# BREAST CANCER IN TURKEY: ECONOMIC EFFICIENCY and COST EFFECTIVENESS

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## Theoretical Framework: Health Expenditures and Economic Efficiency

Health expenditures are evaluated as expenditures directly affecting growth and efficiency particularly because of externalities. It is commonly recognized that health expenditures have a positive impact on growth not only by extending the duration of human life via its level of supply and quality; but also by decreasing negative externalities, in particular through protective health services (Yılmaz 2007).

The distinctive character of health services from other goods and services is also determining on the debates concerning the state's intervention to the market with respect to supply and financing of health services.[1] The middle point reached in the ongoing debates is that everybody has a right to reach a minimum level of health service. This approach brings forth a very basic question; **"Well, what is the economic efficiency of alternative ways of ensuring that everybody benefits from a certain minimum level of such services?"** (Stiglitz, 1988).

Supply of protective health services, which are taken up within the definition of virtuous goods and services under the scope of health services, is regarded to be within the basic responsibility area of public authority. It becomes a basic priority parameter within the process of

[1] For this subject, see: FUCHS, V.R. (1975), "Who Shall Live? Health Economics and Social Choice", Basic Books; FUCHS, V.R. (1986), "From Bismarck to Woodcock:The Irrational Pursuit of National Health Insurance", Harvard University Press; STIGLITZ, J. (1988), "Economics of the Public Sector", W.W. Norton&Company, Second Edition

allocation of public resources that priority of public expenditure in health is protective rather than curatory. The use of such resources after allocation comes up to be a problem of efficiency again within this context.

A point to be assessed concerning the contribution of health services to growth and their quality is the prioritization in the sector per se. Especially the preference between the protective and basic health services and the curatory health services which are of higher cost becomes more and more important in an atmosphere where the social utility of the former is expected to be higher than its cost (Emil et. Al., 2003).

As mentioned above, health expenditures are not primarily considered to be a sole item of cost as distinct from other public expenditures. The fact that health services have a direct impact on life spans and life qualities of individuals in the society and have a significant degree of external impact gives a distinct place to health from other public services. Following this determination, on the other hand, the problem of prioritization within the health services themselves becomes a much more important issue especially when public money (of the taxpayer) is used. Within this framework, the public preference between protective health services and curatory health services which are of higher cost becomes more and more important in an atmosphere where the social utility of the former is expected to be higher than its cost.

In addition to lengthening of life spans and improvement of life qualities of individuals via protective health services, treatment costs also decrease significantly by early diagnosis of diseases. This is much more accurate especially for diseases of high treatment and medicine costs, like cancer.

Analysis of cost effectiveness is another method used in the internal prioritization of resources allocated to health. The impact of policy decisions on health can be assesses through a common measurement called cost effectiveness ratio and it becomes possible to compare the results of various policies. On the other hand, this is seen as an important tool in policy making for decision makers.

Analysis of cost effectiveness shows the cost of a policy having impacts in a single ratio. Cost-effectiveness ratio = (the net cost of performing a policy) / (the development in health achieved by the new policy). For this reason, cost effectiveness shows not only the cost of an intervention; but also the result of the intervention divided to its cost. In the analysis of cost effectiveness, the ratio obtained by the formula specified above is used. This formulation is used by many researchers who made cost effectiveness calculations. For instance, Cowley et. al. define cost effectiveness as: “the cost of a health service divided by Disability Adjusted Life Years (DALY) saved from that health service”.

All the cost effectiveness calculations and approaches are collected together in the work titled as Disease Control Priorities in Developing Countries which is a publication of the World Bank. World Health Organization recently published a new approach to calculating cost-effectiveness; but the general formula determining the cost effectiveness of health interventions remained the same as the cost of intervention divided by health outcome (change in the case in the healthy life year (Study of National Disease Burden and Cost-Effectiveness, 2004, Ministry of Health, Republic of Turkey).

Analysis of cost effectiveness leads to an increase in the quality of decision making processes of administrations when compared with the absence of such analysis. It has a guiding character for the decision maker as a common language used in the allocation of resources. It should not be seen as having a character directly determining or restricting the decision making process.[2]

## A Brief Look at the Structure and Development of Health Expenditures in Turkey

Health expenditures rapidly increase especially in the last 10 years in Turkey. The ratio of health expenditures to Gross Domestic Product (GSYH) was 6.1 % in 1999 and the same ratio increased to 7.5 % at the end of 2006.[3] This development made Turkey considerably approach to the OECD average (8.6 %) in health expenditures and become a country allocating more resources to health than many countries. [4]

It is estimated that increase in health expenditures emanated primarily from increase in public health expenditures. The ratio of public health expenditures to GSYH was 5.2 % (20.9 billion USD) at the end of 2006, whereas it was 3.8 % (7.1 billion USD) in 1999.

