Chapter 2
Economic Tools Used for the Analysis of Health Sector

2.1 Introduction

Though the study of health problems do not appear to be included within the realm of Economics, but is considered to be the concern of only the scientists and medical practitioners; yet in modern times no work on health sector is complete without the application of the knowledge of economics. This is not only because the complexity of the health sector has increased manifold with the complexities of the society, but also because over the last 50 years or so, most nations of the world have experienced rapid increase in health care spending. This has resulted in the emergence of health economics as an independent area of study.

Some of the problems that characterise the health sector, such as the acute pressure of demand for different types of health services, the inadequacy of supply of health services and health infrastructure and the determinants of demand and supply of these health services are precisely the areas of study of economics. These problems in the health sector arises because resources for the use in the health are always scarce, whereas due to rise in population and health related problems, demand for health services is forever rising. The various ways in which the limited resources can be used in the health sector and how these limited resources are to be used for the different subsectors of health in a manner that yields the highest returns can be determined only by the principals of economics. The economic models that are developed to study the health sector can predict in quantitative terms the relative weightage of the determinants of the different parameters of the health sector. In a similar manner, economic models developed for the health sector for examining the relative importance of the different subsectors of demand side can predict the future trend of demand in the health sector.

On the basis of such study, health economists can either examine or study how choices and decisions are made in the health sector. On the other hand, on the basis of such studies, health economists can judge a situation and examine whether such choices or events are good for the nation or the society and the best possible ways

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in which they are to be made. The former type of studies is called *positive studies* and the latter type the *normative studies*. Based on such studies, future course of action and policies in the health sector are decided upon. However, for making such studies which may be extremely complex and may involve collection of huge mass of data related to the health sector, can be undertaken only with the economic tools of analysis. Therefore study of health economics without the knowledge of the economic tools of analysis will be incomplete and sterile.

Accessibility to health services has at all times and at all places being unequal. Non-affordability to health services especially for expensive ones is being ascribed as the main factor behind inequality and inaccessibility. The ones who are able to pay can afford to avail of better health facilities and have therefore a better health status. The ones who are unable to meet the price of health services have poor health indicators and are therefore characterised by poor health status. However, state which is the custodian of the welfare of all section of the population cannot allow the section of the people to suffer from ill health disease and deaths. As a result state spends for those who are unable to pay for medical services. However, government spending on health expenditure for the poor may have long-term economic effect, expenditure on health do not have any immediate short-run benefits. Money spent without any return is termed as bad investment in economics; because as per the principals of economics, limited resources have to be spent where return is the highest, and that is when efficiency in resource allocation is brought about. Efficiency criteria go against the criteria of equity according to which state has to reduce the gap between the rich and the poor. The question therefore that arises is whether such spending which are against the principal of efficiency but promotes equity should be incurred by the state. From here arises the question of trade-off between the principals of equity and efficiency, issues which are extremely important for health economics.

The status of health in any society is determined by the operation of the health institutions for which the understanding of the concept of medical price mechanism, return on investment of health technology, medical equipment and facilities, the cost benefit and effectiveness of medical programmes is essential. All these areas necessitate the knowledge of the application of economics to the health sector. Such knowledge is also crucial for the production of medical industry such as medical equipment, drugs, pharmaceutical industry and health corporate sectors. Allocation of scarce resources for the production and services of the health sector would be incomplete without the knowledge of the science of economics. Knowledge of the best allocation of scarce resources also play a pivotal role for addressing the long-term health objectives of a nation such as providing a healthy environment, water and sanitation, a comprehensive system of preventive treatment and care and rehabilitation services. Managed in a proper manner all these measures can contribute to a healthy life which can reduce morbidity and increase life expectancy. However, mismanagement of scarce financial resources without the adequate application of the knowledge of economics may prevent the country from attaining the requisite health standard.

2.2 Role of Demand in Health Economics

Some of the crucial tools of economics without which no study in health economics is complete will be focussed attention in this section. For instance, demand for goods and services and their supply are the two pivotal pillars around which the entire subject of economics evolves. Unless and until there is generation of demand, supply will not be forthcoming. Why, how and when demand is generated, the nature and extent of demand and the changes therein and the factors responsible for such changes constitute the wide spectrum of the study of demand. Though health needs are slightly different from the needs for other goods and commodities, yet it is the demand for health care which is the basis of survival of the health sector. In fact, greater and greater demand for health care services has been a matter of great concern because such huge demand often goes unsatisfied due to inadequate resources and the inability of supply to meet the health demands.

Like demand, supply is the parallel force in economics, and the interaction of the two crucial forces of demand and supply determines the prices of medical services, drugs and medicines. Supply of health-related products and services, the investment on which is decided by the extent of demand, is decided by the training and production of adequate numbers of doctors, specialists, paramedical personnel, nurses, establishments of health centres, clinics, production of medicines and medical equipment, all of which are needed to satisfy the health demands of a nation. The demand for medical and health services in turn is determined not only by the income level of the health service/care users but also by the socio economic and cultural background of such users. It is also determined by the educational level in general and female education in particular, all of which will be addressed at greater length in the latter section.

2.3 Determinants of Demand in Health Economics

We will therefore begin by examining the various aspects of the concept of demand in economics and their relevance for the study of health economics. Demand for health care and medical services like the demand for all other goods and commodities is firstly determined by the price of the health care and its services. This relationship between demand for a product and its corresponding demand is termed as *Law of Demand in Economics*, which represents an inverse relationship between price and demand. Higher the price of the product lower is the demand for the product and vice versa. It is true that demand for health care which is an urgent necessity of life may not always be determined only by its price, because when it is a matter of life and death, as in the case of health service requirement/demand, resorting to borrowing and replenishing one's own savings is not uncommon. Nevertheless, one cannot ignore the broad contour of relationship between price and quantity. It is a fact that when certain types of medical care are too expensive, consumers switch

over to its substitute, if its price is lower and more affordable, so that the demand for the original product declines. Therefore apart from price which is the most crucial determinant of demand, *the price and availability of its substitute* also constitute other important determinants of demand. For instance, if allopathic treatment is too expensive and similar treatment can be done by homeopathy, the price of which is much lower, some consumers may prefer to go in for the lower priced product.

Due to normally inverse relationship between the demand for medical care and the price of medical care, the demand curve for medical care like the demand for any other product takes the shape of a downward sloping curve, as represented in the diagram below. Figure 2.1 below shows that when the price of medical care items or services is high the demand is low. As the price begins to fall, the affordability rises and therefore the demand too begins to increase. The slope of the curve however is determined by the rate at which the price falls and the corresponding responsiveness of demand, which will be discussed in the subsequent section on the elasticity of demand. Any movement on the demand curve *D*, for health care services, therefore implies the quantum of medical care services at a certain price. Such a phenomenon enables the policy makers to assess the demand or affordability of medical care at a certain price. Pharmaceutical or even the health sector can also assess the demand for their products according to which they can decide upon the prices for their products.

