	0.45	60.0

Note * modified in 1997

source : Lazaro, P. (1992)

MRI has diffused rapidly in the United States. Over 2,700 in patient and out patient MR scanner's are in clinical used. Through the 1980s and into the 1990s the number of MRI installations has grown, utilization rate have increased, efficiency has improved, and expenditures for the procedures have continued to rise. (Mushlin ,1994).

The total number of MRI units available in Japan relative to the population is the highest in the world. The total number of MRI units installed in 1996 (Korogi Y, Takahashi M) was 2,663 , equivalent to 6.5 per million population. As such, an increase in the number of MRI units per population unit does not result in excessive health care costs.

The average charge per procedure in Japan is only one fifth of that in the United States (USA), approximately US\$ 200 and US\$ 950, respectively, suggesting that economic considerations in Japan may not take the highest priority. Despite the low costs, the utilization (the number of patients examined each year of per week) of MRI in Japan is only about half that in the USA.

3.1.2 Factors affecting medical technology diffusion

Influencing technological change in health care means developing policy that affect diffusion of technologies. To affect the diffusion of diagnostic technology such as the CT scanner would be of little use without the knowledge of anatomy and pathology that was developed.

Another example from the United States concerns the Diagnostic Related Group (DRG) system for hospital reimbursement under Medicare, established in 1983. This system more toward a fixed budget, which gives technology assessment a greater possibility of assisting in policy decisions toward which technology to provide and in what intensity. The DRG registration set up a Prospective Payment Assessment commission to advice on over all rates and content of specific DRGs. The commission was also given wide-ranging powers to assess and make recommendations concerning health care technology. This is a direct tie between technology assessment and decision-making in the health care service program. The DRG program has certainly changed the patterns technology adoption and use in the United States. (WHO ,1997)

Impact of technological changes on the health care have had the following impacts :

a) Rising health expenditures. New technologies imported for curative care are generally expensive as they are patented. Their use is normally complicated and unknown dangerous side effect have to be prevented. As a result the health expenditure is rising.

If such technologies are inappropriately used, it would be uneconomical. Besides, an investment is required for personnel development so that the equipment will be efficiently used. Properly trained personnel will help to make diagnoses faster and easier, and to facilitate curative procedure.

b) Inaccessibility to health services. The urban and rural people may not be able to have access to such expensive services with new technologies.

3.2 Utilization of medical technology

In case of medical technology utilization, the demand for medical technology the amount of it that a consumer will purchase or will be ready to take off from the market at a various given prices at a moment of time. This demand in economics implies both the desire to purchase and the ability to pay for medical technology services.

Demand for medical technology determines by several factors, such as, changes in the price of the related technology, income of the people, the number of consumer in the market tastes and preferences of the consumers, income distribution, changes in propensity to consume, consumers expectation with respect to future price.

1) Demand for medical technology:

The law of demand expresses relationship between price and quantity demand. The law of demand or functional relationship between price and quantity demanded is one of the best known and most important laws of economic theory.

According to the law of demand, other things being equal, if the price of a commodity falls, the quantity demand of it will rise and if the price of a commodity demand rises, its quantity demand will decline. When the price of a commodity falls, the consumer can buy more quantity of commodity with his given income.

2) Elasticity of demand for health technology:

Consumers of certain health services, such as hospital and medical technology are not very responsive to price changes, because the consumption of the hospital services are unpredictable, uncertain and unavoidable issue, when a persons gets sick, he wants to get relieve from pain and wants to get cure at any price. When a person is able to pay having no sickness, he does not consume hospital services, whatever low may be the price. An increase in price will not reduce the quantity demanded very much, and a decrease in price will not increase it much. In other words, the elasticity of demand in health care services are low or inelastic.