[2] For more detailed assessments in this subject, see; BRENZEL, L. (1993), "Selecting an Essential Health Package of Health Services Using Cost-Effectiveness Analysis: A Manuel for Developing Countries"

[3] The ratio increases to 7.7 % when public health expenditures which are not reflected in financial reports are added. For more detailed assessments in this subject, see; YILMAZ, H. Hakan (2007), "İstikrar Programlarında Mali Uyumda Kalite Sorunu: 2000 Sonrası Dönem Türkiye Deneyimi", TEPAV Yayını [The Problem of Quality in Financial Adjsutment in Stability Programs]

[4] Public health expenditures were calculated on a yearly basis. Private health expenditures, on the other hand, were estimated for the year 2006 with reference to the study of national health calculations.

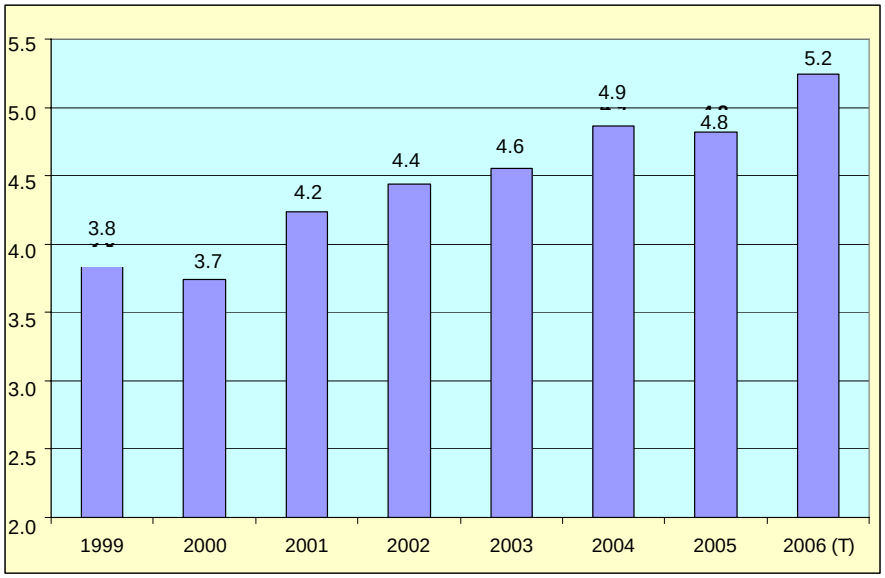


**Figure.1. Development of Public Health Expenditures (%, GSYH) (Yılmaz, 2007)**

Such a level of increase in health expenditures in a period when stability program is implemented is significant. This tendency of increase in health services in a period when serious savings are made in public expenditures in order to reach the aimed the primary surplus creates an additional financial pressure on other public services such as security, justice, and defense. Again this increase should be considered as a situation which should be well interpreted especially in a period when the country passes to the General Health Insurance implementation. This becomes more important in an atmosphere where 60-65 % of the total health expenditures are financed by the public. As mentioned, the crucial point concerning the health expenditures of the public in some developing countries like Turkey is that health expenditures of a significant part of the population are financed by the public. The fact that a significant part of the population is covered by social insurance institutions managed and financed by the public affects the economy because of the public intervention to the price formation (Yılmaz 2007).

In fact, these reveal why studies like economic efficiency, cost efficiency, and cost effectiveness towards public health expenditures become important. This study was also prepared for the same purpose.

## Breast Cancer and Economic Efficiency in the Case of Turkey

Breast cancer is the most frequently observed cancer in females especially in the developed countries. This is valid for Turkey too. In females at reproductive ages, breast cancer incidence increases in positive correlation with age. In America, approximately 211,240 women were diagnosed to have invasive breast cancer as of 2005 and 40,410 women dead due to breast cancer within the same year. More than 2 million women are under treatment because of breast cancer at present in USA (Cancer Facts and Figures, American Cancer Society, 2005). When we look at all death causes in Turkey, we see that cancer is the second both in males and females with ratios of 15.04 % and 10.74 % respectively. In Turkey, the death causes of 21,174 women are recognized to be cancer as of 2000 (National Disease Burden and Cost-Effectiveness Project 2004). In Turkey, breast cancer ranks the 8$^{th}$ with a ratio of 2.1 % within 20 diseases which most frequently result in death in females (National Disease Burden and Cost-Effectiveness Project 2004). With this ratio, the death rate due to breast cancer in Turkey is recognized to be higher than in USA.

Breast cancer is a progressive disease and life expectancy is higher since the probability of treatment is higher in early stage diagnosis. It is of crucial importance that the tumor is diagnosed before it becomes palpable. With early diagnosis and treatment methods, 5 year survival in patients diagnosed to have breast cancer is 80 % in developed countries, while this ratio is 40-60 % in developing countries (Cancer Facts and Figures, American Cancer Society, 2005, Sankaranarayanan et. al. 1998). 63.7 % of breast cancers can be diagnosed in early localized stages with breast cancer scanning methods. 5 year life expectancy of the patients detected in this stage is 97.9 % (Cancer Facts and Figures, American Cancer Society, 2006)

According to the data of disease burden study carried out by the Ministry of Health of the Republic of Turkey, breast cancer incidence in females was 24.4/100,000 and prevalence was 0.3 % in Turkey. Breast cancer is the most frequently observed cancer type in females in Turkey; for this reason, studies for early diagnosis and treatment are crucial. Risk factors are tried to be identified with epidemiological studies, early stage cancers are tried to be diagnosed by applying screening methods. Generally in the world, the following are defined to be the most important factors determining the breast cancer risk, being dependent to age: environmental factors, genetic susceptibility, family story, life style, hormone use, and menarche age. The number of the studies directed to determine the breast cancer incidence and risk factors in Turkey is very low and such studies were carried out making use of limited numbers of patients (Ceber et. al. 2005, Oran et. al. 2004).

