# UNIT 5 HEALTH ECONOMICS AND ECONOMICS OF MALNUTRITION

## Structure



## 5.1 INTRODUCTION

In the earlier units on nutritional problems, we learnt that there are many causes of malnutrition, socioeconomic cause, being one of them. When economic condition of the people is poor, they have inadequate access to food and health services, which contributes to poor nutritional status. We also studied that some micronutrient deficiencies like anaemia and iodine deficiency compromise on mental and physical work capacity, which leads to lowered productivity of individuals at work. This, in turn, leads to reduction in wages earned and poor economic condition. So, we can see that poor economic status contributes to malnutrition and malnutrition contributes to poor economic status. There is a mutual cause and effect relationship between malnutrition and economic status. In this unit, we are going to explore this relationship in detail. We are going to study about economics of health and economic consequences of malnutrition. Since nutrition is a determinant of health, we will discuss about nutrition economics under which we will focus our discussion on food resources and their efficient utilization to improve nutritional status of individuals. At the end, we will explore the concept of economic evaluation of health interventions.

### Objectives

After studying this unit, you will be able to:

- explain the concept of health economics;
- describe economic consequences of malnutrition;
- discuss economics of nutrition;
- explain the food security and issues related to food production; and
- enumerate the concept of economic evaluation of malnutrition.

## 5.2 HEALTH ECONOMICS

Health economics concentrates on application of the principles and rules of economics in the sphere of health. In broad terms, it includes *analysis and evaluation of health policy and the health system from an economic perspective*. In particular, it includes *health system planning, market mechanisms, demand and supply of health care, economic evaluation of individual diagnostic and therapeutic procedures, determinants of health and its evaluation, and evaluation of the performance of health care systems in terms of equity and efficiency.* The process involves calculating the cost incurred to tackle the problem and the consequences, which arise because of the problem. A decision is then taken in where to invest so that maximum benefits are achieved with the existing resources. In general the costs and consequences from a health perspective are given in Table 5.1. It shows various *direct, indirect* and *tangible* costs involved in managing the problems. It also shows the consequences like morbidity, mortality and pain suffering as a result of the occurrence of problems.

**Table 5.1: Cost of managing health problems and consequences**

| Cost of Managing the Health Problems | Consequences of Health Problems |
|---|---|
| Direct<br>– Capital-land, building<br>– Operating-staff, overheads<br>Indirect<br>– Production loss<br>– Transportation<br>– Boarding & lodging<br>Intangible<br>– Pain, Suffering, Grief | Physical functioning<br>– Morbidity, and Mortality<br>– Disability<br>Resources use<br>– Cost averted by health care system in the form of treatment<br>– Productivity loss averted<br>Social and emotional functioning<br>– Pain, Suffering, Grief<br>Changes in quality of life<br>Friends and Family |

Analysis and evaluation of health policy and system is important because it helps us to plan the targeting of health resources required for alleviating the problems. We already know that there are multiple causes of malnutrition; so just focusing on health resources will not help solve the problems. Since nutrition is a determinant of health, focus on food resources becomes very critical. We will discuss food resources in detail under nutrition economics in Section 5.4 later. Now let us review the economics aspects of causes and consequences of malnutrition.

## 5.3 MALNUTRITION AND ITS ECONOMIC CONSEQUENCES

What is malnutrition? Malnutrition can be defined as a *pathological condition resulting from a relative or absolute deficiency or excess of one or more of the essential nutrients.* From a nutritional standpoint, the condition can fall under the following 4 categories as shown in Table 5.2. These categories are *undernutrition, overnutrition, imbalance of nutrients and specific deficiencies of nutrients.*

**Table 5.2: Classification of malnutrition based on nutrient intake**

| S. No. | Type | Nutrient Intake |
|---|---|---|
| 1. | Undernutrition | Inadequate |
| 2. | Overnutrition | Excess |
| 3. | Imbalance | Disproportionate |
| 4. | Specific deficiency | Relative or absolute lack of an individual nutrient |

Let us now understand the causes of malnutrition before we explain the consequences of malnutrition. We have read about causes of malnutrition in Unit 3. We will recapitulate these now.

### 5.3.1 Causes of Malnutrition

You may recall studying about the causes of malnutrition earlier in Unit 5. The causes of malnutrition are classified as *immediate* (individual level), *underlying* (household or family level) and *basic* (societal level) causes as highlighted in Figure 5.1 whereby factors at one level influence other levels. Each of these factors is essential, but is not sufficient in itself to achieve nutrition security. One of the important factors, which act at the individual level, is the *socioeconomic status.* Other factors at the individual and household level include availability or accessibility of food, poor knowledge about balanced diet etc. You would note here that poverty affects almost every factor acting at the individual level as shown in Figure 5.1. For example, you can see in Figure 5.1 that when people do not have enough money, they may not be able to purchase enough food for their families and/or access health services which leads to malnutrition. The problems at the societal level include that of educational status, performance of agricultural sector, policies related to food imports contributing to malnutrition.

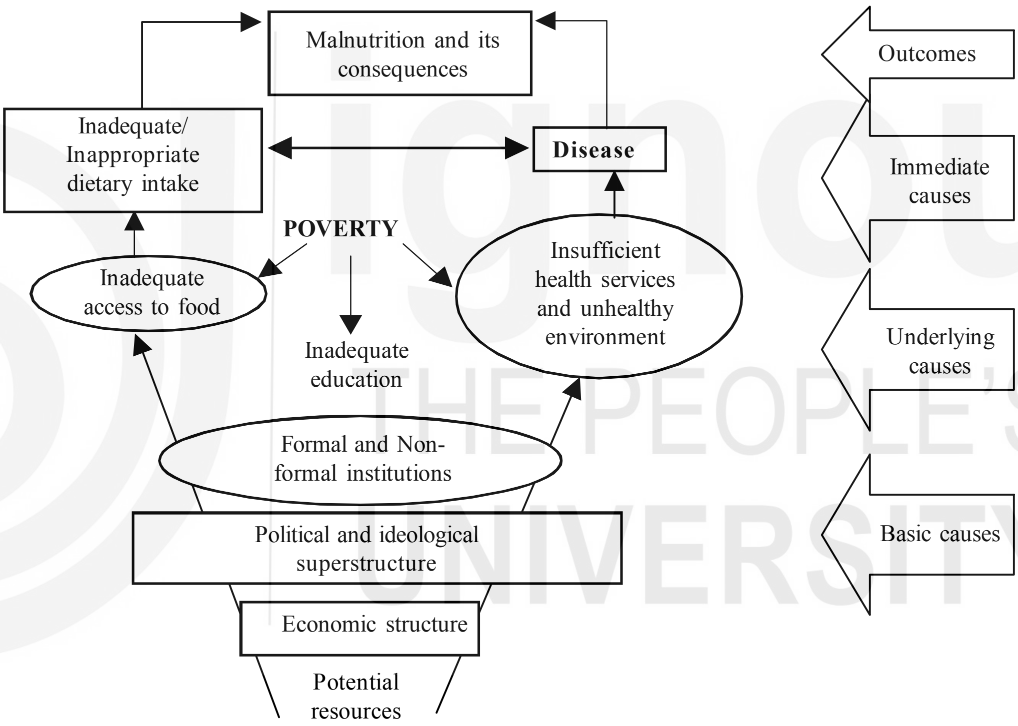



**Figure 5.1: Malnutrition and its causes**

You must have heard many times that cause of hunger is poverty. However, hunger also leads to poverty. So, poverty and hunger have mutual cause and effect relationship. That is, poverty leads to hunger and hunger leads to poverty. Let us see how.

