

## Bariatric surgery. Analysis of hospital admissions for obesity in the Brazilian Public Health System (SUS) in Sao Paulo<sup>1</sup>

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### ABSTRACT

**PURPOSE:** To characterize the comorbidities associated with hospitalizations for obesity and the relationship of these co-morbidities with bariatric surgery and hospitalization costs during the period between 2000 and 2010 in Sao Paulo that were financed by the Brazilian Public Health System (SUS).

**METHODS:** We used data from the Hospital Information System of the Unified Health System (SIH-SUS) for selected individuals hospitalized for obesity according to International Classification of Diseases (ICD10).

**RESULTS:** The total cost of hospitalizations was approximately two million dollars, with 67% of the total cost for bariatric and reconstructive surgery. Women accounted for 87% of hospitalizations, and 77% of subjects were aged between 30 and 59 years; the main comorbidity found was hypertension, and the procedures performed were bariatric surgery and reconstructive surgery (post-bariatric surgery).

**CONCLUSION:** Obesity is a major public health problem that affects people of productive age, causing high costs of hospitalization, which reinforces the requirement for preventive interventions beginning from childhood.

**Key words:** Bariatric Surgery. Obesity. Hospitalization. Health Care Costs.

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## Introduction

Human developmental changes have led to a modern life reflected in demographic, nutritional and epidemiologic changes<sup>1</sup>. These changes result in a higher prevalence of chronic diseases such as atherosclerosis, hypertension, diabetes mellitus and cancer<sup>2</sup>. Estimates from the World Health Organization (WHO) show that chronic noncommunicable diseases are responsible for 59% of deaths and 46% of total morbidity, reducing the years of healthy life<sup>3</sup>.

Obesity is a common risk factor for chronic diseases and is defined by excessive accumulation of corporal fat. WHO data have revealed an increasing proportion of overweight and obese adults worldwide, creating an alarming growth rate. Obesity is considered a public health problem, causing a reduction in longevity and life quality; the increased obesity prevalence is due to two environmental factors, independent of social level and age: high-energy diets and sedentarism<sup>4-5</sup>.

In Brazil, approximately 600 thousand people represent 0.64% of morbid obese patients. There will be an estimated 100% prevalence within the next 10 years, reducing the life expectancy by five to 20 years and becoming the great health public issue<sup>6-7</sup>.

Bariatric surgery has been a treatment achieving adequate and sustained loss of weight, with cure or improvement of comorbidities. Bariatric surgery is indicated in cases where conservative treatments for significant and sustained reduction of body weight have been unsuccessful<sup>8</sup>.

Surgery as a treatment for severe obesity has been employed for nearly 50 years. The initial technique was abandoned in 1970 for causing absorption syndrome. Thereafter, surgical methods (such as the Fobi-Capella technique) that limit the intake of foods have been applied<sup>11</sup>. In Brazil, bariatric surgery is a relatively recent procedure, financed by the National Health System called Sistema Único de Saúde (SUS) of the Ministry of Health and regulated by #252GM/MS of March 1999<sup>9-11</sup>. Individuals with BMI $\geq$ 50 kg/m<sup>2</sup>; or BMI $\geq$ 40 kg/m<sup>2</sup> with or without comorbidities unsuccessfully in clinical treatment for at least two years; or BMI $>$ 35 kg/m<sup>2</sup> with co-morbidities and without successful clinical treatment for at least two years are indicated for surgical treatment of obesity by SUS<sup>11</sup>.

The cost/benefit ratio has been questioned by the health insurance industry. Frieda *et al.*<sup>8</sup> showed the savings in health care costs after bariatric surgery, mainly due to increased work productivity and reduced absenteeism.

The metropolitan region of São Paulo is one of five of the world's largest urban agglomerations with over 20 million inhabitants in 2007, of which 55.4% are owned by the city of São Paulo, representing more than 11 million inhabitants<sup>12</sup>. São Paulo has a highlighted economic and cultural expression. However, Sao Paulo exhibits many contrasts, especially in education and public health. Studies evaluating bariatric surgery and hospital admissions for obesity have been restricted to a few health centers<sup>16</sup> and do not reflect public health events in Sao Paulo City.

The data generated from the Ministry of Health's information systems have been used in many studies and recommended to evaluate epidemiology in Brazil, to develop health indicators and to conduct surveys for monitoring risk factors<sup>13</sup>.

The planning process of public health has become an important aspect of a developing country due to the potential impact of obesity on quality of life, health, and economics. The present study aimed to assess the costs and to characterize the comorbidities associated with hospitalizations for obesity that were financed by the SUS and the relationship of these comorbidities with bariatric surgery over the past ten years (2000-2010), in Sao Paulo City, financed by the SUS.

## Methods

This study had a retrospective and descriptive nature and was based on review of data sources from the Hospital Information System of DataSUS (SIH-www.datasus.gov.br) and sources of the Brazilian Institute of Geography and Statistics. Information about individuals admitted with obesity as the underlying cause was selected according to the 10<sup>th</sup> Review of International Classification of Diseases (ICD) in Sao Paulo, with the following ICDs:

- E660 (obesity due to excess calories)
- E661 (drug-induced obesity)
- E662 (extreme obesity with alveolar hypoventilation)
- E668 (another obesity)
- E669 (unspecified obesity)

Analysis of data recording the gender, age, presence of comorbidities (hypertension and diabetes), length of the hospital stay, procedures performed during hospitalization and costs.