Breast cancer is a long-course tumor progressing insidiously and showing a heterogeneous. It is necessary to conduct regular screenings in order to early diagnose this cancer which is observed this frequently. Diagnosis at early stages can affect prognosis positively and besides decreases morbidity and mortality. It also makes breast protective surgery possible in appropriate cases. Protective approach in cancer has direct impacts on the life of the individual as distinct form vaccination practices. However, since breast cancer is a disease increasingly seen in females at 40s, not only the individual; but also the family and the society certainly benefit from the screenings through indirect impacts like not losing the work force of one of its members on her productive ages and like decreased treatment costs.

The method to be used in cancer screenings should be easily applicable, cheap, of high cost efficiency, reliable, and easily attainable. The efficiency of the screening methods conducted and the validity of the results obtained are important. Mammography is most significant method used in the early diagnosis of breast cancer. In addition to mammography, training of the women, self-examination, physical examination and ultrasonography are the other methods most frequently used. Using two or three of these methods together increases the efficiency of the screenings. Sensitivity of mammography is around 75-90 % and its specificity is around 90-95 %. Positive predictive value of mammography is around 20 % in females below 50, whereas it is 60-80 % in females at the age group 50-70 (Elwood et. al. 2004, Straatman et. al. 1997). This situation is also explained in reference to the fact that reliability and efficiency of mammography screenings decrease due to dens structure of breast tissue before the age of 50.

Method of calculation of growth rate of breast cancer is recognized to be the doubling time of the tumor diameter and his means 8 times increase in tumor volume. It is accepted in exponential growth models that malignant cells continue to increase on a constant rate. According to publications, this doubling time is 205 days in squirrous carcinoma. On the other hand, it is 252 days in papillotubular carcinoma. Increase in the rate of tumor growth means the worsening of prognosis. In studies, the doubling time of the tumor in breast cancer is recognized to be 80-100 days crudely. So it is calculated that a primary tumor, starting from a single cell attains 1 cm diameter in 8 years (Kuroishi et. al. 1990). Doubling time and level in tumor diameter is used a base in treatment response evaluations and screening studies. Although diagnose can be given in earlier stages in mammography screenings, application of the patient as a result of experiencing evidence show a delay of 1.5-2.5 years when the patient is left to the normal course (Kuroishi et. al. 1990, Walter and Day 1983).

Prognosis of cancer patients and type of treatment to be applied change according to the stage of the disease. The most important characteristics determining the prognosis are tumor type, hormone receptor positivity, existence of genetic markers, lymph involvement, existence of metastasis, and tumor size. Although some of these parameters can not be changed, with early diagnosis, early stage and smaller tumors can be detected without conducting lymphatic, vascular invasion and metastasis. For this reason, the early diagnosis of cancer is crucial with regard to provide decrease in the morbidity and mortality of the disease. It is found in a study carried out in North America that the stages of patients diagnosed as a result of screening and patients applying to policlinic as a result of experiencing evidence show differences. In this study, it is seen that the distribution of the patients diagnosed to have breast cancer as a result of screening is rather on early stages; that is on stages I-II and that the number of patients on stages III and IV are very few. However, it was observed that in areas where screenings are not conducted, the diagnosis stages of the patients presenting directly to the policlinics as a result of symptoms are distributed predominantly on stage 3, also covering the more advanced stages. The lymphatic invasion and metastasis ratios which significantly affect prognosis of the disease, treatment protocol, life span, and life quality were found to be higher in these policlinic patients than in screening patients (Shen et. al. 2005).

In randomized clinic studies, it was seen that breast cancer screenings carried out with mammography annually or once 2 years decrease mortality for 30 % (Swedish Organised Screening Service Evaluation Group, 2007). 210,000 women between the ages 20-70 who were applied mammography screening between the years 1958-1977 in Switzerland were applied screening again after 20 years (1978-1997) and breast cancer development incidence and rates of death due to breast cancer were evaluated. When the findings were compared with incidences and rates of the women who were not applied screening before in the said period, a decrease of 44 % in mortality was observed in women at ages of 40-69, and 41 % in all age groups. In monitors of those who were applied screening for the first time, on the other hand, 16 % decrease in mortality in the age group 40-69, and 27 % decrease in the age group 20-39 were observed (Tabar et. al. 2003). In another study carried out in England, on the other hand, it was seen as a result of 10 years monitor of patients diagnosed to have breast cancer again as a result of mammography screening that mortality was 17 % lower in breast cancer cases diagnosed by screening (Moss et. al. 2005).