*Poverty and hunger – mutually causes, devastating effects*

Measures of food deprivation, nutrition and poverty are strongly correlated. Countries with a high prevalence of undernourishment also have high prevalence of stunted and underweight children. In these countries, a high percentage of the population lives in conditions of extreme poverty. In countries where a high proportion of the population is undernourished, a comparably high proportion struggles to survive on less than US$1 per day. While poverty is undoubtedly a cause of hunger, hunger can also be a cause of poverty. Hunger often deprives impoverished people of the one valuable resource they can call their own: the strength and skill to work productively. Numerous studies have confirmed that hunger seriously impairs the ability of the poor to develop their skills and reduces the productivity of their labour.

Hunger in childhood impairs mental and physical growth, crippling the capacity to learn and earn. Evidence from household food surveys in developing countries shows that adults with smaller and slighter body frames caused by undernourishment earn lower wages in jobs involving physical labour. Other studies have found that a 1 percent increase in the Body Mass Index (BMI, a measure of weight over height square) is associated with an increase of more than 2 percent in wages for those toward the lower end of the BMI range.

Micronutrient deficiencies can also reduce work capacity. Surveys suggest that iron deficiency anaemia reduces productivity of manual labourers by up to 17 percent. As a result, hungry and malnourished adults earn lower wages. And they are frequently unable to work as many hours or years as well-nourished people, as they fall sick more often and have shorter life spans. This then brings us to the issue of economic consequences of malnutrition. We have read about consequences of malnutrition in Unit 3. We will recapitulate this here and then study about economic consequences of malnutrition. Let us first recapitulate consequences of malnutrition.

### 5.3.2 Consequences of Malnutrition

Malnutrition manifests itself in terms of illness and death in all age groups. Children, pregnant women, nursing mothers and elderly are particularly vulnerable to the effects of malnutrition. Let us closely look at the effects of Malnutrition in children.

***Malnutrition contributes to more than half of child deaths worldwide.***

WHO states that fifty-four percent of deaths among preschool (<5 years) children in the developing world are due to the underlying effects of malnutrition on disease, but conventional methods of classifying deaths by cause have misleadingly attributed only about five percent of child deaths to malnutrition.

***The risk of death rises as the grade of malnourishment increases among children from mild to moderate to severely malnourished.***

It was previously thought that only severely malnourished children were at increased risk of dying, but recent studies show that even mild and moderately malnourished children are at increased risk of death because of their poor nutritional status. On an average, a child who is severely underweight is 8.4 times more likely to die from infectious diseases than a well-nourished child. Children who are moderately underweight and mildly underweight are 4.6 and 2.5 times, respectively more likely to die than well-nourished children. It is estimated that the vast majority (35%) of all malnutrition related deaths worldwide occur in children who are underweight. Programmes directed only at treating severe malnutrition, therefore, will have only a minor impact on child mortality rates.

***The synergistic contribution of malnutrition to child mortality is consistent across populations and can be estimated at the country level from weight-for-age prevalence data.***

Analysis show that the quantitative relationship between malnutrition and mortality is remarkably consistent across various populations representing diverse ecological, disease and cultural environments. The percentage of all malnutrition-related deaths that occur in mildly and moderately malnourished children can also be estimated from weight-for-age prevalence data.

As discussed earlier, malnutrition affects vulnerable population across all age groups. Table 5.3 summarizes consequences of malnutrition in the other vulnerable population like pregnant and lactating mothers, adults and older adults.

Table 5.3: Consequences of malnutrition

| Common Nutritional Disorders | Consequences |
|---|---|
| *Pregnant and lactating mothers* | |
| PEM, IDD, VAD, IDA, Folate deficiency, Calcium deficiency | Insufficient weight gain in pregnancy, maternal anaemia, maternal mortality, increased risk of infection, night blindness, low birth weight leading to high risk of infant death |
| *Intergenerational cycle* | |
| PEM, IDD, VAD, IDA, Folate deficiency, Calcium deficiency | Deficiencies passed on to the child who may then pass them on to the subsequent generation |
| *Adults* | |
| PEM, obesity, IDA and diet related diseases | Thinness, Lethargy, Obesity, Heart disease, Diabetes, Cancer, Hypertension Anaemia |
| *Elderly* | |
| PEM, IDA, Obesity, Osteoporosis, Diet related diseases | Obesity, Diabetes, Cancer, Spine and Hip Fractures, Anaemia and Thinness |

The discussion above focussed on the consequences of malnutrition across pregnant and lactating women, children, adults and older adults. We may conclude that when people have illnesses as a result of malnutrition, it compromises on their work productivity. Let us now study effects of malnutrition on economic productivity of people or, in other words, economic consequences of malnutrition.

* *Economic consequences of malnutrition*

Figure 5.2 explains the economic consequences of malnutrition. You would note from the Figure 5.2 that the economic productivity of the individual, influences the household income, which influences the household food availability and food allocation in the family. When household real income falls as a result of low economic productivity, families have less food available for different members of the families. Thus food consumption for the different members of the family falls. In our culture, it is mostly the women and the children who suffer the most as a result of poor availability of food at home compared with other members of the family. Poor food consumption contributes to low nutritional status of the family members especially the other and the child. Mothers with poor nutritional status have low capacity to take care of the child, such ignorance to the child leads to long term consequences in terms of growth, cognitive capabilities, morbidities and mortality etc. This also results in loss of productivity in school. For adults, poor nutritional status leads to reduced stamina and endurance and low physical capacity at work, thus contributing to reduced economic productivity. So this loss of productivity influences economic status of the family that can further deteriorate nutritional status. This vicious cycle persists unless strong steps are taken to increase the household real income and improve the nutritional status.

