Cost Effectiveness Analyses of Common Surgical Treatments for Breast Cancer

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***Abstract*-Economic evaluation serves as a crucial tool for decision-making in healthcare, gaining prominence in shaping health policy and treatment choices. The field encompasses several methodologies, including cost minimization, cost effectiveness, cost utility, and cost benefit analyses. Selecting the appropriate method based on the study topic is essential for optimal implementation. In the health sector, economic evaluations can enhance resource utilization, ensuring more individuals receive appropriate treatments. Breast cancer imposes a growing burden on healthcare systems worldwide, with one in eight women likely to develop the disease. Breast cancer originates in the ducts or lobules of the breast, presenting various types, stages, and symptoms, which necessitate different treatment approaches. Common surgical treatments include mastectomy, breast-conserving surgery, implant breast reconstruction, and autologous breast reconstruction, each with distinct outcomes and risks. Given the constraints of current healthcare budgets, understanding the cost implications of these treatments is vital. Economic evaluation can provide valuable insights for stakeholders, aiding in the decision-making process. However, there is a lack of comprehensive studies in this area within our country. This research aims to conduct a cost-effectiveness analysis of different surgical treatment options for breast cancer.**

Keywords: Healthcare policy, Cost Effectiveness Analyses, Surgical Treatments, BreastCancer, Economic Evaluation

I. INTRODUCTION

Economic evaluation is a helpful assistant tool for decision-making and over time economic analyses have become more important in guiding health care decisions. From health care policy decisions to specific treatment decisions more studies are being conducted in healthcare economic evaluation field. Economic evaluation has several limits and types. Four most common economic evaluation methods are cost minimization, cost effectiveness, cost utility and cost benefit analyses. Depending on the study topic appropriate method should be chosen and implemented. Economic evaluation in health sector can help rising the amount of people who reach the correct treatments with effective usage of resources.

Breast cancer's burden on healthcare has a growing trend and a significant problem considering all nations worldwide. One in eight women will develop breast cancer in their life time. Breast cancer is a type of cancer that generally develops on the duct or lobule parts of the breast and the disease have several types, stages, symptoms therefore treatment pathways differ from case to case. Most common surgical treatments are; mastectomy, breast conserving surgery, implant breast reconstruction, autologous breast reconstruction. Every option has different outcome and risk possibilities. The cost factor is a significant part of the decision process and in today's conditions where the healthcare budgets are scarce the impact of the costs could not be overlooked and it should be examined in detail. Therefore, economic evaluation of these treatment would make a useful contribution to the process and stakeholders. However, the number of studies carried out in this field in our country is insufficient. We aim to conduct a cost effectiveness analysis between different surgical breast cancer treatment alternatives.

II. LITERATURE REVIEW

Economic evaluations basically compare costs and consequences of two alternatives in a process. Economic evaluation is a helpful way of thinking that assesses investment efficiency in a decision-making situation rather than being a decision-making method. While conducting an economic evaluation scope of the process must be clearly defined and justified. This means the main question, analytical approach, limitations, comparison options and costs should be specific [1]. Although economic evaluation can be conducted in many areas, getting the best value for money spent on healthcare has been a top priority for governments around the world because need for healthcare has only been going up [2]. Also, economic factors play an important role in the development, management, and evaluation of health systems. Health economic analysis can be used to evaluate the value of an intervention and support the best use of the few resources for healthcare [3]. Due to the scarcity of resources and infinite demand economic evaluation and optimization of resource allocation is a necessity in today's world. Even in the health sector,