The aim in this study is to determine in the middle and long term the economic efficiency and cost effectiveness in resource usage of mammography screenings which have a crucial role in early diagnosis and treatment of breast cancer and to determine the impact of mammography on diagnosis stages of the patients.

## Methodology

This study was conducted making use of the data of 12020 women at the age group 50-69 who were screened for the first time in 2005-2006 at the different times within the scope of Community-Based Breast Cancer Screening Program which was carried out in the following Centers for Early Diagnosis and Screening of Cancer established by the Directorate of the Department of Cancer Control of the Ministry of Health, Republic of Turkey: Ahmet Andiçen District Policlinic of Dr. Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital, Balıkesir State Hospital, Giresun Prof. Dr. İlhan Özdemir State Hospital, and İzmir Atatürk Tarining and Research Hospital Tülay Aktaş Center. Within the scope of this screening program 81 breast cancer cases were detected and cancer stages of only 20 of these cases were reached.

With the aim of determining the stage distribution of the patients who applied to any health policlinic as a result of symptoms and who were diagnosed to have breast cancer, diagnosis-moment stages of 134 patients diagnosed to have breast cancer at different times, being monitored since 2000 under the scope of the study carried out together with Dr. Abdurrahman Yurtaslan Ankara Oncology Hospital Ahmet Andiçan Center for Early Diagnosis and Screening of Cancer of the Ministry of Health, Republic of Turkey and Surgery Polyclinic of Numune Training and Research Hospital of the Ministry of Health, Republic of Turkey and Molecular Biology Research and Development Unit of Ankara University were used.

Treatment and monitor costs according to stages of the patients diagnosed to have breast cancer were taken according to the records of the Oncology Clinic of Numune Training and Research Hospital of the Ministry of Health, Republic of Turkey. 14-57 months monitors of 14 stage I, 6 stage II, 9 stage III, and 6 stage IV patients were used. These patients were randomly selected among different stage patients who applied to the policlinic at different times, detailed files of whom were available.

Breast cancer screening costs were calculated in Dr. Abdurrahman Yurtaslan Ankara Oncology Hospital Ahmet Andiçen Center for Early Diagnosis and Screening of Cancer, of the Ministry of Health, Republic of Turkey standardizing the data taken from the following Centers for Early Diagnosis and Screening of Cancer: Dr. Abdurrahman Yurtaslan Ankara Oncology Hospital Ahmet Andiçen, Ministry of Health, Republic of Turkey, Balıkesir State Hospital, Giresun Prof. Dr. İlhan Özdemir State Hospital, İzmir Atatürk Training and Research Hospital Tülay Aktaş Center.

## Calculation of the Total Number of Women with Breast Cancer

The total cases to be treated, defined within the scope of National Disease Burden and Cost Effectiveness Study (2004) of the Ministry of Health, Republic of Turkey was determined to be 16,883. Nevertheless it

was stated in the same study that it is not possible to say that this number is prevalence or incidence. In our study, probable number of breast cancer cases in women at the age group 50+ in Turkey in general was calculated using the number of breast cancer cases obtained from screening results. Within this scope, female population at the age group 50+ in 2007 was regarded as 6.6 million. Again with reference to this number, probable female population between the years 2007-2012 achieved by the Assistant Professor Şeref Hoşgör in his population projection study was used.

### Calculation of Screening Cost per Patient

Screening costs per patient were calculated by examining in detail the cost structures of Cancer Early Diagnosis and Screening Centers (KETEM). Detailed expenditure data primarily requested from the centers within this scope are classified as personnel, purchases of goods and services, maintenance and repair expenses, and capital expenses. The economic lives of various machines and equipments associated with purposes of mammography, ultrasound, computer and training, which fall within capital expenses, were determined and their annual costs (amortization) were calculated. Nevertheless, in the study, calculation was made with reference to the total costs to be born in case of a comprehensive screening program rather than the total costs of KETEMs including ultrasound and in part pathology. Within this scope, costs were taken to screening basis and the calculations were corrected as such. In the calculation of screening programs, the application of a screening program focused on examination and mammography was predicted. Ultrasound and pathological interventions were not taken into consideration here.

### Breast Cancer Treatment Costs

In breast cancer TNM classification was used. The patients were assessed as stage I, II, III, and IV making assessments of tumor size, nodal involvement, and metastasis.

Treatment and monitor costs according to stages of patients diagnosed to have breast cancer were made according to the records of Oncology Clinic of Numune Training and Research Hospital of the Ministry of Health, Republic of Turkey. A random sample of different stage patients who applied to the policlinic at different times and available detailed files was chosen. The costs of surgical operation, radiotherapy and medicine treatments, and laboratory tests used in diagnosis and monitor, which were applied during the 14-57 months monitor period were calculated excluding the costs of line in hospital for 14 stage I, 6 stage II, 9 stage III, and 6 stage IV patients with adjustment

to 2007 prices and hence treatment and monitor costs for patients in each stage were calculated as average annual costs.