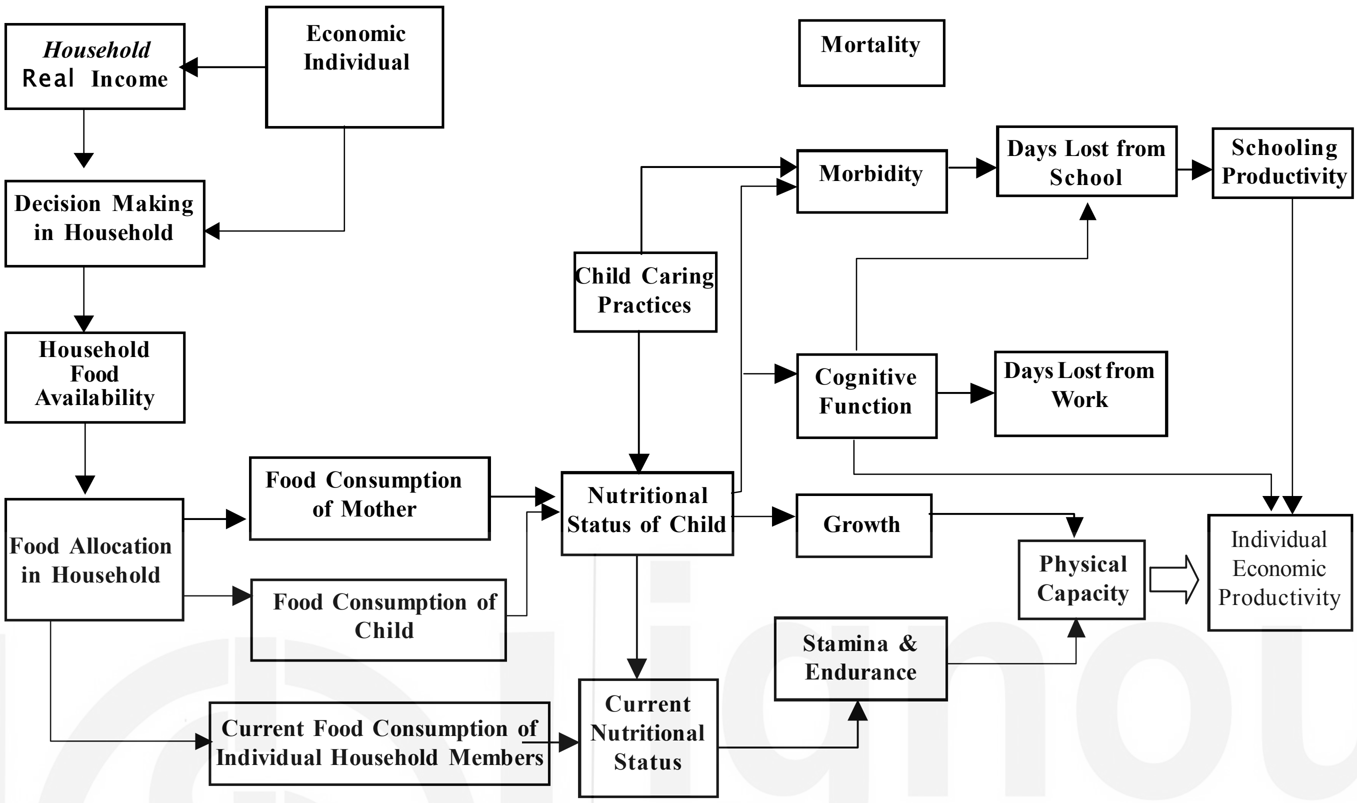



**Figure 5.2: Economic consequences of Malnutrition**

We can now conclude that loss in the productivity of individuals lead to a loss in productivity of the nation as a whole and so nations cannot progress. This brings us to the issue that we need to assess and analyze the situation and plan and implement interventions to improve the nutrition situation. For doing this, we need to come up with some indicators which can help us track changes in the situation as we move towards our goals. We will now study about the "indicators" in detail.

### 5.3.3 Indicators of Nutrition

We will begin our study on this topic by first understanding what we mean by an indicator. An indicator is a *"specific and measurable statistical construct for monitoring progress towards a goal"*. Indicators are used to monitor a given characteristic (e.g. health status) of a population or to make comparisons with a different population or the same population at a different point in time. Indicators are therefore specific measures for assessing progress towards goals. The indicators may fall under the following categories:-

1. *Macro* indicators for sector-wide monitoring and evaluation,

2. *Meso* indicators for regional or cross-agency policy monitoring and evaluation, and

3. *Micro* indicators for agency programme monitoring and evaluation.

Figure 5.3 depicts the three types of indicators.

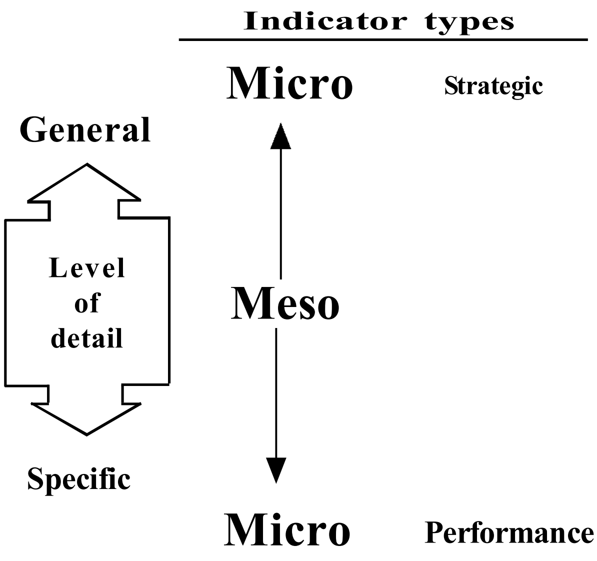



**Figure 5.3: Types of indicators**

As you may have noticed in Figure 5.3, the indicators may fall under three categories:

Macro indicators are used at strategic levels while micro indicators are used at performance levels. From the previous sections it is clear that many factors contribute either directly or indirectly to the nutritional status of individuals. So, choosing an indicator will depend on what we want to analyze. We can have indicators related to 1) government policies, 2) individual information on food/income etc, 3) food and nutrient intake 4) nutritional status, and 5) health status. A few of the indicators are enumerated below:

1. *Indicators related to Government policies*
   a. Nutrition policy
   b. Nutrition interventions: feeding programmes (e.g. Mid day meals at school)
   c. Percent free school meals (eligibility, uptake): is this a marker of nutritional health or a marker of social or health inequalities?
   d. Food availability, e.g. foods stocked in shops used: range, availability
   e. Food accessibility
      i. Food prices, e.g. relative cost of healthier food, money for food, shopping capacity, domestic storage capacity etc
   f. Food security - International and National
   g. Food stocks - e.g. amount of emergency food supplies
   h. Food subsidies
   i. Food budget standards
2. *Indicators at the individual level* **:** Number of individuals who have gone hungry through lack of personal food supply, amount of expenditure on food, percent of disposable income spent on food and cost of 1 kcal etc. are some of the indicators that can be used at individual level.
3. *Food and nutrient intake*
   a. Direct: national, regional, household and individual
   b. Dietary diversity (may be different within country compared with between countries)
   c. Food balance sheets
4. *Nutritional status*

   Biomarkers, anthropometry and energy balance

5. *Health status*
   a. Morbidity and mortality rates
   b. Macronutrients and micronutrient deficiencies

Having looked at some of the indicators, let us now review some of the interventions in malnutrition.

### 5.3.4 Interventions in Malnutrition and Government Expenditure on Interventions

We have studied about the causes of malnutrition at various levels. Similarly interventions for malnutrition should be carried out at various levels. There are several interventions aimed to reduce malnutrition. A detailed discussion on these interventions strategies is presented in Unit 12 later in this course. Here, we will familiarize you with some government programmes aimed to reduce malnutrition in vulnerable groups. Table 5.4 gives a list of various government programmes and their beneficiaries. Some of these have already been described in Unit 3 and 4 on nutritional problems. As you move on to Unit 10 later in this course, you will find that each of these programmes has specific goals and objectives for e.g. National nutritional anaemia control programme is aimed towards eliminating iron deficiency anaemia and so on.

**Table 5.4: Review of Existing Programmes/Schemes**

| Target Group | Schemes |
|---|---|
| Pregnant and Lactating Mothers | Integrated Child Development Scheme (ICDS), RMNCH+A, National Health Mission (NHM), Janani Suraksha Yojana (JSY), Pradhan Mantri Matru VandanaYojana (PMMVY), National Nutrition Anaemia Control Programme (NNACP) |
| Children 0-3 | ICDS, RMNCH+A, NHM, Rajiv Gandhi National Crechê Scheme, National Prophylaxis Against Nutritional Blindness due toVitamin A Deficiency (VAD) |
| Children 3-6 | ICDS, RMNCH+A, NHM, Rajiv Gandhi National Crechê Scheme, Total Sanitation Campaign (TSC), National Rural Drinking Water Programme (NRDWP) |
| School going children 6-14 | Mid Day Meals (MDM), Sarva Shiksha Abhiyan (SSA) |
| Adolescent Girls 11-18 | Rajiv Gandhi Scheme for the Empowerment of Adolescent Girls (RGSEAG), Kishori Shakti Yojana |
| Adults | Mahatma Gandhi National Rural Employment Generation Scheme (MGNREGS), Skill Development Mission, Women Welfare and Support, Programme, Adult Literacy Programme, TPDS, Antoyodya Anna Yoajana (AAY), Rashtriya Krishi Vikas Yojana, Food Security Mission, Safe Drinking Water and Sanitation Programmes, National Horticulture Mission, National Iodine Deficiency Disorders Contol Programme (NIDDCP), Nutrition Education and Extension, Bharat Nirman, Rashtriya Swasthya Bima Yojana. |