Figure 3.1 Demand for health care technology

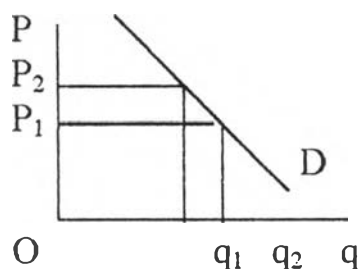


Figure 3.1 Illustrates the impact of price change on demand. An increase in price from p_1 to p_2 decrease quantity demanded from q_1 to q_2 . Suppose p_1 and p_2 are US\$ 4 and US\$ 5 respectively, for a visit to a doctors office and that q_1 and q_2 are ten visits and nine visits respectively, per month. An increase in price of 25% [$(4-5) / 4$] reduces the number of visits to the doctors office from ten to nine visits per month - a ten percent decrease in quantity demand. The price elasticity is less than <1 .

3) Other determinants of demand:

Demand schedule and the law of demand state the relationship between price and quantity demanded by assuming “other things remaining the same” when there is a change in these other things, the whole demand curves undergone a change. In other words, these other things determine the position and level of demand curve. As a result of the change in these factors or determinants, the demand curve will shift to the left or right as the case may be. The following are the factors which determine the demand of goods or services.

4) Changes in the prices of related goods:

Demand for a good is also affected by the prices of other goods especially those which are related to it as substitutes or complements. When we draw the demand curve for a good we take the prices of related goods as remaining constant. Therefore, when the price of related goods, substitutes or complements, change the whole demand curve would change its position ; it will shift upwards or downwards as the case may be. When the price of substitute rises, the demand for that good will increase.

For example, when the price of the CT-scanned falls, the consumers would demand less of MRI than before. MRI and CT-scan are very close substitutes, therefore when MRI becomes cheaper, the consumers substitute MRI for CT and as a result the demand for CT declines. The goods which are complementary with each other, the change in the price of any of them would affect the demand of the other. When the price of treatment in private hospital falls, the demand for them will increase which in turn will increase the demand of drugs.

3.2.1 Concept of demand and supply of medical technology utilization

In case of medical technology the demand is determined mainly by a) consumers income b) consumers taste and choice c) number of consumers in the market , while the supply of hospital are fixed, but the hospitalization is uncertain event. The patient need better hospital services, in that case demand is determined by taste and choice. When the

patient on the consumer has high income, they want to get the better services.

From the above it is clear that the quantity of demand for medical technology is determined by some important factors such as, the price of hospital services price of other commodities, expected waiting time, income of the patient or parents of the patients, distance from hospital, and the quality of service (in case of new medical technologies)

a) Income of the people

Demand for goods also depend upon the income of the people. The greater the income of the people, the greater will be their demand for goods. In drawing the demand schedule or the demand curve for a good we take incomes of the people as given and constant . The greater income means the greater purchasing power. Therefore, when the incomes of the people increase, they can afford to buy more. It is because of this reason that the increase in income has a positive effect on the demand of a good.

When the incomes of the people fall they would demand less of the goods and as a result the demand curve will shift to the left. For instance, during the economic crisis period in Thailand, the incomes of the people have greatly decreased owing to the expenditure on the government and the private sector. With an increase be income the people will shift their demand for hospital service from public hospital to private hospital.

b) Taste and preferences of consumers

An important factor which determines the demand for a good is the tastes and preferences of the consumers for it. A good for which consumers tastes and preferences are greater, its demand would be large and its demand curve will lie at a high level. People's tastes and preferences for various goods often changes and as a result there are changes in demand for various goods due to change in fashion and also due to the pressure of advertisements by the manufacturers and sellers of different products.

In respect of hospital care the demand is determined by the taste and preference of the consumer in respect of quality of care, accessibility, availability of *modern equipment, technology*.

c) Number of consumers in the market

Market demand for good is obtained by adding up the individual demand of the present as well as prospective consumers or buyers of a good at a various prices. The greater the number of consumers of a good, the greater the market demanded for it. Now the question arises on what factors the number of consumers of a good depend.