**Findings of the Study**

Within the scope of the study, when the probable number of breast cancers as of 2007 is estimated by the ratio of the number of cancer cases detected with reference to the data of breast cancer screenings to the population of 50+ in Turkey, it was found that the number is in fact 44,253. However, this number was determined to be 16,883 in 2004 National Disease Burden and Cost Effectiveness report. In this case, there are 27,370 cases having the potential to be covered by breast cancer treatment, which have already developed breast cancer; but not yet diagnosed. We will confront these cases as breast cancer patients in advanced stages according to the phases they give evidence. This is also supported by diagnosis stages of policlinic patients.

In this study, 17 out of 134 patients applying to policlinics with different symptoms and/or cancer suspicion were found to be stage I; 72 stage II; 41 stage III; and 4 stage IV. Stage distribution per cents are 12.7, 53.7, 30.6, and 3 respectively. 81 breast cancer cases were detected as a result of 12020 patient screening at different times between the years 2005-2006 in 4 different KETEMs in Turkey (Ankara, Balıkesir, Giresun, İzmir). Stages of 20 of these cases were reached. Stage distribution per cents of the patients who were diagnosed during mammography screenings were found to be 45 % for stage I and II and 10 % for stage III. If the cases detected during mammography screenings were left to their natural course, we would confront these ratios more intensely in advanced stages.

When we look at the treatment protocols applied according to stages, we see that multimodalite treatment is applied in early stage treatments (stage I and II) of the breast cancer. This treatment is the application of surgery, radiotherapy, and systematic drugs. Characteristics of lymph nodal involvement, tumor size, and invasion are important in systematic treatment practices. In addition, the treatment protocols showing hormonal interaction such as tamoxiphen are also added to the treatment according to estrogen, progesterone receptor positivity. The surgery applied ranges from breast protective surgery to mastectomy or to radical surgical methods including more advanced axillary dissection. The surgical method applied may affect the length of the period during which the patient lies in hospital during the operation and the life quality of the patient in the following period.

Detection of cancer cases in early stages decreases the treatment costs in the middle and long term. As it is shown in Table 4, treatment costs increase as the stages advance. Screening programs are very important for early diagnosis in cancer diagnosis. Even only training and informing the society may be useful for the early diagnosis of evidences.

Indeed, 548 suspected cases were observed during the training given to the individuals at the age groups 15-49 (n= 25462+9705) and 50+ (n=7418+2213) in Bartın province within the scope of the breast cancer control program carried out between January 2006 – February 2007. 99 of these were also found suspected after clinical examination and were guided towards advanced examinations and 11 of these cases were diagnosed as cancer, 52 were taken under monitor. 28 out of the total 41 cases of breast cancer occurrences in Bartın province were detected during breast self examination trainings again within the scope of breast cancer control program. 8 different cancer cases except breast cancer were also detected during the same program. Even the training activities which have almost no cost after a certain infrastructure is established are crucial in the early diagnosis on cancer cases.

**Economic Efficiency**

Within the scope of the study it was aimed to calculate with economic efficiency analysis the level of savings that could be achieved in the treatment costs of breast cancer in the middle and long term through increase in screening activities as a protective health service. Within this scope, a period of 6 years was handled and treatment costs and post-screening treatment costs were compared and net affect (savings) was revealed.

In order to carry out this calculation, the development in the population at the age group 50+ for the years 2007-2012 was used in the first stage. According to the population projection used within the scope of the study, development in female population for the following 6 years was taken into consideration.

**Table 1.Table 1. Total female population (1000 persons, women)**

| Age Groups | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|
| 30-39 | 6,021 | 6,175 | 6,305 | 6,410 | 6,486 | 6,542 |
| 40-49 | 4,462 | 4,578 | 4,700 | 4,834 | 4,977 | 5,128 |
| 50-59 | 3,126 | 3,258 | 3,384 | 3,505 | 3,623 | 3,736 |
| 60-69 | 1,947 | 1,984 | 2,039 | 2,115 | 2,187 | 2,270 |
| 70+ | 1,494 | 1,539 | 1,582 | 1,623 | 1,669 | 1,709 |
| | | | | | | |
| 50+ | 6,567 | 6,781 | 7,005 | 7,243 | 7,479 | 7,715 |

Source: Şeref Hoşgör, 2005

Within the framework of the above population projection, the total number of female population within the scope of breast cancer was re-calculated according to the results coming from the screening centers. The total female population which have the probability of being diagnosed to have cancer, when the same conditions and environment conditions continue to exist in the period 2007-2012 in Turkey, is estimated as shown by the below table.

**Table 2. Total Number of Breast Cancers (Females)**

| Years | Number of Breast Cancer |
|---|---|
| 2007 | 44,253 |
| 2008 | 45,696 |
| 2009 | 47,205 |
| 2010 | 48,809 |
| 2011 | 50,399 |
| 2012 | 51,990 |

In the second stage of the study, average costs per patient for the screening programs were calculated. The average cost per patient in examination and mammography focused screenings was determined to be 15.2 YTL. While 50 % of the total expenditures were composed of personnel expenses, operation expenses followed personnel expenses with 33.8 %. Machine equipment expenses including maintenance and repair, on the other hand, was estimated to be around 17 %.