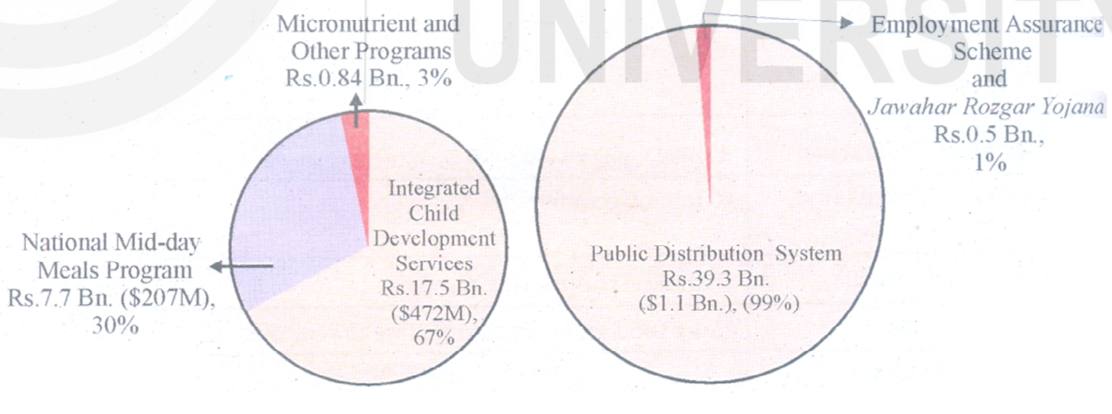
A detailed discussion of each of these programmes is provided in Unit 10. It is important for you to know that our government including the states spend a large amount of money on these programmes to improve nutrition situation in India. We will now review how much money the government spends and which are the major programmes on which most of the money is spent in order to improve the nutrition status of people.

***Total Government Spending on Nutrition***

Total government spending on nutrition covers what the Government of India and State Government spend on nutrition programmes. Experts have analyzed information on the nutrition spending on major *direct nutrition programmes* and *indirect nutrition programmes*. Direct nutrition programmes include short term measures to achieve national nutrition goals. Indirect nutrition programme include long term measures to achieve national nutrition goals. Major direct nutrition programmes for which financial information has been analyzed are Integrated Child Development Services Programme (ICDS), the National Midday Meals Programme (NMMP) and some micronutrient programmes. Indirect nutrition programmes include Public Distribution System (PDS) and Employment Generation Schemes.

We will present you with the analysis for average annual total government spending on direct and indirect nutrition programmes available for the period 2018-2019. As per the Union budget (2018-19) government spend an annual amount of about Rs. 23139.28 Cr. on the direct and indirect nutrition programmes during 2018-2019. Of which Rs. 23088.28 Cr. was spent on direct nutrition programmes and Rs. 51,00 Cr. was spent on indirect nutrition programmes i.e. PDS. Thus, India spends a considerably larger amount on indirect nutrition programmes, even if only the cereal subsidy component of PDS and the food grain component of the centrally-funded employment programmes are included.

Figure 5.4 provides a rough estimate of the average expenditure on these programmes for the period 1995 to 1998. Also under direct nutrition programmes, spending on ICDS was the highest (67%) followed by NMMP (30%) and micronutrient and other programmes (3%).Under the indirect nutrition programmes, spending on PDS was 99% followed by employment assurance schemes (1%).




**Direct Nutrition Programmes** **Indirect Nutrition Programmes**

**Note:** ICDS costs include GOI and state-financed supplementary food expenditures; NNMP costs are all GOI expenditures; Micronutrient and Other Programme costs include GOI expenditures on National Iodine Deficiency Disorders Control Programme plus 5 percent of the Department of Family Welfare budget to cover the Iron and Vitamin A distribution programmes; PDS costs are the total cereal subsidy and EAS/JRY costs are for the food grains provided.

**Figure 5.4: Average Annual Total Government Spending on Direct and Indirect Nutrition Programmes, 1995-1998**

***Sources:*** Central Government expenditure budgets, Departmental Budgets and Economic Survey, 1997-98.

India spends far less on nutrition programmes than what is needed to reduce the extent of malnutrition among children under five years of age and pregnant and lactating women. We consider the nutrition expenditure as a percentage of gross national product (GNP) then, from 1985 to 1990, the average annual expenditure by the states and GOI on direct nutrition programmes (mainly ICDS and NMMP) amounted to only 0.15 percent of gross national product (GNP). Government spending on direct nutrition programmes increased in the 1990s, as a result of the expansion of ICDS and of the NMMP in 1995 and amounted to about 0.19 percent of GNP in 1998. Currently around 0.9 per cent of GNP is spend on direct nutrition programmes. This is still less when compared with other developing countries. For example, Sri Lanka, a country recognized to have achieved considerable success in reducing the level of malnutrition, spent about 1 percent of its GNP on direct nutrition programmes during the mid 1980,s (World Bank, 1993).

Recently, National Nutrition Mission (NNM) has been set up with a three year budget of Rs. 9046.17 crore commencing from 2017-18. The NNM is a comprehensive approach towards raising nutrition level in the country on a war footing. It will comprise mapping of various Schemes contributing towards addressing malnutrition, including a very robust convergence mechanism. NNM targets to reduce stunting, undernutrition, anaemia *(among young children, women and adolescent girls)* and reduce low birth weight by 2%, 2%, 3% and 2% per annum, respectively. Although the target to reduce Stunting is at least 2% p.a., Mission would strive to achieve reduction in Stunting from 38.4% (NFHS-4) to 25% by 2022 *(Mission 25 by 2022).*

The Centre for Budget and Governance Accountability (CBGA) estimated that 25,600 crore rupees (3.9 billion USD) have been budgeted for nutrition specific interventions through centrally sponsor schemes (CSS) such as ICDS while 215,000 crore rupees (32 billion USD) have been budgeted for nutrition-sensitive interventions. Overall nutrition allocation from the central Government has increased by 1.4% (2015-16 RE to 2016-17 RE). India still needs to increase its spending on nutrition programmes.

This brings us to the issue of food resources and how proper planning and targeting of food resources can help in combating malnutrition. We will study about this under the purview of economics of nutrition. Now let us answer the questions given in check your progress exercise 1 and recapitulate what we have learnt so far.

**Check Your Progress Exercise 1**

1. What do you mean by health economics?

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2. Explain economic consequence of malnutrition.

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3. Enumerate on the government spending on major direct and in direct nutrition programmes.

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## 5.4 ECONOMICS IN NUTRITION

We mentioned earlier that nutritional problems affect the productivity of the individual, which, in turn affects the productivity of the nation. This results in a great loss for the nation. Many factors influence the nutritional state of an individual/community. e.g. amount of food production, food storage, food pricing, subsidies, food distribution, targeted public distribution, government policies etc. You would be surprised to know that over the past three decades, the world has produced more grain per capita but yet in any given year of that recent history, several million people have died from hunger-related, causes. On any given day, perhaps a billion individuals are restricted by their economic circumstances to consume less food than they would like, and hundreds of millions have their growth and physical activity limited by inadequate food consumption. Therefore, planning the food resources adequately can largely prevent malnutrition. Ensuring equitable distribution of the available food resources is a multisectoral challenge. The discipline of *'nutritional economics'* hence tries to analyze this relationship, so that the existing food resources can be used efficiently. The issues that are covered by nutrition economics include:

1. Quantities of food commodities and their development in time (Food Production Systems).
2. Prices of food commodities and their development in time.
3. Share of nutrition expenditures in total expenditures and their development in time.
4. Development of total expenditures on food in stable prices.
5. Statement of the nutrition need according to the demographic structure of the population.
6. Transfer of commodities into biological, nutritious values and their development in time.
7. Construction of balances between the nutritious values and the nutrition needs.
8. International comparisons.
9. Construction of the recommended food/dietary allowances (RFA/RDA).
10. Estimates of the future demand of food dietary commodities.

