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Cost effectiveness and economic value of obesity surgery for Turkey (CEVOS-T)

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ABSTRACT

Introduction: Obesity and its comorbidities are among the primary challenges that health systems face globally. In Turkey, the obese population rate is 30.3%, of which 2.9% is classified under the morbidly obese category. One of the treatment alternatives is obesity surgery, which appears to be a clinically effective and cost-effective intervention for moderately to severely obese people compared with nonsurgical interventions. The objective of this article is to clarify the economic value of obesity surgery under the current reimbursement situation from the payer perspective (Social Security Instution-SSI) in Turkey.

Methods: The Delphi Panel Technique was used for determining the economic value of obesity surgery. The model's incomes were generated from the Turkey Burden of Disease Study, Turkey's economic and population information and Delphi Panel consensus results. All calculations assume the SSI reimbursement perspective with the current reimbursement situation for patients above a Body Mass Index (BMI) $\geq$ 40 kg/m^2.

Results and discussion: The SSI-weighted average reimbursement price for obesity surgery was calculated as US $1,717. According to the model, the cost of an operated-upon obese patient is more than an obese patient without an operation in the first year. However, the cost of an obese patient decreased in the following years after the operation. The economic burden of the current reimbursement conditions for surgery is eliminated from the fourth year after the surgery.

Conclusion: Decision makers need to account for these results for implementing new policies for obesity treatment pathways in Turkey.

1. Introduction

Obesity and its comorbidities are among the primary challenges that health systems face globally. According to the World Health Organization (WHO), overweight and obesity are defined as abnormal or excessive fat accumulation that may impair one's health (World Health Organization, 2013). Obesity can have a variety of adverse health consequences, including a risk of death. Increased risk of health problems starts when someone is only very slightly overweight, and the likelihood of adverse health consequences increases as someone becomes progressively more overweight and obese (World Health Organization, 2006). Additionally, much of the burden of chronic diseases is linked to lifestyle, smoking, obesity, inadequate diet and lack of physical activity being responsible for the largest shares of such a burden. Mortality also increases steeply once individuals cross the overweight threshold. An overweight person of average height will increase his/her risk of death by approximately 30% for every 15 additional kilograms of weight (OECD, 2013).

The 2003 Turkey Burden of Disease Study (TBDS) (Republic of Turkey The Ministry of Health, 2006) concluded that 26.006 deaths for males and 31.136 deaths for females could be averted by decreasing the ratio of the obese population. In Turkey, recent research has revealed that the obese population rate is 30.3% (20.5% of males, 41% of females), of which 2.9% is classified under

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Table 1
DALY per obese (2004) (Republic of Turkey The Ministry of Health, 2006).

Cause	DALY	DALY per obese
Ischemic heart disease	346.294	0.0874
Hypertensive heart disease	61.796	0.0156
Ischemic stroke	146.930	0.0384
Diabetes mellitus	152.240	0.0154
Osteoarthritis	61.035	0.0371
Breast cancer	8.859	0.0022
Colon and rectum cancers	7.300	0.0018
Corpus uteri cancer	2.730	0.0007
Total	**787.184**	**0.1986**

the morbidly obese category (The Ministry of Heath of Turkey, 2013).

The treatment of obesity consists of three different options: diet and exercise therapy, pharmacological therapy and surgery. The choice of alternative is determined according to the degree of obesity and presence of comorbidities. Obesity surgery appears to be a clinically effective and cost-effective intervention for moderately to severely obese people compared with non-surgical interventions. Surgery led to a greater reduction in weight in all six studies, and the difference was statistically significant in five studies reporting a statistical comparison (Karason et al., 1997, 1999a, 1999b, 2000; Karlsson et al., 1998; Narbro et al., 1999; Sjostrom et al., 1999, 2000, 2001; Agren et al., 2002a; Agren et al., 2002b; Ryden et al., 2003; Ryden et al., 2004; Sjostrom, 2003; Torgerson et al., 2003; Sjostrom et al., 2004, 2007a, 2007b; Karlsson et al., 2007; Gummesson et al., 2008; Stoeckli et al., 2004; Von Mach et al., 2004; Christ-Crain et al., 2006; Buddeberg-Fischer et al., 2006).

The objective of this article is to clarify the economic value of obesity surgery under the current reimbursement situation from the payer perspective in Turkey.