**Table 3. % Distribution of Average Costs and Expenditures per Patient in Screening-Based Centers**

| (2007 prices, YTL) | Screening |
|---|---|
| **Cost per Patient** | 15.2 |
| **Distribution of Expenditures** | |
| **Total** | **100.0** |
| Personnel | 49.1 |
| Operating Costs | 33.8 |
| Maintanence Costs | 2.4 |
| Machine-Equipment | 14.7 |

Total screening costs were calculated for the years 2007, 2009, and 2011 using the below formulation with reference to the assumption that all the female population under risk at the age group 50+ shall be screened one two years according to the screening program implemented in Turkey.

Total Screening Cost = Population Under Risk * Average Screening Cost

In the subsequent stage, on the other hand, the probable treatment cost, if a community-based screening covering the whole population for the six years between the years 2007-2012 was not conducted, was calculated. Here, costs were calculated separately for each year according to each screening period according to the number of population under the risk increasing on the basis of years. The fist six tables on the right within Table 4 show the probable total treatment expense if screening was not conducted.

In the continuation of this calculation, it was foreseen that all the female population under risk was screened for three times in 2007, 2009 and 2011 in intervals of two years. The first screening results were re-distributed according to the stages found as a result of the screenings carried out under KETEM rather than the data coming from policlinics and the total treatment cost was re-calculated according to the new structure. The stages treated as a result of the second and third screenings were taken to the Ist and the IInd stages within the framework of the studies in the literature (Tabar et. al. 2003). The amount of savings to be achieved in treatment expenditures was found by looking at the difference between the new treatment costs for the six years and the probable treatment costs if no screening was to be conducted.

**Table 4. Treatment costs and total saving amounts according to whether screening is conducted or not**

**2007**

| | Number of Samples | Distribution of the Stage | Total Cases | % Distribution | Average Stage Cost | Total Cost |
|---|---|---|---|---|---|---|
| Stage 1 | 134 | 17 | 5,614 | 12.7 | 2,580 | 14,487,098 |
| Stage 2 | 134 | 72 | 23,778 | 53.7 | 3,624 | 86,117,655 |
| Stage 3 | 134 | 41 | 13,540 | 30.6 | 8,735 | 118,270,600 |
| Stage 4 | 134 | 4 | 1,321 | 3.0 | 4,001 | 5,285,049 |
| Total | **134** | **134** | **44,253** | **100.0** | | **224,220,401** |

| | Number of Samples | Distribution of the Stage | Total Cases | % Distribution | Average Stage Cost | Total Cost |
|---|---|---|---|---|---|---|
| Stage 1 | 20 | 9 | 19,914 | 45.0 | 2,580 | 51,386,588 |
| Stage 2 | 20 | 9 | 19,914 | 45.0 | 3,624 | 72,173,786 |
| Stage 3 | 20 | 2 | 4,425 | 10.0 | 8,735 | 38,654,294 |
| Stage 4 | 20 | | | 0.0 | 4,001 | |
| Total | **20** | **20** | **44,253** | **100.0** | | **162,214,667** |
| **Total Saving** | | | | | | **62,005,734** |

**2008**

| | Number of Samples | Distribution of the Stage | Total Cases | % Distribution | Average Stage Cost | Total Cost |
|---|---|---|---|---|---|---|
| Stage 1 | 134 | 17 | 5,797 | 13.1 | 2,580 | 14,959,191 |
| Stage 2 | 134 | 72 | 24,553 | 55.5 | 3,624 | 88,985,942 |
| Stage 3 | 134 | 41 | 13,981 | 31.6 | 8,735 | 122,124,705 |
| Stage 4 | 134 | 4 | 1,364 | 3.1 | 4,001 | 5,457,273 |
| Total | **134** | **134** | **45,696** | **103.3** | | **231,527,111** |

| | Number of Samples | Distribution of the Stage | Total Cases | % Distribution | Average Stage Cost | Total Cost |
|---|---|---|---|---|---|---|
| Stage 1 | 20 | 9 | 20,563 | 45.0 | 2,580 | 53,061,132 |
| Stage 2 | 20 | 9 | 20,563 | 45.0 | 3,624 | 74,525,726 |
| Stage 3 | 20 | 2 | 4,570 | 10.0 | 8,735 | 39,913,928 |
| Stage 4 | 20 | | | | 4,001 | |
| Total | **20** | **20** | **45,696** | **100.0** | | **167,500,786** |
| **Total Saving** | | | | | | **65,026,326** |