The different aspects of nutrition economics and their interactions are illustrated in Figure 5.5.

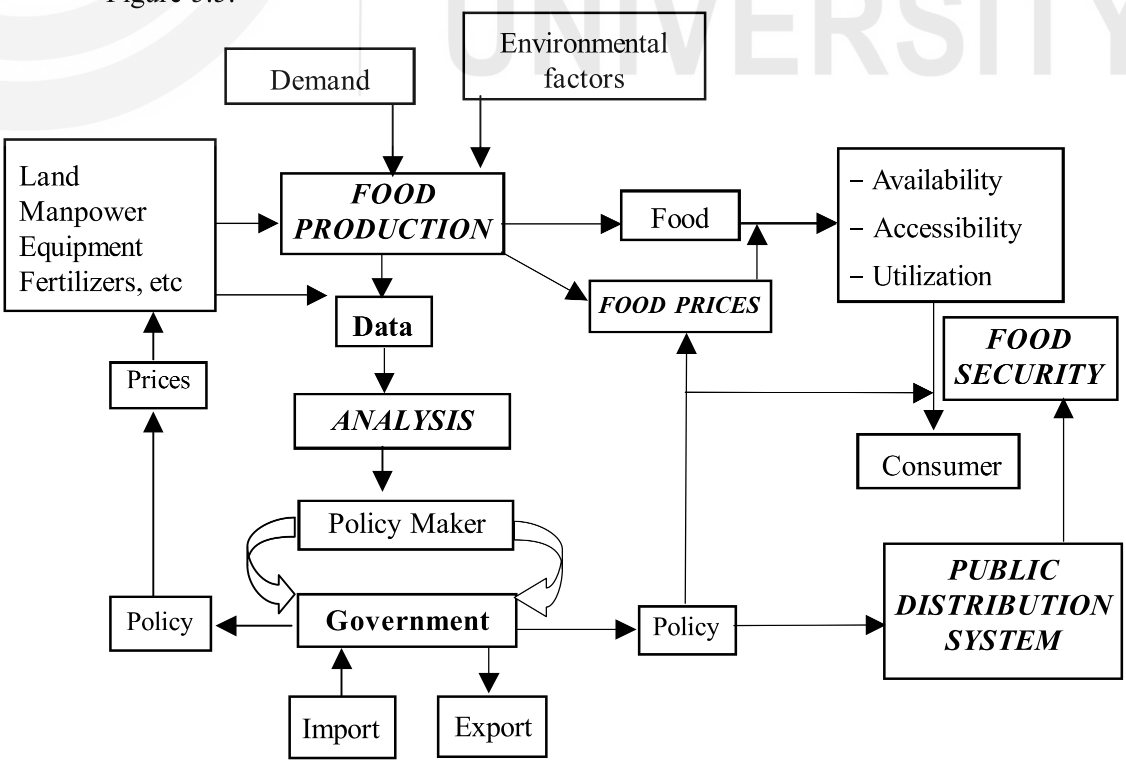


**Figure 5.5: Different aspects of nutrition economics and their interaction**

As is evident food production is determined by demand for food and inputs like land, manpower and fertilizers etc. The data from food production is analyzed for policy formulation. Food production also determines food prices which influences food security of people.

In the following section, we will cover the first two, major aspects, of nutrition economics. These aspects are:

1. Quantities of food commodities and their development in time (Food Production Systems), and

2. Prices of food commodities and their development in time.

However, before we discuss these major aspects, we will first explain food security. This is because, improving food security is a pre-requisite for combating malnutrition. We have already learnt about the concept of food security in Unit 2, we will just recapitulate this here.

### 5.4.1 Food Security

You were introduced to the concept of food security in Unit 2. Food security, we learnt, is *access by all people at all times to enough food for an active healthy life.* In 1983, the FAO Committee on World Food Security, formalized the definition in 1983 and incorporated following three specific goals for food security which include:

1. ensuring adequacy of food supplies,

2. maximizing stability of supplies, and

3. securing access to available supplies to all who need them

Food security can be at the individual level, household level and at the community level. In a given situation, food insecurity can result from the following three causes. These are related to *availability, accessibility* and *appropriate utilization* of the food.

*Food availability*: This refers to *availability of necessary types of food in sufficient quantity, to the individual.* The sources may be from domestic production, imports or donors. In other words, the food should be within the reach of the individual.

*Food Access*: Individuals have adequate incomes or other resources to purchase or barter to obtain levels of appropriate foods needed to maintain consumption of an adequate diet/nutrition level.

*Food utilization/consumption*: This refers to *how food is properly used.* i.e. food preparation, food handling, food storage, balanced diet, nutritional care of vulnerable groups etc. Let us get familiarized with another term i.e. *nutrition security.*

Nutrition security can be briefly defined as a *balance between biological requirements in energy and nutrients and the quantity and quality of food consumed.* Nutritional status is the outcome indicator of nutritional security. On the other hand, indicators for food security are *data related to number of undernourished, food production data, consumption and distribution etc.*

It is obvious that many factors contribute to food insecurity. In a developing country like ours, it can be achieved only through sustained economic growth.

*There are many initiatives, which have a potential to improve nutritional status of the population?* These include:

Increasing food production-building buffer stocks

Improving food distribution-building up the Public Distribution System (PDS)

Improving household food security through:

- improving purchasing power,
- distribution of food to the needy people, and
- direct or indirect food subsidy.

Food supplementation to address special needs of the vulnerable groups - Children, pregnant women and the elderly.

Nutrition education

The contributions from the health sector to tackle

- adverse health consequences of undernutrition,
- adverse effects of infection and unwanted fertility on the nutritional status, and
- micronutrient deficiencies and their health consequences.

So we see that improving food security at various levels is one of the many initiatives to improve nutritional status of the population. Many aspects of nutrition economics contribute to improved food security. For example, if food production is increased, there will be increased availability of food supply contributing to improved food security as already illustrated in Figure 5.5. Let us now go back to two major aspects of nutrition economics. 1) Quantities of food commodities and their development in time (Food Production Systems), and 2) Prices of food commodities and their development in time (Food Pricing).

We will begin our study with first aspect of nutrition economics i.e. Food production.

### 5.4.2 Food Production

We know that agriculture comprises the major source of food production. This is very true in a country like ours where the majority of the population lives in the rural area and farming is the primary mode of subsistence. Improvements in the agricultural sector will hence result in overall improvements of the rural economy. This improvement provides employment opportunities for a large population.

The extent of food production is influenced by various factors. The factors may operate from the *individual level* (e.g. procurement of land, availability of manpower, management of manpower, purchase of equipment etc.) to the *policy level* (food pricing, subsidies, imports and exports. etc). *Environmental factors* also play an important role. An understanding of the interaction of these factors is essential for the economist, to decide on the allocation of resources. If you go back to Figure 5.5, you would note that it shows interaction between various factors. It shows that inputs like land, manpower, equipment and fertilizers and demand for food determine the food supply /production. The data on food production is analyzed to develop policy by the government. Food production also determines the prices of food in the market, which affects the food availability and accessibility by consumers.