If the consumer substitute one good for another, then the number of consumer of that good which has been used in place of the other, the number of consumer will increase. Besides, when the seller of a good succeeds in finding out new market for these goods and as a result the market for this good expands, the number of consumers of those goods will increase. Another important cause of the increase in the number of consumers is population growth.

d) Income distribution

Distribution of income in a society also affects the demand for goods. If the distribution of income is more equal, then the propensity to consume of the society as a whole will be relatively high which means greater demand for goods, such as consumer goods like medical technology. On the other hand, if the distribution of income is unequal, then the propensity to consume of the rich people less than that of the poor people.

Consequently, which more unequal distribution of income, the demand for consumer goods will be comparatively less. This is the effect of the income distribution on the propensity to consume and demand for consumer goods. But the change in the distribution of income in the society would effect the demand for various goods differently.

If progressive taxes are levied on the rich people and the money so collected is spent on providing employment to the poor people, the distribution of income would become more equal and with this there would be a transfer of purchasing power from the rich to the poor. As a result of this, the demand for good which are generally purchase by the poor will increase and, on the other hand, the demand for those goods which are usually consumed by the rich will decrease.

e) Change in propensity to consume

People's propensity to consume also affects the demand for them. The income of the people remaining constant, if their propensity to consume rises then out of a given income they would spend a greater part of it. With the result that the demand for goods will increase.

On the other hand, if the propensity to save of the people increases, i.e. the propensity to consume declines, then the consumer would spend a smaller part of their income on goods with the result that the demand for good will decrease. Therefore, with income remaining constant, change in propensity to consume of the people will bring about a change in the demand for medical technology.

3.2.2 Factors affecting medical technologically utilization

Medical technology utilization is affected by two sources, on the supply side, an increase in the number of technology could significantly alter both the admission rate and the average length of stay i.e, medical technology utilization. On the demand side, the utilization depends on some factor such as patient factor, the provider factor, and organizational factor.

This is supported by Anderson (1973) who described four sets of factors influence the utilization of health services.

The first set arises from demographic characteristic of the population such as age, race and income. The second set has to do with organization of health services. Ecological factor such as distance comprise the third set, while psychological factor such as the influence of friends and neighbors make up the fourth set of variables.

In some, factors have influence over medical technology utilization are a) medical technology to population ratio b) unemployment c) income of the people d) education e) different age group f) migration of the people from rural to urban areas g) ethnic composition and h) urbanization. These are described below

a) Unemployment:

Unemployment has effect on income and limited job opportunities have lower per capita income level. This affects the ability of person to pay for hospitalization.

Countries with limited job opportunities which have lower per capita income levels. This effect the ability to pay for hospitalization. Moreover, fewer health services are generally available in area experiencing severe unemployment problem (Anderson 1973). So, unemployment and lower income has some affect with hospital utilization.

b) Income:

The admission rate among the lowest income group is slightly higher than the higher income group and the median family income is the important predictor to hospital utilization.

Anderson (1973) referred to Andersen and Anderson (1967) who studied the relationship between, variation in the relationship of hospital admission rate to family income overtime. They found that the admission rate among the lowest income group had a slightly higher than the higher income group, specifically median family income, to be an important predictor of medical technology utilization rates.

c) Education:

Education has been found to be related to technology utilization. In fact education makes one conscious about health and may receive hospital services in the outpatient department, but the medical technology utilization also depends on the advice of the physician, nature and severity of illness, etc. Education alone may not be responsible for medical technology utilization. Average use rate also depends on the nature and severity of illness. So, the medical technology utilization may have some association with the education.

Education is also associated with the other variables. Income and employment opportunity increased markedly with education. Also hospitals are more likely to be located in areas where the population is better educated and resources are available to support various health services (Anderson 1973).

d) Age:

Age is important determinant for medical technology which utilization rate among the elderly is high because of less immunity the elderly get sick frequently, but most of the elderly suffer from chronic diseases like diabetes, hypertension. These patients do not stay in the hospital longer and the length of stay in the hospital is shorter.

Anderson (1973) referred to study of Andersen and Anderson (1973) found that hospital admission rates and patient hospital days rose appreciably for the elderly, while during the same period admission rate declined among children.

e) Migration:

Migration of people to the urban area is the cause of over population which resource in low housing condition and malnutrition and leads to some diseases and utilization of medical technology.