**2009**

| | Number of Samples | Distribution of the Stage | Total Cases | % Distribution | Average Stage Cost | Total Cost |
|---|---|---|---|---|---|---|
| Stage 1 | 134 | 17 | 5,989 | 13.5 | 2,580 | 15,453,345 |
| Stage 2 | 134 | 72 | 25,364 | 57.3 | 3,624 | 91,925,457 |
| Stage 3 | 134 | 41 | 14,443 | 32.6 | 8,735 | 126,158,908 |
| Stage 4 | 134 | 4 | 1,409 | 3.2 | 4,001 | 5,637,546 |
| Total | **134** | **134** | **47,205** | **106.7** | | **239,175,257** |

| | Number of Samples | Distribution of the Stage | Total Cases | % Distribution | Average Stage Cost | Total Cost |
|---|---|---|---|---|---|---|
| Stage 1 | 20 | 10 | 23,603 | 50.0 | 2,580 | 60,904,361 |
| Stage 2 | 20 | 10 | 23,603 | 50.0 | 3,624 | 85,541,744 |
| Stage 3 | 20 | | | | 8,735 | |
| Stage 4 | 20 | | | | 4,001 | |
| Total | **20** | **20** | **47,205** | **100** | | **146,446,106** |
| **Total Saving** | | | | | | **92,729,151** |

**2010**

| | Number of Samples | Distribution of the Stage | Total Cases | % Distribution | Average Stage Cost | Total Cost |
|---|---|---|---|---|---|---|
| Stage 1 | 134 | 17 | 6,192 | 14.0 | 2,580 | 15,978,384 |
| Stage 2 | 134 | 72 | 26,226 | 59.3 | 3,624 | 95,048,691 |
| Stage 3 | 134 | 41 | 14,934 | 33.7 | 8,735 | 130,445,250 |
| Stage 4 | 134 | 4 | 1,457 | 3.3 | 4,001 | 5,829,086 |
| Total | **134** | **134** | **48,809** | **110.3** | | **247,301,411** |

| | Number of Samples | Distribution of the Stage | Total Cases | % Distribution | Average Stage Cost | Total Cost |
|---|---|---|---|---|---|---|
| Stage 1 | 20 | 10 | 24,404 | 50.0 | 2,580 | 62,973,632 |
| Stage 2 | 20 | 10 | 24,404 | 50.0 | 3,624 | 88,448,088 |
| Stage 3 | 20 | | | | 8,735 | |
| Stage 4 | 20 | | | | 4,001 | |
| Total | **20** | **20** | **48,809** | **100** | | **151,421,719** |
| **Total Saving** | | | | | | **95,879,692** |

**2011**

| | Number of Samples | Distribution of the Stage | Total Cases | % Distribution | Average Stage Cost | Total Cost |
|---|---|---|---|---|---|---|
| Stage 1 | 134 | 17 | 6,394 | 14.4 | 2,580 | 16,499,011 |
| Stage 2 | 134 | 72 | 27,080 | 61.2 | 3,624 | 98,145,680 |
| Stage 3 | 134 | 41 | 15,421 | 34.8 | 8,735 | 134,695,571 |
| Stage 4 | 134 | 4 | 1,504 | 3.4 | 4,001 | 6,019,016 |
| Total | **134** | **134** | **50,399** | **113.9** | | **255,259,278** |

| | Number of Samples | Distribution of the Stage | Total Cases | % Distribution | Average Stage Cost | Total Cost |
|---|---|---|---|---|---|---|
| Stage 1 | 20 | 14 | 35,279 | 70.0 | 2,580 | 91,035,718 |
| Stage 2 | 20 | 6 | 15,120 | 30.0 | 3,624 | 54,798,005 |
| Stage 3 | 20 | | | | 8,735 | |
| Stage 4 | 20 | | | | 4,001 | |
| Total | **20** | **20** | **50,399** | **100** | | **145,833,723** |
| **Total Saving** | | | | | | **109,525,555** |

**2012**

| | Number of Samples | Distribution of the Stage | Total Cases | % Distribution | Average Stage Cost | Total Cost |
|---|---|---|---|---|---|---|
| Stage 1 | 134 | 17 | 6,596 | 14.9 | 2,580 | 17,019,637 |
| Stage 2 | 134 | 72 | 27,935 | 63.1 | 3,624 | 101,242,669 |
| Stage 3 | 134 | 41 | 15,907 | 35.9 | 8,735 | 138,945,893 |
| Stage 4 | 134 | 4 | 1,552 | 3.5 | 4,001 | 6,208,946 |
| Total | **134** | **134** | **51,990** | **117,5** | | **263,417,146** |

| | Number of Samples | Distribution of the Stage | Total Cases | % Distribution | Average Stage Cost | Total Cost |
|---|---|---|---|---|---|---|
| Stage 1 | 20 | 14 | 36,393 | 70.0 | 2,580 | 93,908,352 |
| Stage 2 | 20 | 6 | 15,597 | 30.0 | 3,624 | 56,527,157 |
| Stage 3 | 20 | | | | 8,735 | |
| Stage 4 | 20 | | | | 4,001 | |
| Total | **20** | **20** | **51.990** | **100** | | **150,435,509** |
| **Total Saving** | | | | | | **112,981,636** |

As a result of these processes, economic efficiency in resource usage in the period covering the years 2007-2012 was calculated if screening is to be conducted. According to this calculation, as it can be seen from the following table, the savings achieved in treatment expenditures for six years is 217.78 million YTL if the total female population under risk is to be screened once two years. This amount is almost equal to the total treatment costs of a single year during this period.