However, it also needs to be mentioned that unlike other regular products of consumption, use of medical services may be a matter of life and death, due to which there may be exceptions to such accepted laws of demand revealing inverse relationship between price and demand. Under such situations, health consumers are willing to pay high price and still demand more of the health care services, if the demand is of an urgent nature. The exceptions will, however, be studied on a case to case basis by the health sector.

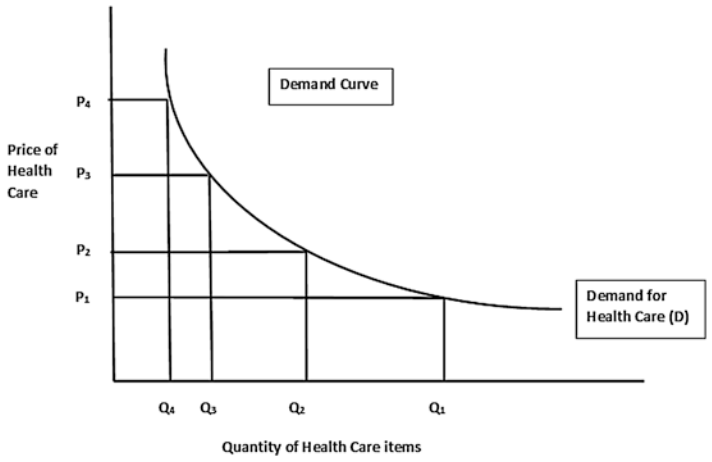


Fig. 2.1 Demand curve for health care/services

Income of the consumers constitutes the other determinant of demand. Consumers belonging to the higher income group can afford to pay a higher price for any product including medical care. Marginal utility of money of the rich people is lower and therefore they do not mind paying exorbitant prices for medical care. The health gyms, for example, are used only by the very rich, because, though maintenance of good health is important, yet is not as urgent as spending on basic live saving drugs which consumers with lower income are unable to afford. Therefore in a nation or in a society with a lower level of income, private medical spending is much lower than in a society with affluent and well off consumers. Under such circumstances of the former type, the state might have to step in to maintain a minimum level of health status of its people. Per capita medical expenditure and per capita government spending on health are thus important determinants of health status of a nation. Therefore the income level and the spending capacity of the public in general assume importance for government's health policy.

The demand for a particular health service may rise, even if there is no change in its price, provided there is a rise in the *price of its substitute*. When the price of allopathic medicine rises, those who were consuming allopathic medicines might switch over to the purchase of homeopathic medicines due to its lower price. As a result, the demand for homeopathic medicines will rise without any corresponding fall in its price. Similar may be the case with the *price of complementary goods.* For instance, for the purpose of injecting medicines, syringes and the liquid medicine is required together. If the price of liquid medicines rises, its demand will fall, but the demand for syringes will also fall, though there is no fall in its price.

Another determinant of demand, though it may not play an important role in case of health economics, is the *expectations of future movements in price.* When consumers expect prices to fall further in the future they postpone the purchase of the commodity, even if prices reveal a declining trend, in the hope of buying more when prices touch the minimum level in the future. Under such a situation, demand may fall inspite of the fact that prices are also falling. Therefore instead of inverse relationship, demand and price may reveal direct relationship. The opposite may be the case when prices reveal an upward trend. In the expectation that prices may rise even further in the future consumers may buy in greater quantity inspite of the fact that prices are rising. In other words, higher the price higher also is the demand. Law of demand is not followed under such situations. However, it needs to be mentioned that in case of medical expenditure such a possibility occurs very rarely. This is because demand for health care facilities is a *derived demand*. Such demand arises not directly for their own sake, but the demand for such services or products is derived from illness, disease and other medical problems. Therefore, it may not be possible to put off the purchases of medical services or items even if there is an expectation of future fall of prices, because such needs are often immediate and very urgent. In a similar manner, for the fear of prices rising in the future normally, consumer do not stock medicines or medical care for the future when prices are low. However, inspite of the difference in the nature of demand for medical services from other normal goods and commodities, one cannot totally rule out such reverse tendency in case of less urgent and immediate medical requirements. Therefore, when

there is an increase in demand for health products/services due to the above-mentioned reasons without a corresponding fall in its price, the effect can be traced not through the movement on the same demand curve as depicted in Fig. 2.1, but in this case, the demand curve itself shifts its position to the right. On the other hand, when the demand falls without any rise in the price of medical services there is a movement of the demand curve to the left. The various movements of the demand curve, either to the right or left, without any corresponding change in the price, are represented in Fig. 2.2.

In the above diagram for instance, when price of the medical service is P_4 the quantity of the health services demanded and consumed was Q_4 when the consumers are at the demand curve D_1. However, at the same price of P_4, when consumers demand an increased quantum of medical services of Q_5 they move to a demand curve to the right which is now D_2 instead of being on the original demand curve D_1 as the quantity of Q_5 and price P_4 cannot be accommodated on the demand curve D_1 but can be accommodated only on a demand curve to the right at D_2. Therefore, any increase in the demand for medical product or service at the same price results in the movement to the right of the demand curve itself. Such a situation can occur in an economy when there is a rise in the population or there is an epidemic or incidence of sudden rise in diseases and illnesses necessitating the provision of higher medical services. The health sector must therefore be ready with medical services and items of certain nature whose demand is likely to increase without a corresponding fall in their price. The health sector industry thereby has to be equally prepared to have increased supply of certain items of medicines and health services irrespective of their prices. The normal law of demand may not work under such circumstances.