Population changes resulting from migration also have important effects on the variables like education, income, employment and age. Countries that experience out migration for long periods of time tend to have older, poorly educated population. Income level are generally lower among persons residing in these countries as are the level of health services available to them.

f) Ethnic composition:

Anderson (1973) referred to the study of Feldstein and Germann on ethnic composition and medical technology utilization, they found that the ethnic composition of population also has a major effect on technology

utilization. This finding reflects differences in education, income, and availability of health services among others.

g) Urbanization:

Percentage of urbanization is an important characteristic of the population that affects the use of technologies. In the urban areas, the percentage of able and adult people are more than the children and elderly people, they have more education, income as a result they utilize less medical technology.

Differences in utilization rates are also apparent between rural and urban areas. The lowest utilization rates occurred among people residing in urban areas.

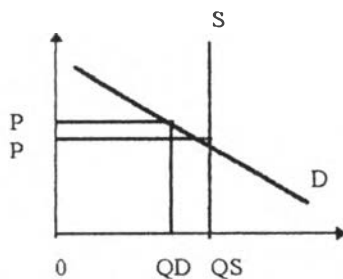
Planning hospital facilities requires prediction of future patterns of utilization. Medical technology utilization can be measured by many indicators such as medical technology to population ratio, the number of patient days which use medical technology, but this proportion does not indicate the utilization of medical technologies. The new supply of new medical technology brings change in demand until an equilibrium is reached with the utilized rate. This is supported by Shain and Roemer (1959) and Anderson (1973). The study presented the data indicating that technology utilization within a state as well as costs are strongly related to the supply of medical technology to the population.

For the medical technology utilization, the number of patient days per medical technology have also been used as an indicator of the use of general hospital facilities.

3.2.2.1 Underutilization

In terms of demand and supply, when the supply is greater than the demand, in respect of medical technologies, the supply of technologies are greater than the demand and technologies are utilized less than the technology capacity, may be treated as underutilization.

Figure 3.2 Underutilization of medical technologies.



source : Were .P , 1985

The above figure 3.2 shows that the medical technology on the quantity of technologies supplied are greater than the demand i.e, the demand for medical technology is less than the technology capacity P price the utilization would be 100 %.

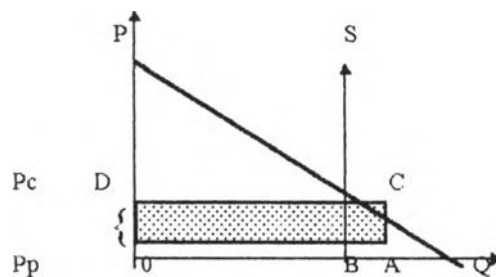
Impacts of underutilization :

As a result expenditure per treatment becomes high, which is a wastage from the provider side.

3.2.2.2 Overutilization

In terms of demand and supply whenever there is overutilization, it means that demand is greater than supply. In this case, service supply of technologies in the hospital can vary many technologies but generally technology, which is fixed and the demand is more than the technology capacity, which may be treated as overutilization.

Figure : 3.3 Overutilization of medical technology



- Transaction cost
- OACD = Total transaction cost
 OA = Total patients
 OB = Number of ordering
 AB = Patients on the floor
 OD = Transaction cost per patients + opportunity cost per patients

source : Were P., 1985

The above figure 3.3 shows that due to the utilization of medical technology, OACD is the total transaction cost for OA number of patients . OB number of patients remaining on technology and AB number of patients remain on floor , who overutilize the medical technology. So, overutilized portion is $AB = OA - OB$. P_p represents the price of the patient, in respect of hospital services the $P_p = 0$, when P_p increases to P_c the transaction cost increases and the consumer surplus decreases.

Transaction cost : Transaction cost is mainly the hospital fee, cost incurred by patient and accompanying relatives, transportation cost, cost for drug, cost for food. Loss of income or wages of patient accompanying

relatives or attendants, opportunity cost, etc. Most of the patient do not have to pay this cost. Therefore, O_{ACD} = consumers cost of overutilization.

