



# Influence of the centralizing gastric cancer surgery on the health-related quality of life in Brazil

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**Background:** The assessment of health-related quality of life (QoL) has improved the treatment of gastric cancer. Aiming to compare the influence of skilled surgeons in general hospitals versus specialized hospitals in cancer in Brazil, this study evaluated the relationship between quality of life and types of hospitals (general or cancer) in treating patients with gastric adenocarcinoma operated by surgeons with specific training in Surgical Oncology.

**Methods:** This was a cross-sectional study involving 104 patients. Inferential analyses were used to compare two Brazilian general hospitals and a cancer center, evaluating scores of the SF-36 and FACT-Ga QoL questionnaires (Kruskal-Wallis test, Mann-Whitney test); gender, smoking, and *Helicobacter pylori* tests status (Pearson's Chi-Square test); ethnicity, alcoholism, location of the tumor in the stomach, Lauren's histological types, and type of surgery (Fisher's exact test), number of lymph nodes resected by Surgical Oncologists [Analysis of Variance (ANOVA) with a Fixed Factor], and comparative survival analysis (Log-Rank test).

**Results:** Patients treated at a cancer hospital had higher scores of the FACT-Ga (FACT-G total score,  $P=0.023$ ; physical well-being, PWB,  $P=0.006$ ; and functional well-being, FWB,  $P=0.011$ ). The mean scores of the SF-36 questionnaire showed similar behavior but without reaching a significant difference. Patients operated by Surgical Oncologists at the cancer hospital had better scores in emotional well-being FACT-Ga domain (EWB,  $P=0.034$  and  $P=0.047$ ) compared to those operated by Surgical Oncologists in general hospitals. There was no significant difference in survival among the three hospitals ( $P=0.214$ ).

**Conclusions:** In this study, it was possible to suggest the relationship between QoL assessment scores with the centralization of care at specialized cancer hospital in the treatment of patients with gastric adenocarcinoma undergoing surgery with curative intent in Brazil.

**Keywords:** Gastrectomy; gastric cancer; gastric neoplasms; quality of life; stomach cancer; stomach neoplasms

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## Introduction

Gastric cancer has three main presentations: adenocarcinoma, the most frequent form with 95% of cases, and, lymphoma and sarcomas, representing one of the most common digestive system cancers (1-3). In Brazil, stomach cancer is the fourth most frequent among men and the sixth among women, with an estimated 13,340 new cases of stomach cancer among men, and 8,140 in women for each year of the 2023–2025 triennium (1).

Surgery is considered a potentially curative therapy. However, the interdisciplinary approach is a determinant of improvement in results (2-5). Furthermore, even the best treatment obtaining a cure for the tumor can result in adverse effects on the quality of life (QoL) of these patients, making it challenging to balance the treatment standardized and the best outcome (2,4,5).

The complete concept of “quality of life” is still poorly understood by some authors who may not be familiar with these assessments according to the definition suggested by the World Health Organization (WHO), which considers the multidimensional and subjective factors of quality of life and defines it as the individual’s perception of their position in life, in the context of the culture and value system in

which they live and place their standards and expectations (2,4,5). This concept incorporates aspects such as life experiences, well-being, satisfaction, social and physical functions, which are influenced by physical, socioeconomic, psychological factors, perception of health status and general satisfaction with life (2,4-6).

The assessment of the QoL can be performed using validated and reproducible instruments in different languages, which usually address the environmental, social, occupational, physical, psychological and spiritual relationships, always maintaining a multidimensional character and evaluating the general perception of quality of life emphasizing the symptoms or limitations resulting from a disease (2). The instruments can be generic (when applicable non-specifically to different conditions and can be used in the general population), or specific (appropriate to the patient with one particular disease or symptom) (4-6). Patient-reported outcomes, such as health-related quality of life, may still incorporate the lived experience of patients and caregivers in the evaluation of medical interventions in clinical trials, but their acceptance has still been limited (7).

The study of the QoL outcome can also be used in public health management, enlightening valuable population information that, together with classical morbidity and mortality analysis data, may support the best decisions in planning lines of care in oncology, especially in gastric cancer (2,6). The medical literature is abundant in describing the prognostic and technical advantages of specific surgical training associated with a large volume of cases and hospitals dedicated to this disease. Reports of improved morbidity and mortality are related to the quality of treatment and cost reduction of the disease, suggesting that the centralization of care in referral units can bring substantial measurable gains (6-29). This centralization of treatment with outcome audit improved results and lowered hospital mortality in Denmark (16), England (19), and Holland (15,25). However, especially in the Western countries, we observe differences in the performance of surgery, and we often witness the practice of inadequate procedures, with disparities due to various factors (30).

In contrast, centralization of care may be associated with an increased need for patient travel and commuting, and worsening of existing discrepancies related to treatment

### Highlight box

#### Key findings

- The positive influence of the cancer care in specialized hospitals on the QoL assessment scores of patients treated with gastric adenocarcinoma in Brazil.

#### What is known and what is new?

- Centralization of care for gastric cancer in cancer hospitals may improve oncological results, morbidity and mortality outcomes.
- The influence of the cancer care in specialized hospitals on the QoL assessment scores of patients treated with gastric adenocarcinoma in Brazil, corroborates with morbimortality data observed in the current literature.

#### What is the implication, and what should change now?

- Such data favor the centralization of attention to gastric cancer in specialized hospitals and should be used for the construction of public policies and planning in oncology, in addition to serving as inspiration for other future studies.

in high-volume versus low-volume centers (31,32). When complications occur after these surgical procedures, high-risk patients and patients who are unable or unwilling to move to the referral hospital and are admitted to a regular hospital can result in the fragmentation of care in complex cancer surgeries, with a potential association with increased mortality (31,33).