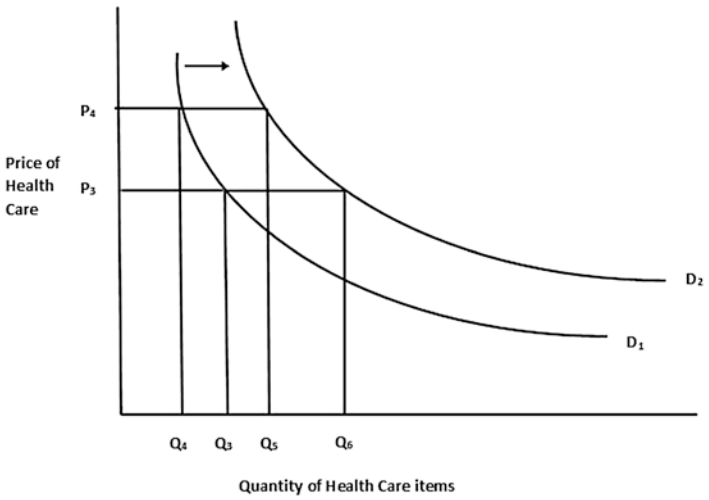


Fig. 2.2 Shift in demand for health care/services with no change in price

Opposite may be the case when the demand for certain medical services may fall without any corresponding rise in their prices. This may be the case when a country records an improvement in the health status. A decline in the incidence of malaria, TB, polio or other such illness in India for instance, has resulted in a decline in the consumption and demand of those medicines and related health care services. The result of this will be a shift of the demand curve to the left from D_2 to D_1 when the demand decreases from Q_6 to Q_3 at the same price of P_3. Under such circumstances, the government department, health sector as well as the health industry has to gear itself up accordingly. Being guided only by the price of health service under such a situation will bring about distortion in the sector, which would result in a misallocation of scarce resources in the health sector.

These features associated with principals of demand side of health economics can be used to understand the demand for health care and health services in general in the health sector. This is important both for the public health sector and more importantly for understanding the health market economy of the health industry. There are many occasions when the public health sector is not guided strictly by the market forces of demand and supply, since public welfare is the guiding principle of public health policy. However the private sector whose dominant guiding principle is maximisation of revenue and generation of profit, market forces of health economy in terms of the demand and supply can hardly be over looked. For this, it is also crucial that we understand the nature of demand for health and health services. Firstly, demand for health is a *derived demand* as mentioned earlier and therefore is determined by many factors and is not a direct demand for other commodities like food or clothing. Good health depends not only on the type and quality of medical care and services but also on the quality of clean drinking water, sanitation facilities, clean living condition, good food, vaccinations and immunisation, medical expenditure as well as awareness about health and general education. Therefore demand for health is a complicated affair and needs greater attention and a thorough study as it is embedded in a complex web of numerous factors.

Demand for medical services arises from the ones who are affected by illness and diseases. It is such demand which compels the users to spend on medical needs such as payments of medical fees for treatment and consultation, hospitalisation expenses, drugs and medicine expenses.

2.4 The Uniqueness of Health Care and Its Demand

Though demand for medical care is extremely crucial, the behavioural pattern of demand in the sector is different from the general demand for other commodities. It has a multi-dimensional demand and is also of an extremely complex nature. It therefore necessitates a different understanding, as well as viewing the nature of demand for health in a manner which is different from the demand for other goods and commodities, though within the same framework of demand and supply. Choices for medical services may not be subject to the same rational behaviour in

case of choice of other goods and commodities since some choices on expenses on medical care may be matter of life and death and consumers are even ready and often do sell their assets to meet such expenses or go into heavy debts for meeting medical expenditure.

Medical expenses are also extremely uncertain as most consumers do not know when they will fall ill with the exception of expenses such as regular health check-ups which is characterised by demand of a steady nature. This kind of uncertain medical expenses is totally different from other normal expenditure. It is also a fact, that under normal choices the law of demand behaves in a predictable manner, when consumers purchase less with a rise in the price. However for medical expenses the choice is extremely limited as consumers may have to make the purchases under extreme compulsion and therefore have to buy even if prices and services are exorbitant. Similarly, unlike the normal goods medical items cannot be stored when prices are falling as no one knows with certainty the type of medicines a person may require in the future. It is due to all these reasons that some medical services are provided free of costs particularly for consumers who are not able to afford the expenses. This is unlike most other expenses where very quantum of free services is provided to the consumers. This is because medical expenses are a matter of life and death. At the same time some other type of demand for health such as leading a healthier life style eating healthier food, better housing, clean drinking water proper sanitation, regular check-ups may rise with arise in income and may fall with a fall in come. However it may also be mentioned that such medical expenses have a long term effect on health condition and may not affect direct health condition when consumers fall ill and need immediate medical treatment.

It is therefore pertinent to mention with regards to health care, that the demand for health care is uncertain, and therefore the firms providing the health care services are also not certain about their customer's demand. Uncertainty also exists from the side of the products. Consumers do not know the outcomes of the treatments, and has to depend totally on the physician's advice. In exactly the same manner, physicians too cannot predict with certainty the effect of their treatments. Asymmetric information is to a large extent attributed to be the cause of some degree of uncertainty. Insufficient information, particularly with regards to the exact time of use of the services or whether they will ever demand the products/services, necessitates changes in the behavioural aspect of the health service provider. Firms cannot proceed as in pure economic models with the assumption that there is perfect knowledge on the part of the customers.

However inspite of some different characteristics of demand for medical care, it is extremely essential that the planning of medical care requires some assessment of demand for health. Study of demand of the health sector also enables the pricing of health products and services. The government sector after making an assessment of health demand also plans the type and nature of free medical services that needs to be provided to the type of consumers with varying level of income. Consequently the same principle that is applied for studying demand in economics is equally applied to the health sector.

2.5 Elasticity of Demand and Its Significance for Health Care Sector

A very important aspect associated with demand for health services/products is the responsiveness of demand for health to changes in its important determinants such as price, income and the price of its substitute or related commodities. The extent of responsiveness or changes in such demand to the extent of change in these variables is termed as *elasticity of demand.* Elasticity of demand for any service or good including that of health services determines the direction that policy issues and formulation should take. In order to have an idea about the extent of increase or decrease in demand for health care services that is desired, policy makers may like to know the percentage of change in price or other factors that needs to be initiated.

The measurement of the proportionate change in demand due to a proportionate change in price is termed as *price elasticity of demand*. In a similar fashion, demand also responds to changes in income of the person, because it is a common perception that when income rises there is generally an increase in demand for the product or the service concerned. In a similar fashion, a decrease in income results in a decline in demand, irrespective of the changes in price. Such responsiveness of demand and its measurement to changes in income is termed as *income elasticity of demand*. It is therefore seen that with an increase in income users of health care services can afford better health facilities. People belonging to the lower income group are for exactly the opposite reason unable to afford the bare minimum health facilities. This is evident from the fact that instances of illness, diseases, epidemics and deaths are more common among the poor income group rather than the upper income group. Health care consumers of the upper income group can therefore afford luxurious health services.