fundamentals of economic principles should be implemented. However, health interventions are not free, people are not infinitely rich, and the budgets of programs are limited. For every dollar worth of healthcare consumed, a dollar will be paid." [4]. Therefore, clinicians also should assess economic consequences of their treatments. So that, variety number of solutions have been suggested in response to professional and public concern about the cost of medical care. In order to assist doctors in offering the more suitable services, professional societies have issued guidelines. With the aim of examining the variations in medical practice and lowering governmental health care costs, the government has started to support the need for more clinical strategy research [5]. There is a measurable increase in the amount of published economic evaluations by over 7200 publications released in 2018 compared to about 1000 publications in 1990. For instance, The National Institute of Health and Care Excellence (NICE) in the UK, the Pharmaceutical Benefits Scheme (PBS) in Australia, Pharmaceutic Management Agency (PHARMAC) in New Zealand and among others, have relied on these researches to direct the allocation of public resources [6]. It can be argued for the clinical community that the purpose of an economic review is not to direct surgical decisions at the patient's bedside, but rather to provide context and aid in the eventual adoption of new evidence. They are not intended to guide treatment decisions for specific hernias or rotator cuff tears, but rather to extend our perspective, take a systemic look at our health, and assess how effectively public health resources are dispersed. Every patient's wellbeing is of the utmost significance in medicine, yet a physician who disregards the financial effects of their medical practice does not, throughout time, care for the welfare of their patients. The cost of a medical operation must be compared to the potential health consequences and the amount of money that can be allocated to personal or governmental expenses. So that, it can be seen clearly the increasing focus on economic evaluations in health sector past decades as mentioned before on above [7].

Cost of intervention would be considered for public health unless we have unlimited sources. Any resources used or saved as a result of the intervention should be considered when calculating cost. Therefore, cost will be examined in different categories, however, cost can be divided two main subjects as direct and indirect costs in generally [8]. Hospitalization, medications, physician fees, laboratory testing, radiographic procedures, rehabilitation, durable medical equipment, and long-term care are the types of direct medical costs that are typically taken into account. However, non-medical services account for a considerable amount of direct costs. Costs that are incurred as a result of loss of life or means of subsistence or as a result of sickness or death are known as indirect costs. For instance, indirect morbidity costs might result from being absent from work, from having less earning potential when working, or from a long-term disability that requires switching jobs [9].

Outcome, which is called benefits also, can be evaluated in different views as same as cost. Researchers must decide the viewpoints of benefits like for the society, the patient, or the healthcare. However, for the mainly medical analysis, patient view is considered because of challenging to decide benefits correctly in the other views. For example, in society view might be hard to find effect of intervention to whole people [10].

On the other hand, health care treatments can have a wide range of health outcomes due to measuring benefits in cost effectiveness analyses is more difficult. For instance, interventions' benefits could lengthen lives, ease pain, stop disease, or just enhance mental health. Converting these various benefits into a common currency is crucial since the fundamental goal of cost-effectiveness analysis is to compare various health interventions [8].

Therefore, the quality-adjusted life year is the preferred and most often used effectiveness metric for cost effective analysis (QALY). By multiplying the amount of time spent in a given health state by its quality of life, the QALY calculates both the quantity and quality of life. "0" indicates quality life death, "1" quality life indicates perfect health [6]. Different perspectives give the different cost and benefits outputs for the analysis. These perspectives can be healthcare, societal, patient or provider etc. For example, Societal perspective includes all cost caused from treatment and patients' expenses but also it considers the patients' and carer's lost productivity as well as any effects the disease condition has both inside and outside the healthcare system [11]. However, patient's viewpoint only considers expenses from surgery, benefits for only patients. Cost-effectiveness analysis is suitable if benefits are measured but not quantified in monetary terms [4]. It is a method of evaluating the cost and effectiveness of different options or interventions in order to determine the most efficient and cost-effective option. This analysis takes into account the costs associated with implementing a particular option or intervention, as well as single unit potential benefits and effectiveness of the option in achieving the desired outcome. These outcomes can be lives saved, change in pain score, or change in peak flow rate. The goal of cost effectiveness analysis is to identify the option that offers the best value for money, while also achieving the desired results in the most efficient manner possible [12]. Cost utility analysis is a type of cost-effectiveness analysis that evaluates the cost and effectiveness of different treatment options or interventions. It is a way to compare the relative value of different interventions in terms of their cost and multiple outcomes health benefits they provide except then cost-effective analysis. Only difference between cost-effective analysis is this analysis has multiple unit instead of single unit such as quality adjusted life year metric which is mentioned in before. In a cost utility analysis, the health benefits of different interventions are measured in terms of quality-adjusted life years (QALYs), which consider both the quantity and quality of life gained. The cost of each intervention is also considered, and the cost-utility ratio is calculated by dividing the cost by the