2. Methods

The *Delphi Panel Technique* was used for determining the economic value of obesity surgery. In the literature, the *Delphi Panel Technique* is described as a valuable scientific method where the subject is discussed with local experts as consultants to ensure a consensus. The Delphi Panel model is mainly used in the absence of sufficient information and is based on the literature and the systematic assessment of expert opinions. The main aim of the panel was to explore the type and frequency of the health-care resources used that will form the basis of the cost of treatment calculations in the project. A form was designed to find out the co-morbidities, surgery methods, and resource inputs used in the pre-, post-, and after-surgery period separately for patients with 30–34.9 kg m^2, 35–39.9 kg m^2, and ≥40 kg m^2 Body Mass Index (BMI). All surgery methods mentioned in the literature were included in the form. The post-surgery period covered the first, second, third, and fifth year after surgery. Six surgeons who undertake obesity surgery and are among the key opinion leaders for the government were invited to take part in the project. The following steps comprised the Delphi Panel part of the research: questionnaire preparation, determination of experts, preliminary information, sending questions to experts, getting answers from experts, analysis of the answers, first Delphi panel meeting, analysis of first Delphi panel outcomes, and second Delphi panel meeting. First, the forms were filled in independently by each surgeon, and the results were analyzed in terms of average and median values. These results were discussed face to face in the first Delphi panel meeting with the aim of reaching a consensus in terms of the answers to the form. In the next step, the project team calculated the cost of treatment based on the conclusions reached in the first meeting. The SGK tariff and payment rules formed the basis of these calculations. The results were again shared with the members of the panel followed by a second Delphi panel meeting. After all these steps, an economic value of obesity surgery calculation model was developed for this study.

The Turkey Burden of Disease Study (TBDS) results provided the main information for the model (Republic of Turkey The Ministry of Health, 2006). The study followed the methodology of the WHO and was conducted by the leading international experts in this field. In the TBDS, attributable Disability-adjusted Life Years (DALY) for obesity were calculated for the population aged above 30. In order to adapt the attributable DALYs for the present day in the model, the population over the age of 30 in 2004 was entered into

Table 2
Pre-op and post-op comorbidities of obesity surgery in obese patients with BMI ≥40 kg/m^2 and percentage changes.

Cause	Pre-op	Post-op				
		1st Year	2nd Year	3rd Year	4th Year	5th Year
Ischemic heart disease	20	15	15	15	15	15
Hypertensive heart disease	40	20	10	5	5	5
Diabetes mellitus	60	20	15	15	15	15
Osteoarthritis	70	60	50	50	50	50
Ischemic stroke	6	3	3	3	3	3
Ischemic heart disease percentage change		25.00	0.00	0.00	0.00	0.00
Hypertensive heart disease percentage change		50.00	50.00	50.00	0.00	0.00
Diabetes mellitus percentage change		66.67	25.00	0.00	0.00	0.00
Osteoarthritis percentage change		14.29	16.67	0.00	0.00	0.00
Ischemic stroke percentage change		50.00	0.00	0.00	0.00	0.00

*Percentage Change is calculated by pre-op rate minus post-op rate divided by pre-op rate. For calculation of subsequent years, the difference from the previous year was calculated and then was divided by the previous year.

Table 3
Weighted cost of operation (SUT Prices, US $).

Operation type	2012 SUT operation package prices		Rate of the application of the operations in 2012 (%)[b]
	(″)[a]	($)	
Gastric banding	2.250	1.25698	16
Gastric sleeve	3.100	1.73184	73
Gastric by-pass	4.500	2.51397	10
Weighted cost of operation (US$)	**1.717**		

[a] Average exchange rate for 2012 was TL 1.79.
[b] Results from Delphi Panel Study.

Table 4
The costs after operation over the years.

Follow-up years after operation	Weighted cost of operation	
	(TL″)	(US $)
1st Year	1.02109	57044
2nd Year	82663	46180
3rd Year	70488	39379
4th Year	70488	39379
5th Year	7060	3944

*Average exchange rate for 2012 was TL 1.79.

Table 5
The cost of operated and non-operated obese patients for BMI ≥40 kg/m^2 (operation in package price) (US $).

Type of costs for obese patients	Cost type amount of obese patients	The cost of after surgery				
		1st Year	2nd Year	3rd Year	4th Year	5th Year
Ischemic heart disease cost (A)	917	687.88	687.88	687.88	687.88	687.88
Hypertensive heart disease cost (B)	164	81.83	40.92	20.46	20.46	20.46
Diabetes mellitus cost (C)	403	134.40	100.80	100.80	100.80	100.80
Osteoarthritis cost (D)	162	138.56	115.47	115.47	115.47	115.47
Ischemic stroke cost (E)	389	194.57	194.57	194.57	194.57	194.57
Operation cost (F)	1716.76	570.44	461.80	393.79	39.44	39.44
Total cost with surgery (A + B + C + D + E + F)	3.752	1.808	1.601	1.513	1.159	1.159
Total cost without surgery (A + B + C + D + E)	2.035	2.035	2.035	2.035	2.035	2.035