Let us now understand some issues related to food production. These are:

- factors influencing food production,
- analysis of food production,
- understanding the response of farmers, and
- developing a strategy.

Let us consider the first issue - factors influencing food production.

*A. Factors influencing food production*

Appropriate food production involves getting an adequate output (i.e food) using appropriate inputs. An essential requisite for this includes labour work-force and good management skills to efficiently use the inputs. If we have skilled labour force and if we can manage the inputs efficiently, the food production will increase. In addition to these two factors, production also depends on: a) environmental, and b) technical factors. Let us study these factors in detail:

a) *Environmental factors:*

You probably know that no agricultural region has a constant climate throughout the year. This is true even in the tropical areas. The variations in climate influence the cultivation patterns. For example, cultivation of rice necessitates adequate supply of water and the dry season is hence unfavourable for rice cultivation. In addition, there may be shortage of labourers in certain seasons. Elimination of these seasonal bottlenecks will improve the food production. On the other hand, too much mechanization will displace hired labour and prevent social gains. One also has to understand that agricultural data also is subject to seasonal variation. So policy makers have to analyze the data and formulate policy, having in mind the seasonal variation in agricultural working pattern.

Seasonality brings in an element of risk and uncertainty for the farmer. This causes the farmer to invest in crops, which are less influenced by changes in climate. It also discourages him to invest more on technical inputs. The distribution of arable land has important economic consequences. Issues related to food/fertilizer transportation and food storage influence the availability and accessibility of food to the consumer.

Let us examine the technical factors in detail.

b) *Technical factors*

Improvement in technology has a significant impact on productivity. Improvements may occur in seed production, fertilizer production, food processing, transportation etc. Agricultural research is an expensive investment. So only few farmers have the resources to carry out research. Advances in biotechnology have been more popular in land-scarce societies and advance in mechanization have dominated the land-rich societies.

In our discussion above, we have seen how environmental and technical factors contribute to food production. We can collect various data on food production and do the analysis of the data. It can be related to capital, labour or prices. The analysis of data can help us predict information related to supply and prices etc. Let us now consider the second issue of food production– analysis of food production.

*B. Analysis of food production*

The agricultural sector is known for its diversity and heterogeneity of decisions right from the farm to the entire marketing system. As mentioned earlier, an element of uncertainty prevails for the farmers. It is important for analysts to know how the farm-level decisions are made so as to bring appropriate changes in policies. Analysts are ready to address the basic production decisions farmers must make to function effectively year in and year out: what crops to produce, what combination of inputs to use to produce them, and what total output to produce.

The supply curve as illustrated in Figure 5.6 is a very convenient *conceptual* and *empirical* tool which summarizes a great deal of complicated producer decision making in a simple two-dimensional diagram. The supply curve is an essential tool in economists understanding of price formation in market economies, The supply curve is a graphical representation of the relation between two factors – the capital and the labour.

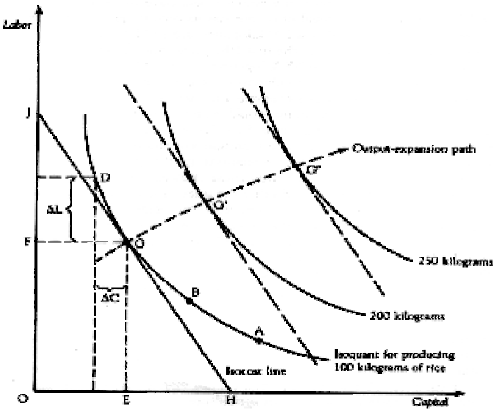


**Figure 5.6: The supply curve**

The supply curve depicted in Figure 5.6 has the capital plotted along the X-axis and the labour along the Y-axis. Various curves are obtained for different combinations of capital and labour and the appropriate one chosen for a given setting. Figure 5.6 illustrates four alternative techniques: hand labour (point D), oxen (point G), a small tractor (point B), and large mechanized equipment (point A). The isoquant connecting these points portrays the possible technical alternatives for growing 100 kilograms of rice. The appropriate combination of labour and capital is determined by the prices of the inputs.

Thus, we see that using a simple empirical tool like a supply curve, food production at various combination of labour and capital can be predicted which can help economists in understanding of price formation in market economies. Location of the supply curve is affected by the government policies, which in turn affects the food production. Although government policy may be favourable to the farmers, it is important to understand how the farmers will react to a particular situation. We will now look at the third issue related to food production i.e. understanding farmers' response.

*C. Understanding the response of farmers*

Understanding the response of the farmers by the government also influences the food production. Government policy influences the location of the supply curve directly through investments that lower marginal costs of agricultural production and indirectly by influencing the decision of the farmer, as price policies alter the incentives to use more intensive techniques of farming to produce more output. Though, government can bring changes in the policy, it is important to know how the farmers may react to the situation. This issue can be addressed only by careful attention to exactly which question is being asked, coupled with specific statistical analysis of country or regional data.

Describing the agricultural sector in statistical terms is complicated by agriculture's unique characteristics. Annual production statistics by crop for the entire country can be obtained but this doesn't reflect the decisions taken by the individual farmers. Moreover each farm setting is unique in its own sense. A model, which may be successful in one area, may not work in another area. This necessitates to collect data (e.g. village-level surveys etc.) from a variety of ecological settings (i.e. different types of agricultural lands). To serve this purpose, the arable land is divided into *Agroclimatic zones*, where similar ecological zones are grouped together. Data is collected from selected areas of each zone. The data may cover the following issues:

- how farming systems are likely to respond to policy changes,
- type of crops grown,
- farm-size distribution,
- farm prices, yields, profitability data,

the ratio of commodity prices received by farmers to the price paid for a key input such as fertilizer provides a rough assessment of how tightly the agricultural sector is being squeezed by low economic incentives relative to other regions and countries.

comparing regional prices with international prices.

Thus, we see that food production will vary depending upon how farmers response to policy of the government. India being such a diverse country, each farm-setting is unique. Therefore, survey is required for different settings and data, is analyzed to understand many issues related to production and prices.

We have seen earlier that it is essential to understand the factors influencing food production analyze food production data and understand farmers' response. Last and the fourth issue of food production, then becomes, that an appropriate strategy is developed which would help in bringing an improvement in rural economy. Let us see how and why we do that briefly.

*D. Developing a strategy*

It is necessary to develop a strategy that results in improvement in the rural economy. This could be achieved by framing policies which can pump more money into the rural sector. This would also result in improvement of employment opportunities in the rural areas. It can thus be concluded that, for successful food production, it is necessary to understand the decision making process of the farmers and the policy formulated accordingly.

So, we studied about the four issues related to food production. These are factors influencing food production, analyses of food production, understanding the response of farmers and developing a strategy. A thorough understanding of these issues is important before making a policy change and planning an intervention to improve food production in the country.

We will now study the second major aspect of nutrition economics i.e. Food pricing.

### 5.4.3 Food Pricing

The pricing of the food products bought by the consumer is subject to multifarious factors. Each of the factors as discussed below can affect the pricing both in the interest of the consumer and against it. An overview of these factors will help one understand the umpteen tasks faced by the policy makers in achieving at a decision which will be in the best interest of the consumer, as well as, will help positively towards the burden of the malnutrition in the community.

The costs of *storage, transportation, processing*- which are known as the marketing transformations – are an integral component of food price formation. The storage at the non-harvest season can increase the prices due to logistic reasons or due to the wish of the storage-marketer to look for some gains during the non-harvest season. The transportation costs may rise with the increase of the distance between the production point, and the final consumer. Also, poor conditions of the roads and communication will contribute into the increase of the price. Processing, e.g. the milling of the rice before selling it to the consumer will increase the price, but then consumer also prefer it more as compared to the raw unmilled rice directly from the farm.