When policy makers want that the use of certain lifesaving drugs should increase and the poor are unable to use the same due to its high price, the price is reduced in an attempt to raise its demand and use. However, the extent to which prices should to be reduced and the extent of responsiveness of demand can be known only with the help of price elasticity of demand. When the state desires to restrict or stop the consumption of any harmful drugs, the best answer is to raise its prices. The question that arises is the extent to which prices should be raised so that consumers are discouraged from purchasing such drugs. Policy makers also need to know that there are also certain medicines or minimum health care services which must be used when medical needs are acute, irrespective of the level of their prices. In such cases even if prices are raised, demand may not go down. Such services or commodities are said to have *inelastic demand*. Inelastic demand implies that there is no responsiveness of demand to a change in price.

Elastic demand, on the other hand, implies demand which is highly responsive to a small change in demand. For instance if a 15 % fall in price results in 2 % rise in demand, it is said to have inelastic demand, whereas if a similar fall in demand results in 25 % rise in demand, demand is said to be highly elastic or responsive.

However, if a similar decline in the price level results in absolutely no change in demand, demand is said to be *totally or perfectly inelastic*. Whether demand will be highly elastic, inelastic or absolutely inelastic is determined by the nature of the health product or service whose elasticity is being determined. Health care services which are extremely essential for life and without which survival is impossible or extremely difficult are said to have inelastic demand, as the service has to be availed for survival whatever may be the price. Another unique feature of health care services is that a major category of services under health care falls under this category. In contrast, expensive health care goods and services which are consumed mostly for their status symbol or for the sake of pleasure and are not included under the basic necessities of life are said to have elastic demand. It is possible to survive or continue life even without the consumption of these commodities. Therefore if their prices rise there may be a fall in the demand for such services.

The methodology for measuring this kind of responsiveness in demand to price is to divide the proportionate change in the quantity by the proportionate change in price. The change in demand for goods and commodities can be measured directly in terms of the change in quantity demanded, whereas change in the demand for services is measured in terms of the amount spent on the service. For the purpose of measurement of price elasticity of demand, the following methodology is used

$$E_d = \%\Delta Q_d / \%\Delta P$$

where ΔQ_d and ΔP are the changes in the quantity and price of the health care services respectively.

The figure below depicts three types of price elasticity of demand, namely, highly or very elastic demand, unitary elastic demand and low elastic or very inelastic demand depending on the extent of responsiveness of demand for health care services to its price change. The price of the medical care service is represented in the vertical axis and the quantity demanded on the horizontal axis. E_d denotes the elasticity of demand, and $\% \Delta Q_d / \% \Delta P$ represents the change in quantity of medical care services demanded due to a change in its price. The curve representing elasticity of demand depicts three types of elasticity for any product including health products/services. The upper range shows demand which is highly elastic, where the responsive of demand is more than the change in price. In contrast, the lower part of the diagram represents highly inelastic demand, where change in demand is less than the change in price. The middle portion shows unitary elastic demand, meaning that the change in the quantity and the price demanded is similar (Fig. 2.3).

On the basis of the above method, once the percentage change in both price and quantity are known, the price elasticity of demand is estimated. Price elasticity is always in terms of a certain number and is also always a negative term. It needs to be noted further, that for estimating large changes, it is essential to estimate the proportionate change both in price and demand.

Responsiveness of demand to changes in price often differs from one price range to another. For instance, for a small percentage change in price the demand may still continue to be inelastic because the consumers might have to spend an extra amount

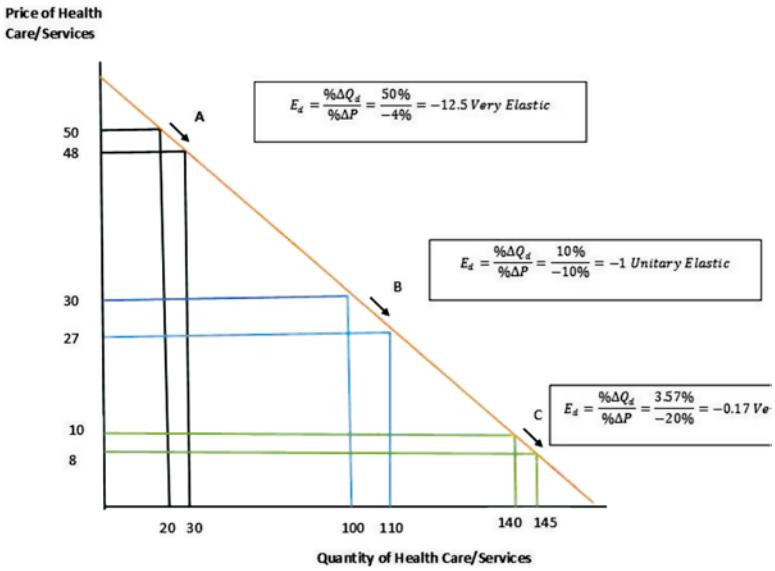


Fig. 2.3 Elasticity of demand for health care services

which may constitute a small percentage of the income. The usefulness of the product may be too high even to reduce small percentage of its consumption. As a result the consumption of the commodity is not reduced. However, for the same commodity when price rise is of a significant proportion the consumer might be compelled to reduce the consumption of the commodity and the demand may be elastic at that range of price. Policy makers therefore need to realise for the purpose of policy formulation that the same product may display different variety of elasticity at different price ranges.

2.6 Income Elasticity of Demand for Health Sector

Just as price elasticity of demand assumes importance, in a similar manner income elasticity of demand too is crucial for policy makers and thereby for health status. Though it is normally assumed that consumption rises with a rise in income, this may not always be true for all categories of products, especially health products. Certain medicines and drugs cannot be consumed in higher proportion even if income rises. When the consumption of a product rises along with a rise in income, the product is said to have positive income elasticity. Such products are called normal products, because that is what is normally expected. However, there are also certain products whose demand actually declines with a rise in income. Such products are said to have negative income elasticity of demand. Products, goods or services which are "inferior" have negative elasticity of demand. Such products are

particularly used by consumers belonging to lower strata of income because they are unable to afford expensive products. Therefore whenever there is an increase in income the consumers feel better off and can afford to switch over to more expensive substitutes. As a result, the demand for the original products decline.

Like price elasticity of demand, income elasticity of demand is also estimated by examining the relative change in demand and the relative change in income in the following manner

$$E_d = \%\Delta Q_d / \%\Delta Y$$

where ΔY is the change in income

2.7 Cross Elasticity of Demand and Its Significance for the Health Sector

Another important term associated with elasticity is the cross elasticity of demand which relates to the elasticity of demand for a product in terms of its relationship with the price of its related or complementary product. Complementary product implies when two products have to used simultaneously to satisfy one consumption need. For instance, syringes and needles are used together for the injecting injection. The demand for needles will be affected due to a change in the price or demand for syringes even if there might be no change in the price or direct demand for needles. Therefore the demand for needles is determined by its complementary goods. Such demands are called cross elasticity of demand.