the model. The obese rate was 12% in the population over the age of 30 (The nearest data for 2004 were from 2003) (Statistics Institution. Turkish Health Research, 2012; Rebuplic of Turkey Prime; Updated Report. modified, 2013). According to this, the obese population over 30 was 3,964,078 in 2004. To find the DALY per obese person, "total DALY of cause of diseases" was divided by "the obese number in 2004." The financial burden of obese patients is calculated by multiplying Turkey's GDP per capita in 2012 (US $10,499) by total DALYs attributable to obesity (Statistics Institution. Turkish Health Research, 2012; Rebuplic of Turkey Prime; Updated Report. modified, 2013).

The Social Security Institution (SSI) is the main public financing organization in Turkey, and the prices in this study are calculated from the SSI reimbursement perspective. The weighted average price of bariatric surgery was calculated from the results of the Delphi panel. Currently, bariatric surgery is reimbursed for patients above BMI ≥40 kg/m^2. For this reason, the economic value of bariatric surgery was evaluated only for these patients in Turkey.

This article is an economic analysis and does not involve any human subjects.

3. Results and discussion

Table 1 presents the DALYs attributable to obesity. The information about comorbidities of obesity as well as its preoperative and postoperative aspects were gathered from the experts in the Delphi panel. Pre-operative and post-operative comorbidities of obesity rates over the years and the calculation of percentage changes are presented in Table 2. The SSI-weighted average reimbursement price for obesity surgery was calculated as US $1,717, as shown in Table 3. The cost of post-operative follow ups was calculated from a Delphi panel, as shown in Table 4.

It is concluded that, according to the estimations of the model, the cost of an operated-upon obese patient is more than an obese patient without an operation in the first year. However, the cost of an obese patient decreased in the following years after the operation. It was found that, at the end of the fifth year, obesity surgery can save US $1200 per patient. In other words, the economic burden of an operation was eliminated after five years (Tables 5 and 6 and Graphic 1).

4. Conclusion

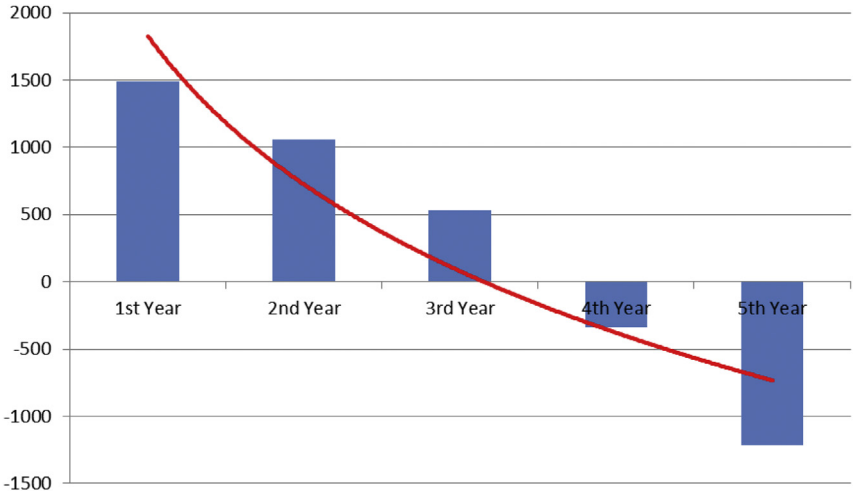
Obesity surgery is one of the most commonly performed procedures globally. Today, obesity surgery, especially with laparoscopic procedures, is a safe and minimally invasive procedure with a very low mortality rate (Updated Report. modified, 2013). Obesity surgery gave improved outcomes in terms of weight loss, improvement of obesity-associated comorbidities and quality of life. Moreover, most of the studies showed that surgical management was more costly than nonsurgical management (Kirshtein et al., 2010; Salem et al., 2008; Campbell et al., 2010; Clegg et al., 2003; Terranova et al., 2012).

Obesity surgery is reported as a cost-effective operation in several articles. Surgical management (with an adjustable gastric band) of moderate to severe obesity (BMI ≥ 30 kg/m^2 and <40 kg/m^2) in patients with Type 2 diabetes was more costly than nonsurgical management, but the outcomes were better (Campbell et al., 2010) In the UK, the cost per Quality-adjusted Life Years (QALY) was estimated as £11,000, indicating the surgery is a cost-effective option (Clegg et al., 2003). It was shown that surgical management was more costly than nonsurgical management in each of the three patient populations analyzed with improved outcomes (Clegg et al., 2003). In Sweden, The Swedish Obese Subjects (SOS) study was conducted with 15 years follow up of 4030 patients. It was repoted that long-term treatment cost of prediabetes ($10 194 vs $13 186; −$3329 [−5722 to −937]; p = 0·007) and diabetes ($14 346 vs $19 511; −$5487 [−7925 to −3049]; p < 0·0001) subgroups were lower than conventional treatment group. It was stated that long-term health-care cost results shows bariatric surgery is needed to be prioritisation of patients with obesity and type 2 diabetes (Keating et al., 2015).