Impacts of overutilization :

The consequent of overutilization is a barrier to failure utilization, the reasons for cost ineffectiveness of treatment, and unnecessary x-ray or treatment procedure (Were et al , 1984)

The factors that influence persons to become patients and utilize a health care system can be classified into five broad categories. This is health status and need, demography characteristic, physician availability, organizational characteristic of health care services and financing mechanisms (Anderson,1968).

In general one would like to concentrate modifiable factors, the alteration of which would influence utilization patterns. The objectives were to improve access to health care availability of services in order to increase utilization. The goal to increase utilization, both quantitatively and in relation to need, was successfully met by several means. The first was a financing mechanism, e.g., Medicaid. The second involved organizational changes such as neighborhood health centers with and expanded spectrum of services including outreach programs. The third was an increase in resources e.g., physicians, nurse practitioners and physician assistants (Hulka and Wheat ,1985).

Measuring medical technologies utilization :

There are many standard measures of utilization. Hulka and Wheat (1985) referred to Mauran and Eichhorn (1981) who listed more than 100 different indices or independent variable that have been used to measure. At least some aspect of utilization are determined by two sources of care : outpatient care and inpatient care.

For the MRI utilization, the number of patient days per million population have also been used as an indicator for the use of general hospital facilities. (Anderson, 1973)

Health status and need for medical care :

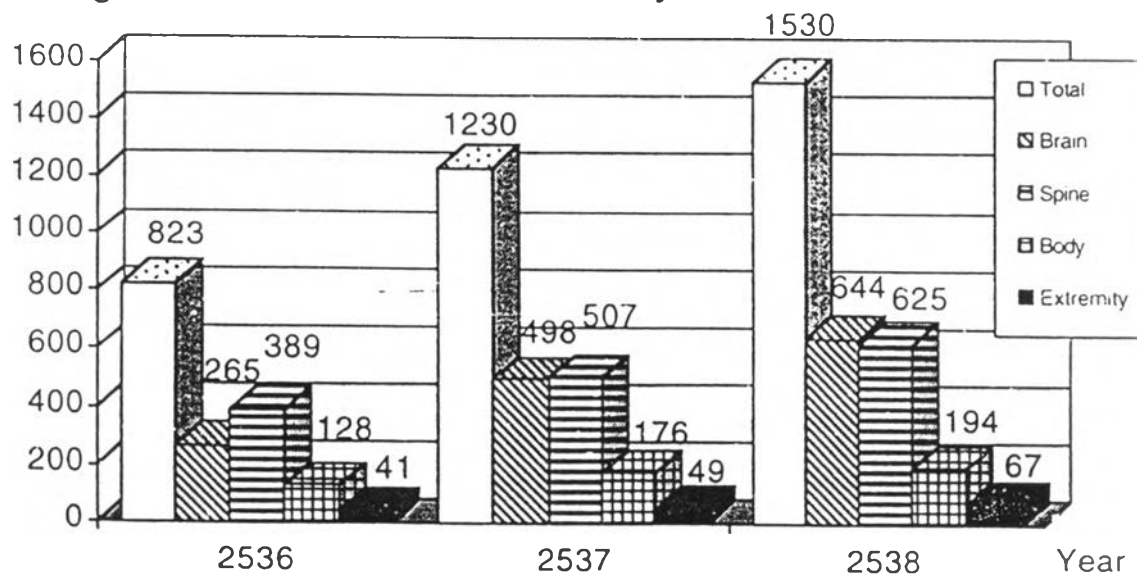
Anderson (1968), found that health care need is dependent on some factor which are related to illness, family resources, medical facility and manpower, demographic characteristics such as age, social class and race. Theoretical models of utilization of medical care services was reviewed and behavioral, economic, and social psychological aspects was consider. The utilization depends on patient, provided and the medical facility in the sense of high technical technologies, these utilization has some impacts on quality of care.

Table 3.3 Regulations for the use of large- scale medical technology.