2.8 Elasticity of Demand and the Heath Sector

In health sector too, nature of demand for health care and health services ranges from absolute necessities to luxurious items of consumption. It is therefore crucial that policy makers in the health sector firstly identify the nature of the demand for the health services. Accordingly, they may take the decision regarding the extent of price changes that needs to be initiated in order to attain the desired objectives in the health sector. Accordingly, it is then decided whether to subsidise health care, if so, to what extent or whether to provide health care totally free of cost. These objectives and policies in turn are some of the important determinants of health status of a nation. It is therefore evident that without the knowledge of health economics the task of the policy makers on health would be incomplete and hazardous. It is very important for the policy makers as well as the ones who work in the health sector to have thorough knowledge about such tools of measurement in economics.

It is therefore essential for policy makers in the health sector to be able to identify the consumers of the particular health product or service. Do they belong to the

poorer section of the society or are they the well-off section of the society? Are the health products or services the essentials or luxurious items of consumption? What effect the rises in price have on the total market demand? What in turn will be the impact of such change be on the industry or the firm engaged in health product? Answer to all these issues necessitates a thorough examination and study of the economics of the health sector.

Whenever there is an increase in the cost of health infrastructure and production of health services, medicines and drugs, the policy makers needs to examine whether the rise in cost can be passed on to the consumers. If the demand is inelastic because they are the essential health services and there are no substitutes which are available, the rise in cost can be passed on to the consumers and the consumers are bound to spend more. If they are not so essential demand will be elastic and there will be decline in revenue because the increased cost cannot be passed on to the consumers. Study therefore needs to be conducted on the effect on welfare of the consumers, due to price rise or due to a reduction in consumption or due to having to spend more because of price rise. The overall impact of all these on the health status of a nation is extremely crucial for any study related to the health sector.

It is in this connection that the desirability of imposition of taxes on health products needs to be viewed. Taxes may be imposed on those harmful items the consumption of which may be harmful for health status. The impact of tax imposition on health products, the percentage of taxes and the rates of different health products and the targeted group who has to bear the impact of tax imposition are areas which come under the purview of health economics. Information on all these aspects of health sector plays a pivotal role for the study of health status of a nation. Just as imposition of taxes can influence the consumption and thereby the welfare of the health consumers, in a similar manner providing subsidy to health consumer, especially on those health products consumed by the poor can raise the welfare of the poor section of the consumers. The responsiveness of demand to provision of subsidy are also crucial areas in health economics which all policy makers in the health sector needs to be highly familiar with.

Study on health status therefore is associated with the knowledge of taxes and subsidies in an attempt to have knowledge about the nature and types of taxes and subsidies that are to be proposed by the policy makers. Such policies can influence the consumption in the health care sector which in a broader sense can influence the health status in general.

This is the reason for free medical centres in the rural areas under rural health centres as also the different health-related schemes which are meant particularly for the poor. This in turn also helps the policy makers to decide the amount of investment that needs to be made in the health sector.

Income elasticity of demand too helps the policy makers to understand and take decisions accordingly, relating to rise in the standard of living and income of the poor and its effect on the demand for health products. Provision of subsidy which is similar to a rise in income may also impact the demand for the particular health product depending upon the nature of the health product, whether it is an inferior product or a normal product. Income elasticity of demand can thus be examined in

case of those health products and policy decisions are then taken to decide whether subsidy can be provided in case of those products and if so the extent to which subsidy can be provided. In a similar manner, imposition of a tax on harmful items of consumption not only provides revenue to the government but more importantly the objectives are to improve health status by discouraging the consumption of such items through stiff rates of taxation. The knowledge of health economics is essential here as the objectives of the policy for reduction in consumption may be a complete failure if the burden of taxes is not shifted on to the consumers by way of high prices. In case it is shifted to the consumers to what extent, is it the full amount of the tax or a small proportion which may make no difference to the amount consumed if the demand for the product happens to be of an inelastic nature. In such a case the policy objectives cannot be achieved. It is therefore necessary to examine the *impact, shifting and incidence* of the imposition of taxes, the areas on public economics which again become important for health sector. In this connection, it needs to be mentioned that if taxes are imposed on medical care items of emergency nature, which may be matter of life and death like costs of life saving drugs or surgeries of an emergent nature, the burden would fall only on the actual users since the use of such goods and services is highly inelastic and can hardly be reduced. Therefore all policy makers need to be extremely cautious before imposing taxes, about the nature of the health item/service or the socio economic status of the health consumers.

2.9 Production Cost of Health Care Services

No study of Health Economics is complete without a discussion of the cost incurred on either producing health products or delivering health services to the health care users. The items on which these costs are incurred are called production inputs. Various types of skills are required for delivering health care services ranging from highly technical to soft skills, sophisticated equipment, expensive drugs and various types of health infrastructure which are all indispensable for the purpose of delivering health care services to the users of health services. The costs incurred on these inputs for production of health services need to be worked out for the purpose of determining the prices of health care services to be provided as well as the extent of taxes or subsidies that may need to be provided for the use of health care.

The knowledge of cost and production techniques studied in economics is therefore extremely crucial for the purpose of studying health economics. Scarcity of financial resources as well as other scarce inputs necessitate that highest level of efficiency with the help of economic tools of analysis is acquired. This will not only provide productive efficiency but also achieve allocative efficiency. Study of economics reveals the ways in which the scare health resources may be used in the best possible manner or the ways of acquiring the inputs at the lowest price. All such decisions become extremely significant when the health providers have to operate within strict competitive environment.

In every production process, there are three distinct areas like inputs, the production process and the final output, all of which are interrelated. Inputs are the various resources such as manpower resources, physical inputs and capital that are necessary for the productive process. Productive process defines the transformation or productive technique which changes inputs into desired outputs, which are the end result of production. In economics, all these relationships are explored within the framework of the production function. Production functions therefore are the ways of representing both qualitatively and quantitatively the relationship that exists between such types of inputs and outputs. The various ways the quantities of labour (L) and capital (K) are combined by a certain process (T), which assumes a fixed technology or a particular production process shows the efficiency of the system.