number of QALYs gained. The intervention with the lowest cost-utility ratio is considered the most cost-effective, as it provides the most health benefits at the lowest cost. This analysis can be useful for health care decision makers in determining which interventions to prioritize in order to provide the most value for the resources available. In a cost benefit analysis, all costs and benefits are quantified and monetized in order to make them comparable. This means that the costs and benefits of a particular decision or project are expressed in monetary terms. For example, the cost of implementing a new policy might be measured in terms of the money spent on staff, training, and equipment, while the benefits of the policy might be measured in terms of the money saved on health care costs or the value of increased productivity [13].

Breast cancer comes in a variety of forms. Depending on which cells are harmed by cancer will determine the type of breast cancer. Any area of the breast might develop this malignancy. The lobules, ducts, and connective tissue are the three major structural components of the breasts. Milk is created in the lobules, and is transported to the nipple by the ducts. Everything is surrounded by and held together by the connective tissue. Breast cancer typically develops in lobules or ducts. Blood vessels allow for the spread of this type of cancer to other bodily organs. Breast cancer represents a major global health problem: with an estimated 2.26 million cases recorded in 2020, it has surpassed lung cancer as the most frequently diagnosed cancer in the world and is the leading cause of cancer death among women [14].

Human development and the incidence of breast cancer are closely related, breast cancer cases are highest in two nations with the highest levels of human development. And there are several risk factors for the disease. The most significant risk factor is age, and the oldest females have the highest incidence rates. Less than one in five women with breast cancer are diagnosed before the age of 50 in the UK, while more than one-third of cases affect women beyond the age of 70 [15]. Other important risk factors can be classified as reproductive and non-reproductive risk variables. The risk of breast cancer rises with younger menarche age, older menopause age, having fewer children, and less breast-feeding exposure. Other two non-reproductive risk factors of particular relevance are obesity and alcohol intake. Obesity has been linked to a doubling of breast cancer risk among overweight post-menopausal women and effect of alcohol consumption account for 4% of all breast cancer diagnoses in 2020 [16]. Lastly, genetic or inherited factors such as mutations account for five to ten percent of breast cancer cases [17]. Breast cancer patients experience different symptoms. The most common symptoms of breast cancer are [18];

• A lump in the breast or armpit
• Any breast area that has thickened or swollen
• Breast skin that is itchy or has dimples
• Nipple region or breast redness or dry skin
• Nipple pulling in or soreness in the nipple region.
• Nipple discharge other than milk (such as blood)
• Any modification to the breast's size or form
• Aches in any breast area

A. Breast Cancer Surgical Treatment Process

The selection of a treatment plan is based on the biology of the disease (pathology, including biomarkers and gene expression), the extent and location of the tumor (size and location of the primary tumor, the number of lesions, and the number and extent of lymph nodes involved), as well as the patient's age, body type, and general health status and preferences. The two most common surgical treatments are mastectomy and breast conserving surgery and after surgery there are two breast reconstruction options; implant breast reconstruction and autologous breast reconstruction [19].

- **Mastectomy;** removing the entire breast through surgery
- **Breast-conserving surgery (BCS);** removing cancer or other abnormal tissue from the breast and some normal tissue around it, but not the breast itself through surgery
- **Implant breast reconstruction** (I-BR); type of breast reconstruction uses breast implants (silicone devices filled with silicone gel or salt water) to reshape breasts
- **Autologous breast reconstruction (A-BR);** type of breast reconstruction uses tissue (skin, fat, and sometimes muscle) from another place on the body to form a breast shape

Patients with early-stage breast cancer can choose between mastectomy or breast-conserving surgery (BCS). The benefit of BCS over mastectomy is preservation of the breast contour, which optimizes the affected breast's cosmetic outcome. To achieve oncological outcomes comparable to mastectomy, BCS must be followed by adjuvant radiation, often known as breast-conserving therapy (BCT). As a result, some patients prefer mastectomy due to radiation side effects or disease recurrence in the case of BCT, or they may need mastectomy due to contraindications for BCS or irradiation.