Agency providing medical care	Current regulations (mid -1985)
Out-patient care (By panel doctors)	Obligation to report the purchase of medical technology to the Association of Panel Doctors . Owner-user operation on the basis of fees per examination
In-patient care (hospital care)	Co-ordination obligation when purchasing, using, or co-using medical technology with responsible authority.
	<i>Cost coverage :</i> Investment costs : coverage via public support pursuant. User costs : coverage via flat and daily hospital rates.

There is strong evidence that Health Maintenance Organizations (HMO) are associated with lower rates of medical technology utilization. Irrespective of utilization rate the salary of doctors and staffs, cost of drug administrative cost and cost for maintenance the equipment are the same. Due to the lower rate of technology utilization the cost per patient becomes high. This is an economic loss to the provider.

Figure 3.4 Number of MRI classified by different examination



Source: Wangsupachrt S.,1996

There are many standard measures of utilization. Wangsupachrt S.(1996), who listed more than 100 different indices that have been used to measure. In MRIs utilization have report in the number partial scan per year as shown in figure 3.4. *Neuroimaging* exams are the most common MRI procedures ordered by both generalists and specialists.

3.3 Financing issues for medical technology

Technologies for medical services are freely imported with special import tax exemption in accordance with investment promotion policies. This has resources in the competition in purchasing and importing high-costs equipment, clustering of certain equipment items, and imbalance utilization of technology for national development. For instant, in 1989, there were 10 CT scanner/one million population in Bangkok, compared with England which had only 2.3 machine per one million population. The number of such machine has been increasing rapidly to 15.7 machines per one million population in 1994 (Table 3.4).

Table 3.4 Ratio of CT scanner per million population

Country	Ratio
Japan	29.2
United States of America	14.7
Australia	8.6
France	2.8
United Kingdom	2.3
Thailand (1989)	2.0
Bangkok (1989)	10.0
• Thailand (1994)	3.5
• Bangkok (1994)	15.7
• Provinces (1994)	2.2

Sources : Viroj T. et al., 1995

In the future, the health care services in Thailand will require a larger amount of health care technologies as a result of changes in illness pattern requiring new types of drug, equipment, procedure and personnel.

Regarding the diffusion of medical and health technologies, particularly high-technology equipment, most of such items are clustered in large city and in the private sector (see table 3.4).

Table 3.5 Important medical devices and their diffusion in 1994

Device	No. by region :		No. by sector :			
	Bangkok No.	(%)	ProvincialNo.	(%)	Public	Private
1.CT scanner	88	(42.9)	117	(57.1)	59	146
2.MRI	15	(75.0)	5	(25.0)	8	12
3.Lithotrypters	14	(37.8)	23	(62.2)	19	18
4.Laser	75	(73.5)	27	(26.5)	36	66
5.Ultra sound	197	(38.3)	317	(61.7)	259	309

Source : Viroj T. et al.,1994

Viroj et al. (1994) have surveyed in distribution of medical equipment 5 items . Thailand have CT-scanner 205 units or 3.5 per one million population . There are diffusion which high overlapping between Bangkok and up-country .It state that in Bangkok has 15.7 units per one million population .While in up-country has only 2.2 units per one million population .

Most of CT-scanner has been private hospital which have share about 71 percentage . And many private hospitals , which have more 50 beds will has CT-scanner (88 %) .Even though less than 50 beds hospitals will still has CT-scanner (10 hospitals) . Besides Bangkok , up-country which have the total number of CT-scanner more than four units . There are more than eight provincial .

To a certain extent information is available on the diffusion and utilization pattern of MRI in Thailand . In 1995 a study of Tancharoensathien (1995) shows that the number of units installed in Thailand were 20 of which 75 % in Bangkok while the percentage installed in the private sector was 60 %.

For the same year the majority installed in the public sector were in medical school(88%) while the MRI's in private sector were allocated over MRI centers (42%), private hospitals not listed on the stock market(33%) and private hospitals listed on the stock market(25%) .

MRI installed in Bangkok seem to be overutilized while those installed in hospital outside Bangkok are underutilized due to the lack of technical personal which will result in additional costs.