**Table 5. Saving impact of the screening on total treatment costs**

| 2007 Price YTL | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | Total |
|---|---|---|---|---|---|---|---|
| Total Cost (With Screening) | 261,843,377 | 167,500,786 | 252,719,763 | 151,421,719 | 259,298,489 | 150,435,509 | 1,243,219,644 |
| Treatment Costs | 162,214,667 | 167,500,786 | 146,446,106 | 151,421,719 | 145,833,723 | 150,435,509 | 923,852,511 |
| Screening Costs | 99,628,709 | | 106,273,658 | | 113,464,766 | | 319,367,133 |
| Total Treatment Cost (No Screening) | 224,220,401 | 231,527,111 | 239,175,257 | 247,301,411 | 255,359,278 | 263,417,146 | 1,461,000,604 |
| Net Effect | -37,622,976 | 64,026,326 | -13,544,507 | 95,789,692 | -3,939,211 | 112,981,636 | 217,780,961 |

Although screening period is determined to be once two years, in addition to this, utrasound and partial pathology examination of 125-150 thousand patients each year will be continued with studies to be carried out in KETEMs performing their activities in approximately 41 centers especially with reference to risk areas and groups. Hence, almost 750-900 thousand patients will be controlled during six years.

**Cost Effectiveness Analysis**

In addition to the fact that detection of breast cancer patients in earlier stages as a result of screenings provides serious savings in treatment expenditures in middle and long terms, it also increases DALYs saved. According to National Disease Burden and Cost-Effectiveness Study of the Minstry of Health, Republic of Turkey, the number of patients with breast cancer is estimated to be 44253-51990 rather than 16.883 in our study. The increase of patient number lead to an increase in the number of DALYs in cases of no treatment and hence to an increase in the number of DALYs to be saved as a result of treatment.

## Table 6. Diagnosis and treatment of breast cancer (Female)

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|
| Cases To Be Treated | 44,253 | 45,696 | 47,205 | 48,809 | 50,399 | 51,990 |
| Deaths | 10,597 | 10,943 | 11,304 | 11,688 | 12,069 | 12,450 |
| YLL | 128,603 | 132,794 | 137,181 | 141,842 | 146,463 | 151,085 |
| YLD | 44,723 | 46,180 | 47,706 | 49,326 | 50,934 | 52,541 |
| Target Mortality (% Deaths in Case of No Treatment) | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 |
| Number of Those Died in Case of No Treatment | 24,339 | 25,133 | 25,963 | 26,845 | 27,720 | 28,594 |
| YLL-in Cases of No Treatment | 295,366 | 304,991 | 315,066 | 325,771 | 336,385 | 347,000 |
| YDD-in Cases of No Treatment | 20,125 | 20,781 | 21,468 | 22,197 | 22,920 | 23,643 |
| DALYs-in Cases of No Treatment | 315,491 | 325,772 | 336,534 | 347,968 | 359,306 | 370,643 |
| Externality Factor | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Diagnostic Accuracy | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |
| Impact | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |
| Effectiveness | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 |
| SHE | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 |
| Dalys-Saved | 170,365 | 175,917 | 181,728 | 187,903 | 194,025 | 200,147 |
| Cost/Case (YTL) | 5,067.0 | 5,067.0 | 5,067.0 | 5,067.0 | 5,067.0 | 5,067.0 |
| Total Cost (YTL) | 224,232,455 | 231,539,558 | 239,188,114 | 247,314,706 | 255,373,006 | 263,431,307 |
| Cost Per DALY Saved (YTL) | 1,316 | 1,316 | 1,316 | 1,316 | 1,316 | 1,316 |

The cost calculated in this table includes only the treatment costs. Cost items like work loss, access expenditures are not included in the total.

Results of Table 6 show us in a very striking manner that a serious level of DALYs are saved when an effective screening and treatment afterwards is supplied. On the other hand, this corresponds to a very significant result for the female population with reference to living a healthy life in Turkey.

**Conclusion:**

Mammography usage in community-based breast cancer screenings provides apparent improvement concerning the stages of patient diagnosis.

Early diagnosis of breast cancer cases decreases treatment costs which increase in correlation with stage. Indeed, in the calculations conducted within the scope of this study, treatment costs at the end of a 6 years period evidently dropped following screenings. This would surely affect the life span and life quality of the patient. This is also supported by DALY calculations.

In order to achieve a more effective result from mammography screening programs, a more extensive screening activity among women at the age group 50+ who are defined as the risk group should be started in the country in general by opening new screening centers and strengthening the capacity of the existing screening centers.

Also the determination of risk groups in Turkey within the scope of screening activities would ensure that the screening population in subsequent periods could be held limited or that a different screening program could be applied to such groups.

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