International standards advise that every patient who will undergo a mastectomy operation must be informed of the option of postmastectomy breast reconstruction because the loss of a breast may negatively impact psychological health, body image, and sexual function. The breast reconstruction methods available vary among costs, timing, durations, complication rates and cosmetic outcomes [20]. Postmastectomy breast reconstruction attempts to enhance the patient's health and quality of life. However, patients who choose breast reconstruction also face the risk of complications, reconstruction failure or unsatisfactory results [21].

B. Cost-Utility Analysis of Breast Cancer Treatment

Breast cancer is a type of cancer that affects the cells of the breast. It is the most common type of cancer in women, and can also affect men. One in eight women will develop breast cancer in her lifetime. Symptoms of breast

cancer may include a lump in the breast, changes in the size or shape of the breast, dimpling of the skin, changes in the nipple, or discharge from the nipple. Treatment options for breast cancer may include surgery, radiation therapy, chemotherapy, hormonal therapy, or targeted therapy. High portion of resources has to be spent for the fight against to breast cancer. It has been estimated that Turkey spent 38,551 million dollars on healthcare in 2017, accounting for 4.5% of the country's GDP (TUIK). Studies on the proportion of cancer treatments in overall healthcare spending don't exist in Turkey. For many countries, it is vital to perform studies on the cost-effective analyses of breast cancer interventions, which have a substantial disease burden on countries due to the limited resources provided to healthcare [22]. There are different types of cost-effectiveness analysis in economic evaluation in healthcare. As mentioned before in the literature review most common of these are cost-minimization, cost-effectiveness, cost-utility and cost-benefit analyses. These analyses should be evaluated depending on the situation because different analyses examine different aspects of interventions' benefits. Breast cancer treatments include several types of outcomes to patients. For example, mastectomy remove the entire breast through surgery; Breast-conserving surgery (BCS) remove cancer or other abnormal tissue from the breast and some normal tissue around it, but not the breast itself through surgery.

III. METHODOLOGY

In the light of the information given in the literature review, a cost-effectiveness analysis will be made among breast cancer surgeries. The patient data to be analysed, will be obtained from Kocaeli University Training and Research Hospital by keeping patient information confidential. It is aimed to compare the results of the treatments by using the data of patients who have been treated for different breast cancer treatments, and to guide the decision-making process. Surgery costs will be evaluated with the healthcare provider point of view and the cost of the patient's surgery to the hospital will be taken as a basis. There are several methods for cost-effective examination of Breast Cancer treatments. The purpose of this cohort study is to analyse cost effectiveness of common surgical treatments for breast cancer for more efficient resource allocation by using real breast cancer patient data obtained from a University Training and Research Hospital. These data belong to patients who had undergone surgical breast cancer treatment from the university sellected.

In this study it is assumed that the surgical treatment pathways are different by their benefits in relative with their costs and can be compared using cost-utility analysis. Cost-utility analysis is considered to be the most suitable method for this study. It is also assumed that the patients answered the questions accurately and honestly, and the questions were objective. The data characteristics to be used in the study were decided by considering the opinions and recommendations of the doctors in the breast surgery department at Kocaeli University Training and Research Hospital. In the process of the determination of data characteristics, attention was paid to set limits where the disease is most common and which will not affect the treatment process to a major extent.

Data Characteristics were listed as follows:

- Time Range; 2018 - 2020

- Age Range; 30 - 65

- Cost; Surgical operation and aftercare cost (in TRY)

- Operations; Mastectomy (MSC), Breast Conserving Therapy (BCT), Autologous Breast Reconstruction (A-BR)

- Treatment Facility; Kocaeli University Training and Research Hospital

- Health State; No previous cancer treatment, no history of disease that significantly affected the course of treatment

- Other Important Factors; No recurrence after surgery, no treatment-related complications

Data Source

Patient's data is used in this study who has been undergone breast cancer treatments which are mastectomy, breast conservative surgery and autologous breast reconstruction. These are analysed in cost and utility sides.