As far as health sector is concerned, clear cut relationship between input and output through production process is very difficult to establish. This is due to the complexities of the health sector which is not like any production unit, because of the dynamic nature of the sector which uses different inputs in a multiplicity of ways. They use different types of inputs simultaneously. The way these inputs are reduced is not understood and it is difficult to relate to any particular output to any one intervention or activity. Different inputs are used in the health sector unlike only capital and labour in pure production process with the result that they are not only difficult to measure and value these inputs but they are even more difficult to identify. It is even more difficult to define the output of the health sector, which are multi-dimensional and complex and then measure and value them taking their costs for the final valuation of the output. However, all these difficulties notwithstanding techniques are now being developed to measure the outcomes of health services for the purpose of health planning and evaluation.

Production of any health related product or services require the combination of various inputs, chief among them being capital and labour inputs. Such inputs are always scarce in supply and therefore have to be utilised in the best possible way so that the highest level of health outcome can be obtained. There are various ways in which the inputs can be combined for the production of the final health outcome which are denoted by different types of production function. A production function in general represents the relationship between inputs and outputs which are highly mathematical in nature. A simple production function assumes the following nature:

$$Q = A(L,K)$$

where Q represents total output and L the labour inputs and K the capital inputs respectively and A the technical relationship between input and output.

The knowledge of economic tools of analysis can be used as a guide to attain the minimum cost that need to be incurred for acquiring and also combining L and K in a manner using different technology A, so that Q or the health outcome is the maximum.

It is with the above objective that certain terms and concepts in economics, relating to the production function, becomes relevant for the purpose of examining cost and production of health services. For instance, when we mention about efficient

use of resources it is implied that there are no better use of the resources for the production of that particular health service. The inputs could also have been combined for the production of some other health services but had to be sacrificed for the production of the present health service under consideration. The production of the health outcome, that has been sacrificed but could have been produced with the concerned inputs, is termed as *the opportunity cost.* When the opportunity cost of any combination of the factor inputs is high, it implies that the present combination for the production of the present health outcome is certainly not the best one. Under such circumstances, production of the particular health service with the combination of the inputs is certainly less than the efficient. It is therefore essential that the producer have familiarity with the various combinations of the factor inputs so that he is able to select the best out of the available ones. This however may not always be possible, particularly in the health sector, when consideration of equity dominates over efficiency, especially in the public health sector, where subsidisation of health services is the norm rather than the exception. However in the private sector and in the health industry such issues become the only guiding principle of production of health services. The subject of economics, however, proceeds entirely on the basis of such assumptions. However, what it actually tries to convey is the idea of choosing the best combination of the inputs so that there is always an effort to strive for the highest level of efficiency, which is so essential in an economy characterised by acute shortage of valuable resources (Fig. 2.4).

The various combinations of the factor inputs in different forms for the purpose of the requisite output or health outcome are represented in the figure above. The figure reveals that the various combinations of factor inputs which produces the same quantum of output is represented by a convex curve known as *production*

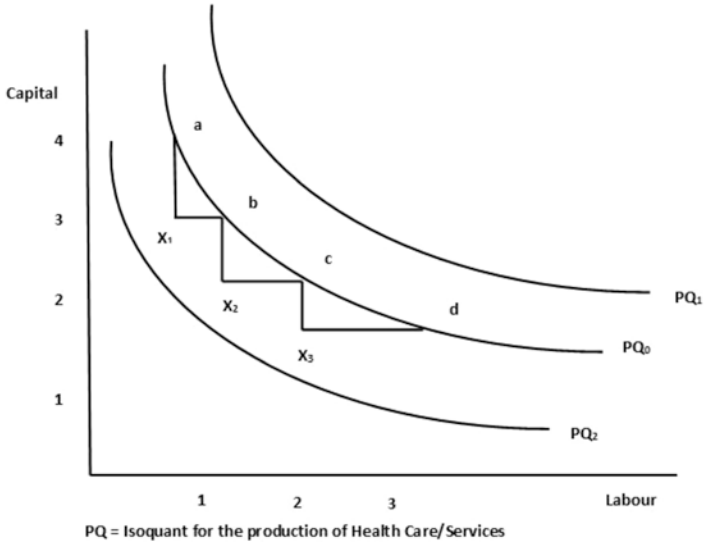


Fig. 2.4 Production isoquants of the health sector

isoquants. If the two axis represents labour (L) and capital (K), different points on the convex curve means the increasing use of one input at the cost of decreasing the use other input. The slope of the production isoquant therefore shows the rate at which one input can be substituted by the other. This technique is termed as *marginal rate of technical substitution (MRTS)*, which is practised by all production sectors. For instance, for the production of an X-ray machine, there might be a combination of either four units of capital and two units of labour or two units of capital and three units of labour. The producer whether in the general production or in the health care sector has to decide which will be the best combination of the factor inputs that needs to decide so that the production cost can be kept at the lowest. If the factor inputs are perfect substitutes, the slope of the isoquant will be a downward sloping straight line. Whereas if the factor inputs are perfect complements which is most often the case with respect to health care delivery services and has to be used in fixed proportions to derive a certain output, isoquants are L shaped.

It is also necessary in this connection to understand about the marginal productivity of a factor of production so that decision regarding the choice of the quantum of factor inputs may be made. When more and more of any particular factor of production is used, keeping the amount the other factor as constant, the productivity of the additional units of that particular factor will go on diminishing. This is termed as *diminishing marginal productivity* of a factor input. For example, if a doctor can examine 20 patients in a day for which he requires two nurses and certain number of medical equipment. Suppose the number of doctor is increased to two without increasing the number of nurses or the other subsidiaries. The total number of patients that will be examined will not be doubled to forty but less than that. This is mainly because one single doctor by himself cannot treat twenty patients. He needs the assistance of nurses and other equipment, but since their number is not increased the services of the existing nurses and equipment has to be over utilised and only some additional patients over and above the normal number can be treated. The overall effect will be that the productivity of the second doctor will be less than that of the first. This is termed as *diminishing marginal productivity* of a factor input, because the doctor here is considered as an input for delivering health services, but it is more important to understand the right combination of the number of doctors, nurses and other health equipment, so that health outcome can be the highest. Therefore, the knowledge of economics is extremely crucial for health services because it reveals the best possible way of delivering health care services to the actual users.

It also needs to be highlighted that the production of goods (output) as in an industry and delivery of health care services which is synomnous as output are not identical, and certain adjustments need to be made with respect to health care services. Output in health sector can be defined as number of children immunised, cases of diseases prevented, death prevention and longevity gained. As a result, suppose, emergency medical units which always needs to be ready for any kind of medical service at any time, even if they are not in use such units cannot be termed as underutilised and therefore inefficient. This is due to the nature or the goals of medical services which have different characteristics then pure productive eco-

nomic activity. The problem arises in terms of differences in definitional aspect where the exact definition of output is very difficult in health services. If the target is immunisation of a certain number of children, which is much easier than treating a certain number of patients in the hospital where the fixed number of patients (output) is known in advance.