3.3.1 Health care expenditure of MRI technology in Thailand

In Thailand, government is the main provider for medical care, having inadequate and fixed budget allocation for drugs, equipment and buildings especially at the rural based hospitals, as a result the equity in term of diffusion. Government is allocation, more money to the hospitals situated in the urban areas. As a result the over utilization in use of modern Medical technology.

The growth in health care expenditure in Thailand over the last 12 years has necessitated of priority setting and decision making based on the results of economic evaluation. (shown in table 3.6).

Table 3.6 Health expenditure of imported medical instruments

YEAR	VALUE (million Bahts)
1974	628.08
1975	668.34
1976	715.21
1977	984.40
1978	715.21
1979	1,629.50
1980	2,136.55
1982	2,818.85
1983	3,994.54
1984	3,758.34
1985	4,164.14
1986	3,960.53

Note : The Whole Country = 2.0 CT scan / million pop.

Bangkok = 10.0 CT scan / million pop.

Source: Pirom K., 1992

Cost. Any purchasing decision by a hospital or MOPH for a technology costing above a predetermined threshold. Expensive technologies such as magnetic resonance imaging (MRI), positron emission tomographe (PET), and yttrium aluminum garnet (YAG) lasers, as are the addition of new procedures such as cardiac catheterization laboratories. Less expensive technologies such as pace makers and cardiac catheter are generated to high total system costs. Beside the costs of diagnostic tests themselves, usually β 10,000 for MRI, β 4,000 for CT in 1995, the health care costs associated with the diagnostic resources were burden with high per-patient costs.

3.3.2 Prospective reimbursement of MRI technology

Prospective reimbursement is the government response to the problem of high medical costs. Under cost-based reimbursement, the radiology department is moving from a profit center to a cost center, and the emphasis is on improving productivity and efficiency.

As far as new radiology equipment is concerned, hospitals look for systems with high-quality workmanship and the capability to perform diagnostic procedure with quality and efficiency. Above all, equipment must be cost-effective.

To be cost-effective, the equipment must be fully utilized. The system must be versatile for a wide variety of procedures. The hospitals and radiology department are developing cost accounting methods that accurately reflect the cost of services rendered.

On reviewing the relationship between insurance and MRI utilization, first consider are studies that look for the effect of having or not having insurance or use of services. The second group considers how to MRI utilization varies with the amount of out-of-pocket expenses via deductibles or coinsurance.

The need of medical care is an unpredictable issue, if there is health insurance the people can consume the health services at the time of need, otherwise they are to sell their properties to meet the expense for treatment.

3.3.2.1 Health insurance

Health insurance is a system in which prospective consumers of care make payment to a third party in the form of an insurance scheme, which in the event of future illness will pay the provider of care for some or all of the expense incurred.

Health insurance was developed because major illness is uneven and seldom predictable for individuals. When serious illness occurs, the patient often suffers from large medical expenses and also faces the risk of impairment or loss of earning ability.

Health insurance can make both positive contributions and negative contributions to national health objectives. The third-party payment system causes problems of inefficiency. Two characteristics of market failure in the health sector, including moral hazard and asymmetric information, lead to cost escalation.

Both patients and providers are less concerned about the price and quantity of services utilized since the cost is born by health insurance agency. Consequently, unnecessary services and drugs are given, and patients visit doctors frequently (moral hazard).

Moreover, in the health care market, since consumers do not have sufficient knowledge, doctors as suppliers of services have direct influence on consumption, supplier-induced demand (Siriwanaragun, 1996).

3.3.2.2 Payment mechanism

Methods of payment and reimbursement can also influence the medical technology utilization, the setting where services are provided, the level of technology used, quantity and quality of care provided, the distribution of health resources and last but not least, the cost of health care (Abel Smith, 1978).

In Thailand, the capitation method is applied for social insurance. The main advantages of this payment method for insured persons are free choice of doctor (up to the limits imposed on doctor's point of view is that administration is simple and easy to handle. The question of poor quality services may be due to too few diagnostic tests ie. CT and MRI scanned and overutilizing services.