In Sao Paulo, 5.840.420 hospitalizations were recorded from 2000 to 2010. Other causes of hospitalization or uncompleted fill data were excluded.

Hospitalization for obesity was analyzed according to established criteria, and 4.988 cases were analyzed.

*Statistical analysis*

The sample size (n) was calculated using the following formula:

$$n = \frac{s^2}{(\bar{x} - \mu)^2} \times (t_{\alpha;gl})$$

Where the estimated variability (S2) was based on the study of the Ministry of Health<sup>13</sup>, considering a 95% confidence level and an allowable estimated error of 5% of the difference. Thus, the minimum sample size was 4.738 individuals.

Data are presented as percentages or means±standard deviations. The statistical analysis was performed with SigmaStat software, version 3.1. The chi-square (χ<sup>2</sup>) test and Student's t-test were used to compare the parameters as the number of cases for qualitative variables and values for quantitative variables, respectively. The level of significance considered was 5% (p<0.05).

**Results**

Table 1 presents 4.988 cases of admission by obesity characteristics; 87% were women, and approximately 77% of the subjects were aged between 30 and 59 years (46±10 years).

For age, 18% (898) were between 18-29 years, 32% (1.572) were between 30 and 39 years, 27% (1.334) were between 40 and 49 years, 19% (932) were between 50 and 59 years, and only 5% were over 60 years.

The comorbidity analysis revealed hypertension (63%) as the main disease associated with obesity, followed by cholecystitis (14%), lipodystrophy (5%), and diabetes.

Table 2 shows that the number of hospitalization days for the hypertensive patients was higher than for the normotensive individuals (9±7.9 days vs 5±7.5 days, respectively).

**TABLE 1** – Data from the Hospitalar information system-SIH/DataSUS, showing the characteristics of individuals admitted for surgery related to obesity. Sao Paulo City, between 2000 and 2010.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Men	16%	21%	11%	15%	15%	14%	13%	16%	07%	11%	12%	13%
Women	84%	79%	89%	85%	85%	86%	87%	84%	93%	89%	88%	87%
Age (years)	38±11	40±9	37±12	47±11	40±11	42±12	40±12	49±15	42±12	43±11	39±9	46±10
Age range												
18-29 years	59	42	64	91	106	74	126	74	86	80	96	898
30-39 years	98	73	123	159	159	153	190	101	183	169	164	1572
40-49 years	82	71	119	122	121	136	141	101	163	143	135	1334
50-59 years	42	28	49	71	101	85	112	98	129	102	115	932
60-69 years	5	4	13	14	14	26	18	20	23	24	18	179
70-9 years	0	4	2	9	13	12	9	3	14	3	2	71
≥80 years	0	0	0	0	0	1	1	0	0	0	0	2
Normotensive	278	205	355	454	501	472	572	375	577	495	507	4791
Hypertensive	8	17	15	12	13	15	25	22	21	26	23	197
	286	222	370	466	514	487	597	397	598	521	530	4988

Data are presented as the percentage or as the mean±SD.

**TABLE 2** – Data from the Hospitalar information system-SIH/DataSUS, showing the characteristics of obesity surgery. Sao Paulo City, between 2000 and 2010.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total/média
Normotensive days in the hospital	5±4.6	6±9.9	6±8.9	5±7.1	5±5.9	6±11.3	5±8.4	6±7.7	5±5.5	4±4.4	4±6.4	5±7.5
Hypertensive days in the hospital	7±2.5	9±10.3	8±7.1	10±6.7	8±6.0	10±10.4	9±4.5	8±3.9	9±5.0	8±5.1	13±12.1	9±7.9*
Bariatric surgery	64.0%	69.0%	47.0%	10.0%	53.3%	48.6%	52.5%	16.6%	26.7%	32.8%	7.1%	36.42%
Repair surgery	10.5%	0%	35.6%	2.8%	28.9%	34.9%	34.0%	12.0%	30.9%	56.0%	19.4%	26.56%
Other admissions related to obesity	25.5%	31%	17.4%	87.2%	17.8%	16.5%	13.5%	71.4%	42.4%	11.2%	73.5%	37.02%
Total admissions for obesity	286	222	370	466	514	487	597	397	598	521	530	4.988

Data are presented as the percentage or as the mean±SD. \*, p<0.05 vs normotensive – Student's *t*-test.

Of the total admissions, 36% (1.817) were for performing bariatric surgeries, 27% (1325) were for performing reconstructive surgery after bariatric surgery, and 37% (1.846) were for other obesity-related reasons.

Table 3 presents the hospital admissions costs due to

obesity from 2000 to 2010. R\$ 4 million Real was spent on these admissions, increasing by over 300% between 2000 and 2010. The total cost of bariatric surgeries was R\$ 2.3 million and that of reconstructive surgeries was R\$ 400.000, totaling 67% of the total cost of hospitalizations for obesity.