- Cost;

Administrative data is used when analysing the cost part of analysis. The costs to hospital and health system during the operation process is used who have undergone mastectomy, breast conservative surgery and autologous breast reconstruction treatment in Kocaeli Hospital. Data are obtained from hospital accounting department. Cost data were adjusted for discount rate which is got from inflation rate between 2018-2020 in Turkey.

- Utility;

Survey data is used when analysing the utility part of analysis. EQ-5D-5L questionnaire was specialized for breast cancer patients and made survey to control group who had treatment in Kocaeli University Hospital. It was obtained from the answers of the patients to the 5-scale questions about their health status after the treatment.

Data Quality and Preparation

Treatment costs are stored in the accounting department of the hospital as receipts. These data were taken as the costs of the surgical operation and the services received by the patient from the hospital in the following process. In the Utility part, treatments results are collected by us, as a survey for each patient. The answers given to the questionnaire by patients who were treated for breast cancer were adjusted to QALY metric. "0" represents dead people's health status, "1" represents perfect health status.

Ethical Considerations

The data of the persons to be used throughout the study is kept confidential within the scope of KVKK. Personal information will never be shared with third parties.

Limitations

The Cost-utility analysis is a comprehensive evaluation however, there are some limitations about this method. Although it includes direct hospital costs in the study, indirect costs were not accounted for. These are costs such as loss of income due to the time that patients cannot work, psychological support costs, special care services, and other expenses out of the hospital.

Also, there may be bias in the QALY calculation since the survey with patients is subjective. EQ-5D-5L is 5 scale questionaries and it is up to patients. The people surveyed may interpret the results of the treatment differently due to their characteristic features (age, pain sensitivity, response rate to treatment, etc.).

And finally, although the study was planned to be conducted for four treatment pathways implant breast reconstruction was excluded from the study due to the small number of patients receiving this treatment in the Kocaeli Hospital and the majority of those patients who received pre-treatment such as, breast conservative surgery or other breast reconstruction treatment before receiving this treatment.

Sensitivity analysis to test the robustness of the model will be performed. Raw data of 157 patients were obtained from the hospital for three different treatment processes. Initial cost data for each patient included all treatments the patient has received at the hospital up to the current date, that data set was reduced to the required date range and those related to cancer treatment were pulled exclusively. For cost analysis, three years after the diagnosis of the disease were selected as the date range, and the treatment periods of all patients were selected between 2018-2023. The discount rates used for the cost analysis are the reported Turkey Central Bank Discount Rate which were obtained from CEIC Data. Discount rates were 14,3% for cost calculations and 1.5% for QALY calculations. In order to calculate the Quality Adjusted Life Year metric, a physical appearance satisfaction section specific to breast cancer was added to the EQ-5D-5L questionnaire, which was mentioned in the model section before, and surveys were conducted with each patient over the phone. The patients who could not be reached during the survey and the patients who continued their treatment in another hospital were eliminated, and the analysis was carried out with 127 patients, including 42 mastectomy, 38 autologous breast reconstruction, 47 segmental mastectomy patients.

IV. ANALYSIS AND RESULTS

The costs of the treatment processes of the surveyed patients are listed as follows. It was taken as the expenses paid by the hospital and the patient within 3 years of the treatment process of the patients. Only direct costs are added to study. Costs also were discounted to base year of study (2018) to be more reliable analysis. Discount rate is derived from CEIC “Turkey Central Bank Discount Rate” data. Average of 2018-2022 years discount rate is used which is 14,3%. Mean costs are 21.382 TL for Mastectomy, 28.749 TL for A-BR and 17.523 TL for Breast Conversation Surgery which is lowest against the others [24].

These costs include the costs up to 3 years after the start of the treatment process. In the Mastectomy category, the main costs are Plastic, Reconstructive and Aesthetic Surgery and Radiation oncology, in BCS, Plastic, Reconstructive and Aesthetic Surgery and Radiology, and in A-BR, Plastic, Reconstructive and Aesthetic Surgery and Radiation Oncology.

The largest portion of expenses associated with mastectomy belong to Medical Oncology, which accounts for 67.00% of the overall costs. This shows the significant role of oncology treatments in the overall expenditure. Also, with percentages of 15.17% and 13.39%, respectively, the departments of general surgery and plastic, reconstructive, and aesthetic surgery also make up a considerable portion of the overall costs.