Seasonality by virtue of the harvest and the non-harvest seasons will affect the pricing. Pricing will increase with the demand, e.g. local food habits will determine the pricing of a grain in respect to its acceptability in the local population.

Increasing the prices of the seeds, fertilizers, pesticides, and other farm related equipments will increase the prices of the grain, but at the same time these things if are under subsidy from the government, can help in decreasing the prices.

Markets do not always function in the best interests of a broad cross section of society. Highly unequal financial bargaining power is often brought to the exchange relationship between seller and buyer. In the absence of any price regulatory body, all the middlemen involved right from the level of the production to the level of the consumption may have a wishful interest in the pricing. Thus, more is the number of the middlemen in the path, more the prices will increase.

A shortage of food means high prices in a market economy, with only the well-to-do able to purchase it. A food shortage in a socialist economy means rationing, with perhaps little choice about what the poor can eat. Competition and the number of market participants affect the logic of decision-making behaviour. For competition to be effective, however, there must be an adequate number of participants on both sides of the exchange relationship so that no single agent can significantly influence the outcome of the exchange. Farmer's range of choice at the initial point of sale is the first step in understanding how competitive price formation is likely to be. The more agents there are competing to buy the farmer's grain, the better the information available to the farmer about the prevailing price and the easier it is to switch from one buyer to another whose terms are relatively better. At the opposite end of the marketing chain, where consumers buy foods if many alternative retail stalls offer similar commodities and services, the freedom of consumers to choose one retailer over another prevents excess profits from high margins accruing to the retail-marketing agents.

Government induced subsidy directly to a commodity will help in decreasing the prices. International markets affect the prices in an intricate way. Actually the domestic markets are in an effect only a networking between the various international markets, so it is not astonishing to find the price getting affected as a result of the international price correlation.

The cost of the labour involved at every stage will increase the prices. Tax levied by the government will also increase the prices. Thus, we see that there are many factors, which influence the price of the food commodities. Food commodities available at affordable prices by the poor can go a long way to improve the food security of vulnerable population and thus help improving their dietary intakes.

In the above section, we studied about economics of health and nutrition. We looked at various health and food resources required to improve nutritional status of population. We also analyzed various economic consequences of malnutrition. Now we will review how we can efficiently plan and allocate these limited resources to alleviate the large problem of malnutrition. Thus, in the next section, we will explore the concept of economic evaluation of malnutrition. But before moving on to this topic let us check our understanding on the subject so far by answering the questions given in check your progress exercise 2.

**Check Your Progress Exercise 2**

1. What is Food Security? Enumerte the three causes for food insecurity.

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2. Define the term nutrition security and list any four initiatives to improve nutritional status.

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3. Explain in brief the factors responsible for food pricing.

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4. What are the various issues related to food production and explain any one in brief?

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## 5.5 ECONOMIC EVALUATION OF MALNUTRITION

You must be familiar with a proverb frequently used in the field of economics, which says– "resources are limited and wants are unlimited". This can be applied to the area of programme planning also for alleviating malnutrition. Shortage of resources is constantly faced by programme planners where they try to make the best use of the limited resources using it for the programmes which will yield the best results. Taking into consideration the scarcity of resources, especially in developing countries, it becomes important for the decision makers to strike the most favourable balance between the health benefits achieved and the cost incurred. At some point, the society must decide one programme in preference to an alternative. The term 'opportunity cost' describes *the link between the scarcity of resources and sacrifices made by the society.*

*So, how do we know which intervention is better than the other in terms of the health benefits or which is least expensive strategy for achieving the same health outcome*? We can find that out by conducting an economic evaluation. Economic evaluation in the health care sector consists of comparing two or more health care interventions in terms of their cost and consequences as described earlier in Table 5.1. There are two objectives of economic evaluation. These are:

1. To introduce resource consideration into analysis and to assess the opportunity cost of new procedures and programmes (preventive, diagnostic, therapeutic, rehabilitative)

2. To develop a framework within which the costs of the new procedures or programmes can be compared to their benefits.

Depending upon what objective we want to achieve, we can conduct three types of economic evaluation:

cost-effectiveness analysis,

cost-utility analysis, and

cost-benefit analysis.

Let us discuss these briefly:

*Cost effective analysis:* Cost effective analysis provides for the choice of least expensive strategy at the least cost. Here the outcome is measured in terms of natural units e.g. life-years gained, number of children prevented from developing malnutrition etc.

*Cost utility analysis:* Cost utility analysis provides for measurement of health outcomes for a given cost. The health outcomes are measured quantitatively, as well as, qualitatively. These can be quality-adjusted life years (QALY) or health years equivalent (HYEs).

*Cost-benefit analysis:* Cost benefit analysis is a useful tool to establish the priority of a particular health service action. In this, both inputs and outputs are measured in monetary terms. Cost benefit analysis is probably most useful for health programmes that have a major impact on economic development.

You would note here that the first step for economic evaluation is to estimate the cost of intervention that is being used for control or prevention. The process of identification, measurement and valuation of costs associated with each alternative are identical in all three methods. The difference lies in the way the consequences are measured and valued as represented in Figure 5.7. Which depicts the components of economic evaluation.

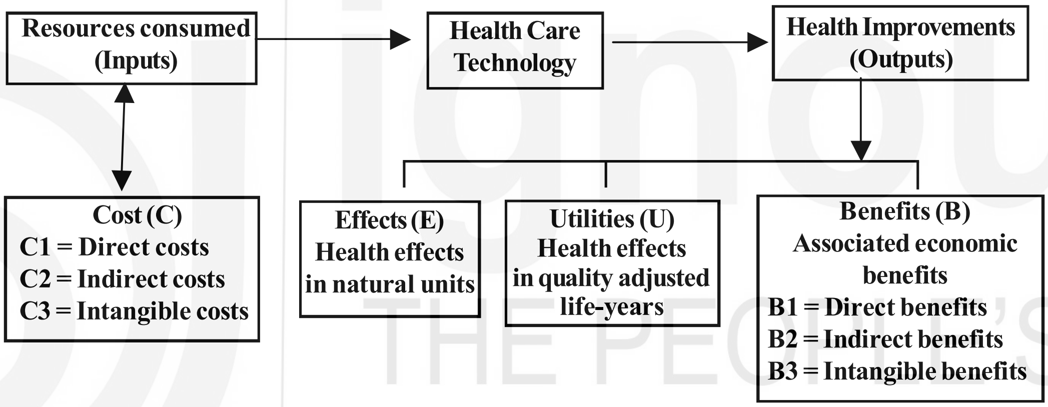


**Figure 5.7: Components of economic evaluation**

Figure 5.7 shows cost incurred in terms of resources consumed (inputs). These resources with the use of health care technology yield improvements in health, which can be measured in terms of benefits, utilities and effects.

So, we can conduct any type of economic evaluation depending upon what our objectives are for use of resources and measurement of benefits. Policy makers to make decisions regarding allocation of limited resources generally use economic evaluation. But have you ever wondered what does it cost to a nation on a yearly basis when we have several people suffering from malnutrition? We use the term "annual productivity loss" to calculate this loss to the nation. Let us find out more about it in the next section.