Some of the other terms with respect to costs and production that are important to health economists are variable inputs and fixed inputs and the costs incurred for them as the variable costs and fixed costs. Those costs which vary in proportion to the variation in output such as labour costs and costs of raw materials are termed as *variable cost*. An increase in the use of such inputs results in an increase in output, just as a decrease in such inputs results in a decrease in output. In the health sector, expenditure on syringes, medicines and lifesaving drugs are all instances of variable costs, because they vary with a variation in the level of activity or services rendered which is equivalent to the level of output in terms of production activity. On the other hand, those inputs such as expensive machines of costly infrastructure remain more or less constant whatever be the level of output. Such inputs are therefore termed as fixed inputs and costs incurred on them as *fixed costs*. Medical infrastructure, such as hospitals, and expensive medical equipment are included under fixed costs and expenditure on them do not vary with a variation in the level of output.

2.10 Economic Efficiency and Economic Evaluation of the Health Sector

Utility of the study of health economics lies mainly in the best use of the limited resources. Economic efficiency therefore implies transforming inputs into outputs with minimum of expenses, minimum of wastes and getting the highest returns. Highest return in health sector means best value for indicators of health status, such as infant mortality, maternal mortality, lower level of morbidity and disease, longer life span, better nutrition, etc.

For such a purpose, two crucial criteria such as effectiveness and efficiency are to be used simultaneously. The former identifies the technical possibilities for transforming inputs into outputs, whereas efficiency means ranking these alternatives by comparing the costs of inputs with the value of outputs. Firstly, it has to decided how much of resources are to be invested in the health sector in contrast to other social sectors. Efficiency in health sector requires that resources are to be allocated to productive activities in the best possible manner. Health and health services are not the only things that are valued by the society, and society may prefer health over more urgent needs. Policy makers need to assess and compare the value of health and their costs with the value and costs of other services in the society and select accordingly how much of health services/care to produce. In practical situation such a comparison though extremely useful is also very difficult. A number of techniques have been developed that attempts to make this procedure simple. Some of these

techniques are cost effectiveness analysis, cost benefit analysis and cost utility analysis. These techniques differ in their degree of sophistication, and the particular technique selected is determined by the degree of specificity that is required.

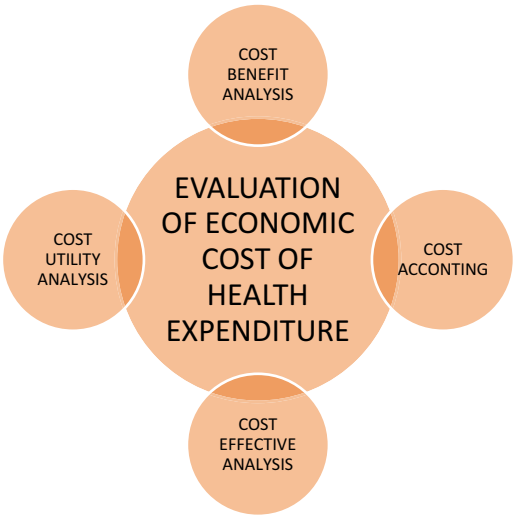
The core of the study of economics lies in the best use of scarce resources, the decisions relating to which is taken by those who are entrusted with such responsibilities. In health sector too, there are crucial decisions which has to be taken by the health and hospital administrators. In a hospital, decision has to be taken for instance on the amount of capital investment that needs to be made and where they can be best utilised. Policy makers in the health sector must decide how much of subsidy needs to be provided in the health sector and who should be the beneficiaries of such subsidy. These are crucial economic decisions which are taken on the basis of evaluation of cost and benefits of the total amount of expenditure incurred in the concerned sector. Such decisions are taken by the application of economic tools of analysis, since they all attempt to find out ways and means of improving the use of resources so that the health delivery services can be improved either to the patients at the individual, group or at the level of the society.

Decision making with respect to investment and spending on health sector affects vitally the quality of life, the health statistics and the health indicators of a nation. It is therefore extremely vital that such decisions be taken in an extremely systematic and professional manner. This calls for an economic evaluation of the decision taken in terms of the costs and benefits of the various alternative course of action so that the best out of these may be selected. A medical treatment option is not considered in isolation from all other treatment options that are alternatives to treating a well-defined medical condition. Evaluation is made on the basis of the costs and consequences of these alternative options. Economic efficiency in the health sector therefore studies the best possible use of scarce resources so that maximum health benefits can be provided to the users of health care. However, best possible use of scarce resource differs from private health expenditure to public health expenditure where choice of health expenses in the former case may not always be guided by rational economic behaviour and optimum levels of efficiency. For public health expenses, it is extremely essential to meet the criteria of effectiveness and efficiency, keeping in view the broad characteristics of the health sector. Effectiveness measures the methods of transforming resources into health outcomes and efficiency evaluates the various ways of comparing costs of the resources with the value of the health outcomes in terms of their ranks.

Economic evaluations are therefore the specific measurements to evaluate the viability of health services. Health outcomes are studied with the help of economic tools and econometric models to examine the viability of investments in different sectors of health and make a comparative analysis.

The four types of economic evaluations which are predominantly used in economics as well as in Health Economics are firstly represented in a diagrammatic form followed by a brief discussion on their conceptual framework (Diagram 2.1).

Diagram 2.1 Techniques of cost benefit evaluation



- *Cost Accounting* (CA) which means the set of procedures for determining the cost of a product or the various activities involved in its manufacture and sales and for planning and measuring performances is the cost accounting. This method determines and analysis costs for the purpose of evaluating the operating efficiency of each division, deals with the accumulation and utilisation of cost data for purposes of controlling costs. As a management tool the method helps to estimate the cost of production of every unit, work order and processes and thereby indicate various forms of waste in terms of material and labour.
- *Cost Effective Analysis* (CEA) is the methodology in which comparison is made in achieving one particular objective in various ways. The CEA uses the monetary method of measurement and attempts to concentrate on one major desired outcome such as health improvement with respect to one disease or reduction of incidence of any particular disease. However, when different options for measurement are used, the method assumes that cost or effectiveness is constant for the various alternative options. It attempts to examine which one of the equally costly alternative policy actions is likely to be most effective or which one of equally effective policy action is expected to be least expensive.
- *Cost Utility Analysis* (CUA) is a measure to find out the various ways of bringing down the cost of medical care. This technique is used extensively in health sector for which knowledge of economics is extremely crucial. In the health sector, CUA estimates the ratio between the costs of health related intervention and the benefit it produces in terms of the number of years lived in full health by the beneficiaries. Cost is here measured in terms of monetary costs, whereas benefits are in terms of quality adjusted life years (QALYs). This common unit of measurement in terms of money/QALY gains enables health policy makers, comparisons across different health programmes and policies providing a holistic analysis of total health benefits. However, measuring QALYs according to economists is very subjective and therefore extremely difficult.