Similar to mastectomy, Medical Oncology is the biggest proportion in cost allocation for A-BR, accounting for 38.31% of the total costs. The second-highest proportion, 36.18%, belongs to the Plastic, Reconstructive, and Aesthetic Surgery department, highlighting the importance of breast reconstruction costs in this treatment.

Medical Oncology continues to be the primary driver of expenses in BCT, contributing 62.06% of the overall costs. In comparison to mastectomy and A-BR, radiation oncology has a much greater proportion (19.63%), demonstrating the rising importance of radiation treatment in breast conserving therapy.

Overall, across all three treatments, medical oncology consistently remains a major cost driver. And Plastic, Reconstructive, and Aesthetic Surgery department makes a significant contribution to mastectomy and A-BR.

Quality Adjusted Life Year values of the patients were calculated for a 10-year time horizon as a result of the survey studies as you can see in below. In the survey study, the EQ-5D-5L questionnaire was used as mentioned in the literature. The survey was customized for breast cancer patients, and a total of 127 people were studied. QALY values also were discounted by 1,5% which is recommendation of The National Institute of Health and Care Excellence [23]. Highest quality of life of treatments from survey is BCT as 0,841 and follows A-BR as 0,727 and Mastectomy as 0,720. After than discounted by 1,5 percent in 10-year horizon values are 7,555 for BCT, 7,088 for A-BR and 6,949 for Mastectomy.

The incremental cost effectiveness ratio were calculated for the treatment methods over a 10-year period. MSC refers mastectomy without breast reconstruction, BCT refers breast conservation therapy and A-BR refers mastectomy with autologous breast reconstruction. Costs are discounted by 13,5% discount rates and QALYs are discounted by 1,5%. As a result, from table BCS dominates other treatments because of their less cost and more utility. A-BR has ICER which is 52.930 TL per QALY versus MSC. Because differences in costs were divided by a very small QALY effect, it is important to consider that when QALY gains differ by as little as they did in this study, cost-effectiveness ratios can become extremely large.

V. CONCLUSİON

In this study, it is aimed to make cost-utility analysis of different breast cancer treatments according to each other. Although there are studies on this subject in the world, it is aimed to work in this field because studies in Turkey are lacking. At the end of the study, it was foreseen that the health care budget would be distributed effectively and benefit in the social perspective by making a guideline in the treatment choices. In this work, Mastectomy, Breast Conserving Therapy (BCT) and Autologous Breast Reconstruction (A-BR) treatment methods were examined, and a questionnaire study was conducted with a total of 127 patients who received these treatments in Kocaeli University Training and Research Hospital. Incremental Cost Effectiveness Ratio (ICER) was used for Cost-Utility analysis. On the cost aspects, all the costs paid by the hospital and the patient up to 3 years after the beginning of the treatment process of the patients are taken. Indirect costs were not used in the study since it is difficult to calculate (the time the patient cannot work due to treatment, transportation costs, psychological support, etc.). Due to this situation, although working in a social perspective is beneficial, it cannot be expected to give exact results.

Average cost per patient from treatment in Mastectomy 27.253 TL and 21.382 TL with discounted, in BCT 22.842 TL and 17.523 TL with discounted, in A-BR 35.888 TL in 28.749 TL with discounted. Discount rate was taken average of Turkey Central Bank Discount Rate between 2018-2022. There are some assumptions in literature about discount rate as a 5%; however, these countries are mostly developed countries. So, this is no applicable for Turkey. The cost distribution across the departments provides information on the variations between breast conserving treatment, autologous breast reconstruction (A-BR), and mastectomy. Medical oncology represents 67% of overall expenditures for mastectomy, which highlights the importance of oncology medical treatment. The expenses of surgical treatments and reconstructive services are particularly important to take into account when discussing general surgery and plastic, reconstructive, and aesthetic surgery's contribution to mastectomy. Similar with A-BR, Plastic, Reconstructive, and Aesthetic Surgery makes a significant contribution while Medical Oncology is the most dominant part with 38,31%. Radiation oncology stands out with a greater percentage in BCT, reflecting the emphasis on radiation treatment, even if Medical Oncology continues to be a major cost driver. These variances demonstrate how crucial it is to take departmental issues into account when analyzing costs and allocating resources for breast cancer treatments.