*Annual productivity loss*

The above section dealt with optimum use of resources and the kind of health benefits obtained with the use of those resources to prevent and control malnutrition. When people suffer from malnutrition or any specific micronutrient deficiency, their productivity at work decreases. For example, when they have iron deficiency anaemia, their work capacity may reduce and they may be more susceptible to infection. With the result, they are more likely to produce at less than optimal level or miss out from work due to sickness. Missing out time from work is known as *productivity loss*. Nowadays, there is a constant pressure on health care research personnel to calculate productivity loss due to health consequences. Productivity loss can be measured using 3 parameters which include productive life expectancy, average annual wage for an adult and average rate of employment.

Thus, the formula given for calculation of annual productivity loss is:

Annual productivity loss = (n*p*w*e) + (d*pe*w*e)

where,

n = no. of adults suffering from deficiency disorder

p = productivity loss due to disorder

w = annual wage

e = employment rates

d = death due to disorder

pe = productive life expectancy

The assumed productivity loss (p) due to different deficiency disorder is given in Table 5.6 and can be used in the formula above.

**Table 5.6: Productivity loss due to different deficiency disorders**

| Nutrient | Deficiency Disorder | Assumed Productivity Loss (%) |
|---|---|---|
| Calories | CED | 10% |
| | Obesity (CEE) | ? |
| Iron | Anaemia | 20% |
| Iodine | Mild iodine deficiency | 5% |
| | Cretinism | 50% |
| Vitamin A | Partial blindness | 25% |
| | Total blindness | 50% |

***Source:*** *Assumptions made by Judith McGuire et al., National strategy to reduce childhood malnutrition: Final Report; Min of HR&D:GOI, Administrative staff college of India, Hyderabad. Dec, 1997.

Let us understand the concept of productivity loss with the help of an example. We can take the case of anaemia and calculate the annual productivity loss as follows:

Let us assume

| | |
|---|---|
| Productive life expectancy (years) | = 15.6 |
| Annual wage for an adult | = Rs.3500 |
| Average rate of employment | = 75% |
| No. of adults suffering from anaemia | = 5000000 (hypothetical figure) |
| No. of deaths attribute to anaemia | = 10,000 |

Annual productivity loss for anaemia of a given geographic area for the given year

= ( 5000000*.20*3500*.75) + (10,000*15.6*3500*.75)

= 2625000000 + 409500000

= 3034500000

= Rs. 3 billion/yr

In the table above productivity loss due to obesity is not included. Some evidence suggests that obesity, in particular, is associated with an increased risk of temporary work loss such as sick leave (absenteeism) and reduced productivity while being present at work (presenteeism). It is also associated with permanent work loss, which includes disability pension and premature death. Recent reviews have found strong evidence that temporary and permanent work loss attributable to obesity result in a substantial burden for national health and insurance pension systems.

The example of calculating annual productivity loss presented above is based on hypothetical figures.

You would be surprised to know that the total estimated annual productivity losses (2010) for India for micronutrient deficiency is approximately Rs. 3914 billion (low scenario) to 1000 billion (high scenario). Isn't that too much? If we eliminate malnutrition, then productivity of people of our country will increase and we would have a monetary gain of Rs. 1000.0 billion in terms of increased goods and services and better quality of life for people.

With this we end our study on the economics of malnutrition. We hope having gone through the concepts present in this unit you would realize what is the cost of malnutrition and how economic evaluation of malnutrition keeps to plan the targeting of resources for alleviating the problem.

**Check Your Progress Excercise 3**

1. Fill in the Blanks:

   a. ...................................... benefit analysis is a useful tool to establish the priority of a particular health service action.

   b. Missing out time from work is known as ...................................... loss.

   c. ......................................and ...................................... are health outcomes measured quantitatively as well as qualitatively as part of the cost utility analysis.

   d. ...................................... is the term which describes the link between scarcity of resources and sacrifices made by the society.

   c. The full form of QALY is......................................

2. Give the formula for Annual Productivity Loss with complete expansion.

   ......................................................................................................................

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## 5.6 LET US SUM UP

This unit focused on the economics of malnutrition. The major points emerging from this unit were:

Health economics concentrates on application of the principles and rules of economics in the sphere of health. In broad terms, it includes analysis and evaluation of health policy and the health system from an economic perspective.

Malnutrition causes huge amount of economic losses to the nation. The causes of malnutrition are multifactorial and interventions have to be done at various levels.

Nutrition economics deals with many issues relating to food resources such as food pricing, food production, food marketing and food storage etc. The discipline tries to analyze relationship between all these issues so that food resources can be adequately planned, equitably distributed and efficiently used to improve the nutritional situation of the people.

Food security is access by all people at all times for enough food to lead an active health life. Food security can be at the individual level, household level and at the community level. In a given situation food insecurity can result from the following three causes: These are related to availability, accessibility and appropriate utilization of the food.

Economic evaluations play an important role to estimate the burden of a given public health problem and help in planning and policy making.

## 5.7 GLOSSARY

**Biotechnology** : biotechnology describes the use of organisms and biological processes to provide food, chemicals and services to meet the needs of humans.

**Isoquant** : locus of all input combinations that yield the same level of output.

**Pathological** : the branch of medical science that studies the causes, nature and effects of diseases.

**Synergistic** : action of two or more substances to produce an effect that neither alone could accomplish.

## 5.8 ANSWERS TO CHECK YOUR PROGRESS EXCERCISES

**Check Your Progress Exercise 1**

1. Health economics is concerned with analysis and evaluation of health policy and the health system from an economic perspective. In particular, it includes health system planning, market mechanisms, demand for and supply of health care, economic evaluation of individual diagnostic and therapeutic procedures, determinants of health and its evaluation, and evaluation of the performance of health care systems in terms of equity and allocative efficiency.

2. When an individual is malnourished his/her economic productivity falls. This further deteriorates the nutritional status of the individual. Economic productivity of the individual influences the household real income which influences the household food availability and food allocation in the family. When household real income falls as a result of low economic productivity, families have less food available for different members of the families. Poor food consumption contributes to low nutritional status of the family members especially the mother and the child. Mothers with poor nutritional status have low capacity to take care of the child. This insult to the child has long term consequences in terms of growth, cognitive capabilities, morbidities and mortalities etc. This results in loss of productivity in school. For adults, poor nutritional status leads to reduced stamina and endurance and low physical capacity at work, thus contributing to reduced economic productivity. So this loss of productivity influences economic status of the family, which can further deteriorate or prevent improvement of the nutritional status.

3. Total Government spending on nutrition covers what the GOI and state government spend on nutrition programmes. Under direct nutrition programmes, spending on ICDS is the highest (67%) followed by NMMP (30%) and Micronutrient and other programmes (3%).Under the indirect nutrition programmes, spending on PDS was 99% followed by employment assurance schemes (1%).

**Check Your Progress Exercise 2**

1. Food security is access by all people at all times to enough food for an active healthy life. The three major causes for food insecurity are:
   - Food availability
   - Food access
   - Food utilization/consumption

2. Nutrition security is defined as a balance between biological requirements in energy and nutrients and the quantity and quality of food consumed. The four initiatives to improve nutritional status are increasing food production – building buffer stock, building up the PDS, nutrition education, food supplementation.

3. The various factors that affect food pricing are storage, transportation, and processing.

4. The major issues related to food production are factors influencing food production, analysis of food production, understanding the response of farmers, and developing a strategy.

**Check Your Progress Exercise 3**

1. a. Cost

   b. Productivity

   c. QALY, HYES

   d. Opportunity Cost

   e. Quality Adjusted Life Years

2. The formula for Annual Productivity Loss is:

   Annual Productivity Loss = (N* p* w* e) + (d* pe* w* e*)

   Where, N = no. of adults suffering form deficiency disorder

   P = productivity loss due to disorder

   W = annual wage

   E = employment rates

   D = death due to disorder

   pe = productive life expectancy