- *Cost Benefit Analysis* (CBA) is a method mostly used to justify the adoption or implementation of a certain health programme. It is a method in which comparison is made between the costs of providing service with the gain accruing from the service. Attempts are made to measure all socially relevant health outcome in terms of money, though monetary evaluation of health benefits are extremely difficult. This method is useful for all those health programmes which have a major impact on economic development.

The tests are used mostly to examine the economic feasibility, acceptability, or viability in deciding to implement specific health programmes whether in the public or private sectors. The health services and programmes implemented by the public health sector are adopted for the purchase of the needed medical supplies, equipment and facilities, vaccines for communicable and non-communicable diseases, immunisation programmes, use of contraceptives, etc. Since all these programmes involves huge amount of public resources, judicious planning for allocation of these resources in the various sectors of health is of utmost importance so that maximum return in terms of benefits is assured to the beneficiaries. It also needs to be mentioned here that that most of the benefits of health programmes may not be always measurable in terms of monetary benefits, because assigning monetary benefits to human health benefits is not really a satisfactory procedure. The reasons for the inability to measure the health benefits arise due to the fact that the general socio-economic condition often affects the health condition of the people. Besides, the impact of health services is also determined by the utilisation and maintenance as well as the cooperation by the beneficiaries. Extent of public cooperation in turn is determined by the educational level of the public particularly female education. It is also determined by the income level of the beneficiaries, all of which have been accepted for the present study as determinants of health status. However, till now there is no index of population health status in any country for the measurement of direct benefits. Added to this is also the problem that different medical specialists value a given health impairment differently (Satpathy and Bansal 1982). It is because of all the above reasons that it is only in very rare instances that highly specific cases of estimation of health services on the reduction of health risks and problems have been possible.

2.11 Measurement of Costs of Health Delivery

Monetary costs incurred for health delivery system is determined by some of the crucial decisions that needs to be taken in the health sector. Some of these decisions are taken both at the micro level as well as at the macro level. Individual patients must decide where to go for treatment, whom to go to and how much to incur for medical treatment. He/she takes the decision on the basis of the best alternative choices available to the patient, which again is a matter of economic choice. At the macro level, decision needs to be taken by the policy makers on the investment to be made in the health sector. Sectoral allocation of resources for the health sector and

the alternative choices in health policies also come under the purview of health economics.

Given the limited resources both individuals as well as policy makers aim to maximise the return from health investment both to the individual as well as to the society by minimising the costs. It is here that model building in economics is undertaken which helps particularly the policy makers in understanding, explaining, and predicting decision making and costs which plays a pivotal role in health economics.

Costs incurred for health care and services, which can be measured quite easily in case of an individual, cannot be measured in the same manner for the society. Though opportunity costs are crucial indicators of costs foregone, yet costs as far as the health sector is concerned is a much broader concept. Cost of illness to the individual and the society are extremely important information for the policy makers and health economists. Cost of disease, illness, and epidemics to the nation which are both explicit as well as implicit are also very important. Long run as well as short run costs to the society is also very crucial for policy makers. In an interesting study made by Druss et al. (2001) for the US economy, it was revealed that in 1996 that total cost for the treatment of mood disorders diabetes, heart disease, asthma, and hypertension was $62.3 billion. Out of this heart disease and hypertension constituting almost half the total expenditure. The cost of treating coexisting medical condition totalled $207.7 billion. In addition to that, it was also estimated that an additional amount of $36.2 billion was lost due to lost man days due to these five diseases. Therefore the total cost to the society was $306 billion. All these are indirect but extremely important components of health costs. Such costs are the costs to the society by reducing the productive capacity of the people of the economy due to ill health and disease, loss of earning power of the individual, and the other additional costs which are related to ill health and sickness though they are not strictly speaking medical costs. This highlights the difference between *Direct and Indirect Costs* in the health sector. The former category includes the costs of prevention, detection, treatment, rehabilitation, research and training as well as long-term capital investments because of diseases and illnesses. They can be further subdivided into two types: direct medical costs and direct nonmedical costs. The former type of costs are the costs associated with the use of medical resources such as the costs of hospitalisation, medical procedures, laboratory testing, pharmaceutical drugs, costs of medical care, etc. Direct nonmedical costs are the expenses incurred by the patients themselves such as transportation costs, loss of income, and other expenses to help the patients. Indirect costs are costs to the economy and society due to poor health condition of the people such as high degree of morbidity, illness, disability, and deaths. They also include the loss to the economy due to low productivity, loss of manpower due to sick leave, morbidity, and deaths.

Health costs therefore include the expenses incurred by both the producers of health services, use of medical staff of all categories, buildings, materials and medical supplies as well as the costs incurred by the users of medical/health services. All these costs can be divided into (1) *Capital Costs* and (2) *Recurring or Current* Costs. Normally capital expenditure spreads over a longer period, whereas current

costs are incurred for meeting the immediate needs. Under the former category are included costs of building, purchase of equipment, and training of medical practitioners. In the latter category are included the costs incurred on medicines and drugs, and all other day-to-day expenses for rendering health care services to the population.

Intangible costs also constitute an important aspect of costs in the health sector. Such costs include pain and suffering, grief and anxiety, which cannot be quantified but has large costs to the society.

Depreciation costs like any other investment is also an important part of health costs. Expensive equipment and building depreciates in value over time due to their continuous use.

2.12 Economic Models

With the help of the economic theories, tools of analysis, and the various concepts of economics, economic models are constructed in the health sector to examine in a simplified manner the relationship between the key variables in an attempt to analyse their relationships. As a word of caution, it needs to be mentioned here that models are never realistic, but convey the general picture of the relationships among variables in real life situation. Economic models do not include all variables. Only important variables which have significant influence in the area of study are considered and non-important variables are either taken as constant or considered to be zero. Consequently, emphasis is laid upon only those relationships that are under study and examine the interrelationships between them. Models are used for the purpose of future decisions based on the interactions of the accepted variables enunciated by theoretical relationships of the variables.

For the purpose of the present study, various economic models in the health sector will be developed based on the theoretical underpinnings of health economics. Based on the results obtained, analysis will be made and conclusions derived relating to the health sector, which may help the policy makers working in the sector to reshape policy decisions.

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