The QALY calculation is derived from patient questionnaires. The EQ-5D-5L questionnaire in the literature was customized for breast cancer patients and surveyed to the patients. QALY was calculated by examining the results over a 10-year period. Since the survey studies are patient-based and subjective, they may contain bias. The outcomes that patients receive from the treatment may differ even if they are in the same type of treatment. Quality of life (QoL) of treatment methods for Mastectomy, BCT, A-BR respectively 7,423, 8,071 and 7,572. QALY of for Mastectomy, BCT, A-BR with discounted in 10-year horizon are respectively 6,949, 7,555 and 7,088. Discount rate accepted as 1,5% per year from The National Institute of Health and Care Excellence (NICE) from literature. According to the results of the study, BCT has approximately 0.5 points higher QALY value than other treatment modalities over a 10-year period. It cannot be said that there is a significant difference between Mastectomy and A-BR, it is about 0.13 QALY. As a result of these, it can be deduced that the BCT method in this study provides more benefits and quality on patients than others. Next, Cost-utility analysis was performed, BCT is dominant with an average cost of 17,253 TL and 7,555 QALY compared to other treatment methods. Mastectomy has 21,382 TL and 6,949 QALY and A-BR has 28,749 TL and 7,088 QALY. BCT is dominant because it has less cost and more effectiveness than others. Compared with A-BR versus Mastectomy, it was found to be 52,930 TL per QALY. Considering the QALY difference between them, A-BR may not be selected as cost-utility option. Otherwise, sensitivity analyses showed that, changes in General Surgery expenses of 20% had minimal effect on the cost-utility study. The cost-effectiveness of mastectomy with autologous breast reconstruction compared to mastectomy without reconstruction revealed only a little shift, and breast conservation therapy (BCT) remained the dominant treatment. The cost-utility study was significantly impacted in Scenario 2 by increasing the expenses of Plastic, Reconstructive, and Aesthetic Surgery by 20%. BCT remained dominant, although there was a noticeable improvement in A-BR's cost-effectiveness when compared to MSC. Cost-utility analysis showed that A-BR was more beneficial with lower plastic surgery expenditures. Finally, in scenario 3, a 20% change in Medical Oncology expenses resulted in an increase of roughly 5000 TL/QALY when dropped, and vice versa. BCT continued to be dominant for both alternatives. In conclusion, BCT was continuously the most cost-effective choice, but A-BR vs MSC's cost-effectiveness was affected by changes in the prices of medical oncology and plastic, reconstructive, and aesthetic surgery.

Furthermore, it should be considered, treatment methods vary in different cancer stages. The same treatment cannot be used in every cancer stage. According to the literature, the 10-year survival rate of BCT is 94%, while mastectomy is around 90% (Agarwal et. al., 2014). However, it should not be deduced that this BCT is a more successful treatment method. In this study, it was carried out to make a recommendation rather than to determine the treatment selection method.

In conclusion, this cost-utility analysis study comparing breast conserving therapy (BCT), autologous breast reconstruction (A-BR), and mastectomy demonstrates that BCT is the most favourable treatment option. Not only does BCT offer lower costs compared to mastectomy, but it also yields superior quality of life (QoL) outcomes for patients. The Incremental Cost-Effectiveness Ratio (ICER) observed between autologous breast reconstruction (A-BR) and mastectomy (MSC) is ₺52.930/QALY. It is crucial to

emphasize that when the QALY gains are minimal, even slight disparities can lead to remarkably large cost-effectiveness ratios which is the case in this study. BCT proves to be a superior option in terms of preserving breast tissue and maintaining natural aesthetics, contributing positively to patients' psychological well-being and overall QoL. These findings support the recommendation for prioritizing BCT as the preferred treatment option, from a cost-effectiveness point of view. However, it is important to acknowledge that limitations within the study design may cause potential biases, which should be taken into consideration when interpreting the observed ICER and its implications.

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