This study was aimed at assessing the cost effectiveness of three bariatric procedures: gastric banding, gastric sleeve, and gastric bypass. A cost-effectiveness analysis is described as a probability and cost estimates tool that is based on actual and modeled data to compare different strategies with an overall metric of cost/DALY. In addition, the relationship between obesity surgery and five obesity-related comorbidities—ischemic heart disease, hypertensive heart disease, diabetes mellitus, osteoarthritis, and ischemic stroke—was also covered by the study. Regarding the consideration of the obese population aged over 30 with a BMI ≥40 kg/m^2 with five comorbidities, the total health-care cost of an obese patient would be recoverable in the third year, after the application of obesity surgery.

Table 6
Cost differences of operated and non-operated BMI ≥ 40 kg/m^2 obese patients over the years (US$).

Cost type	1st Year	2nd Year	3rd Year	4th Year	5th Year
Cost with operation (A)	5.559	7.161	8.674	9.832	10.991
Cost without operation (B)	4.070	6.105	8.139	10.174	12.209
Differences (A−B)	**1.489**	**1.056**	**534**	**−342**	**−1.218**



Graphic 1. The cost difference of operated and non-operated BMI ≥40 kg/m^2 obese patients over the years (US $).

The findings of the study are parallel to the published literature. However, there are certain limitations to be addressed. First, DALY data are based on 2004, as the figures for recent years are not available yet. Similarly, obese population data for those over 30 are based on the nearest year's data. Second, only the five most important obesity-related comorbidities are covered in the study. Third, complications of obesity surgery are not added to the model. Finally, weight gain after the surgery may reduce the cost effectiveness of the procedures. In spite of these limitations, the conclusion that the results are parallel with the published literature is crucial for Turkey's health-care system, as SSI covers obesity surgery for only patients with a BMI ≥40 kg/m^2.

As in many countries of the world, the obese population is increasing in Turkey as well. The obese population has increased by about 42% from 2003 to 2012. However, according to the results of this study, the total economic burden of obesity can be attributed to the ratio of 1.16% of GDP in 2004–1.73% in 2012 (The Ministry of Heath of Turkey, 2013). Considering the increase of the obese population, the increase of the economic burden will increase in later years.

Bariatric surgery, the method of obesity treatments, is applied in Turkey. Operating expenses for obese patients with a BMI ≥40 kg/m^2 are covered by the SSI. In international health technology assessment guidelines, surgical procedures are recommended for a BMI = 35–40 kg/m^2 with serious comorbidities or BMI ≥40 kg/m^2 patients. However, it was reported that while current guidelines offers obesity surgery for BMI ≥ 40 kg/m^2 or BMI ≥ 35 kg/m^2 with obesity-related morbidity, obesity surgery should be redefined to BMI 35 kg/m2 or BMI 30 kg/m2 with comorbidities (Sinha et al., 2015).

Obesity treatment guidelines published in Turkey have similar recommendations. In the "National Obesity Prevention and Treatment Guideline" by the Obesity Research Association of Turkey, surgical treatment of obesity is suggested for the age range of 16–60 or a BMI >35 kg/m^2 with comorbidities (National Obesity Preventi, 2009). Similarly, The Turkish Society of Endocrinology and Metabolism, in its "Obesity Treatment Guideline and Lifestyle Advice" reports surgical treatment is recommended for a BMI >40 kg/m^2 or a BMI = 35–39.9 kg/m^2 with severe medical conditions (Kaya, 2009).

Obesity surgery is stated as hee only treatment that offers significant and sustained weight loss for obesity patients, even the lack of reliable level 1 evidence (Hopkins and Welbourn, 2015) According to the results of this study, the economic burden of the current reimbursement conditions for surgery is eliminated by the fourth year after the surgery. Decision makers need to account for these results in implementing new policies for obesity treatment pathways in Turkey.

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Conflict of interest statement

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Supplementary data

List of abbreviations

BMI	Body Mass Index
DALY	Disability Adjusted Life Years
ICER	Incremental Cost-effectiveness Ratio
QALY	Quality Adjusted Life Years
SSI	Social Security Institution
TBDS	Turkey Burden of Disease Study
WHO	World Health Organization

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