**TABLE 3** – Data from the Hospitalar information system-SIH/DataSUS, showing the costs of hospital admission for obesity. Sao Paulo City, between 2000 and 2010.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Bariatric surgery	R\$232	R\$130	R\$145	R\$39	R\$256	R\$301	R\$418	R\$88	R\$345	R\$369	R\$82	R\$2,405
Repair Surgery	R\$13	-	R\$19	R\$6	R\$30	R\$43	R\$21	R\$35	R\$80	R\$126	R\$45	R\$418
Other procedures	R\$33	R\$33	R\$17	R\$209	R\$5	R\$16	R\$7	R\$130	R\$119	R\$173	R\$654	R\$1.396
Total (Thousand Real)	R\$278	R\$163	R\$181	R\$254	R\$291	R\$360	R\$446	R\$253	R\$544	R\$668	R\$781	R\$4.219

Data are shown in thousand Real (R\$). US\$1 = R\$2.23 (01/06/2014).

## Discussion

This study described hospital admissions related to obesity only that were registered in the Unified Health System (SUS) in Sao Paulo. The data were collected in the SIH/DataSUS, and they represent official data that are open to public investigation (preserving the identity of the individuals) and have a broad population coverage and low cost. This study revealed that, among admissions for obesity over the last 10

years in the city of Sao Paulo, 63% of admissions resulted in bariatric surgical procedures and reconstructive surgeries after bariatric surgery, such as abdominal dermolipectomy and lower limb, brachial, crural, mammoplasty, and sequential corrective plastic surgeries.

The total number of bariatric and reconstructive surgeries accounted for 67% of the costs of all hospitalizations for obesity, totaling R\$4.2 million, which is approximately 4% of what the SUS spends on the clinical treatment of obesity in Brazil<sup>14</sup>.

The quantity of bariatric surgeries financed by SUS in Brazil between 2001 and 2008 increased by 540%, mainly in Sao Paulo State. This study demonstrated a 2-fold increase in the hospitalization days for obese hypertensive patients compared with normotensive patients. Another study indicated that obese hypertensive patients have a 12 times greater risk of complications compared with normotensive patients, as well as an increased number of hospitalization days<sup>15-16</sup>.

Comorbid hypertension exhibited the highest prevalence in this study, followed by cholecystitis, lipodystrophy and diabetes mellitus, in descending order. The predominance of hypertension as a comorbidity was reported previously by Costa<sup>5</sup> and is believed to be up to 6 times more frequent in obese subjects than in lean subjects<sup>17</sup>. The arterial blood pressure tends to increase with the duration of obesity<sup>1</sup>. In 2012, about a quarter of the Brazilian population (24%) had hypertension, compared with 23% in 2006, and the disease is more common in women than in men<sup>17</sup>; in 2008, the obese hypertensive population in São Paulo was estimated to constitute 29% of the total population<sup>18</sup>.

In this study, individuals admitted to the hospital due to obesity surgery represented at least 1% of total hospital admissions between 2000 and 2010 that were supported by the SUS. We observed a crescent number of admissions over the years, twice more in 2000 than 2010.

Women represented 87% of hospital admissions for obesity, as was observed in other studies. Women have more time available for health care treatments<sup>5</sup> in primary health care settings compared with men<sup>12</sup>. Commonly, women seek beauty and well-being, and weight reduction and plastic surgery are strongly related to aesthetic aspects<sup>7</sup>. However, in Sao Paulo, there is no difference in the prevalence of obesity between genders<sup>18</sup>.

The age range prevalence between 30 and 59 years was pronounced in both sexes, and it was observed previously by the Sao Paulo Municipal Secretariat of Health, confirming the higher prevalence of obesity in this age group (30%)<sup>18</sup>.

Brazil follows the global trends in growth of the obese population. Over the last 34 years, the prevalence of obesity increased, reaching 12% of men and 17% of women<sup>18</sup>. A nutritional survey applied to Sao Paulo city residents in 2008 revealed that 32% of the population is between 20 and 59 years of age, representing over 800,000 persons<sup>18</sup>. In the United States, one of the main countries affected by obesity, two-thirds of the American population is overweight or obese. If the growing trend of obesity is not reversed, the 16.2 million obese individuals in 2005 will increase to 48.3 million obese individuals in 2050<sup>18</sup>.

Obesity remains a major public health problem in adults of working age in the city of Sao Paulo, who spend millions of dollars in hospitals because of obesity, especially for performing bariatric surgeries and post-bariatric surgery reconstructive surgeries. With the prospect of increased numbers of individuals who are obese bariatric surgery candidates, it is important to reflect on the impact of costs on public health services, which reinforces the requirement for educational interventions to change lifestyles in children, adolescents and young adults to achieve effective prevention of obesity.

## Conclusion

Although our study is descriptive, it provides an insight into the growth of admissions for obesity and the number of bariatric surgeries performed in Sao Paulo over the last 10 years. Hypertension management is important for reducing the high public health costs associated with obesity.

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