D2 lymphadenectomy is considered the standard for curative surgeries. However, it is still associated with more significant morbidity, especially in less experienced centers, where surgeons have not completed their learning curve (10), which revolves around 15 to 100 procedures (21,22) in 18 to 24 months (21). Currently, even in developed Western countries, it is suggested that about only 20% to 30% of patients undergo lymph node dissection considered adequate (12,30). Surgical learning curves are challenging to measure and are rarely presented. Thus, the definitive understanding of the centralization of care as an inducer of better results may subsidize a profound restructuring of health systems, and, in this sense, the analysis of QoL can contribute, as well, their results must now be included in core result sets for cancer surgery efficacy trials (7).

The present study highlights the importance of knowledge, experience, and awareness provided by specialized cancer hospitals when treating oncologic patients by applying specific and general instruments as the FACT-Ga and MOS-SF36. This fact may contribute to the patient's health-related quality of life (QoL), as observed in this study, when comparing the outcomes in different general hospitals and a cancer-specialized hospital in Brazil. We present this article in accordance with the STROBE reporting checklist (available at <https://jgo.amegroups.com/article/view/10.21037/jgo-22-1114/rc>).

## Methods

### *Procedure*

The convenience sample transferred in this research consisted of 104 patients with gastric adenocarcinoma undergoing surgical treatment with curative intent, 23 (22.1%) from the HGA center (general hospital A, Hospital Dr. Alberto Lima, Federal University of Amapá, Brazil), 43 (41.3%) from the center HGB center (general hospital B, Base Hospital of Federal District, Brazil) and private hospitals, not accredited to the Brazilian public health system, in the same city, in addition to 38 (36.5%) of the

HC center (specialized oncology hospital, Dr Amaral Carvalho, Jaú, Brazil). After an initial comparison among the hospitals, seven patients operated on in private care hospitals and 25 patients operated on by surgeons without specific residency in Surgical Oncology were excluded to avoid biases. Patients were consulted and interviewed about their QoL in their postoperative periods (at a variable time interval), identifying themselves related to different treatment times from 0.3 months (8 days) to 125.9 months (period of up to 10 and a half years approximately), time measured between the day of surgery and the application of the questionnaires. We use database and questionnaires answers; of alive, randomly, and sequentially selected patients, with gastric adenocarcinoma, preceded by surgical treatment with curative intent and operated by surgeons with specific training in Surgical Oncology.

The present study protocol was approved by Research Ethics Committees of Base Hospital of Federal District (No. 36817120.1.3004.8153); Federal University of Amapá (No. 36817120.1.3001,0003); Federal University of São Paulo (No. 36817120.1.3003.5505) and Amaral Carvalho Cancer Hospital (No. 36817120.1.0000.5434). All participating hospitals/institutions were informed and agreed on the study. All patients signed an Informed Consent Form before enrollment. This study was carried out under the principles of the Declaration of Helsinki (1964) and its later versions.

Searches in physical or electronic medical records in the participating institutions were carried out, with pertinent data collected per the epidemiological questionnaire. A descriptive analysis was performed according to the sample collected. Inconsistent or absent data were not computed.

To assess Quality of life, the following instruments were assessed: Medical Outcomes Study 36-Item Short Form Health Survey or MOS-SF36, and Functional Assessment of Cancer Therapy or FACT-Ga), both translated and validated for the Brazilian population. Copyright permissions were granted for this study (6).

Those who agreed to participate were interviewed by medical researchers from the assistant teams, previously trained to apply the questionnaires.

The MOS-SF36 is a generic multidimensional QoL assessment instrument, allowing its comparison of chronic diseases in a general population. It is validated for a Brazilian population, consisting of 36 items encompassed in 8 domains: functional capacity, physical aspects, pain, general health, vitality, social aspects, emotional aspects, and mental health. Each question is assigned a value in grades from 8 domains ranging from 0= to 100= best, for

each domain (2,6).

The FATC-Ga is a specific instrument to assess the quality of life in patients with gastric cancer, consisting of 27 items, divided into scales of physical well-being (PWB), functional well-being (FWB), social well-being/family (SWB), and emotional well-being (EWB), additional concerns (GaCS) and when added together derive a Test Result Index index-TOI (PWB + FWB + GaCS) or a FACT-G total score (PWB + SWB + EWB + FWB) or a FACT-GASTRIC total gastric score (PWB + SWB + EWB + FWB + GaCS). The sum of the scores in each question adopts the highest/best polarity, with the highest score corresponding to the best quality of life, being a scale accepted as an indicator of the quality of life, when answered in more than 80% of its items (2,6).

Statistical analyzes were performed using the statistical program R version 3.3.2. (R Core Team, 2016) (6).

#### **Inclusion and exclusion criteria**

Patients of both genders, with gastric adenocarcinoma and its subtypes, over 18 years of age, achieving cancer treatment, with partial or total gastrectomies and their lymphadenectomies according to literature standards, with curative intent were included (defined by the teams that performed the treatment), in which one seeks to comply with the principles of “R0” or radical surgery.

Patients who did not understand or complete the instruments and patients who refused to participate in the study, those operated at private practice hospitals (including only patients treated in Brazilian public health system hospitals) or by surgeons without full residency in the Surgical Oncology specialty were excluded.

#### **Statistical analysis**

The inferential analyzes applied to confirm or refute evidence found were:

- ❖ Mann-Whitney test compared general hospitals and cancer hospital regarding scores of the FACT-Ga and MOS-SF36 questionnaires.
- ❖ Kruskal-Wallis test compared general hospitals (with teams specialized in oncology) and cancer hospital, regarding scores of the FACT-Ga and MOS-SF36.
- ❖ Pearson’s Chi-Square test compares gender, smoking, and *Helicobacter pylori* tests.
- ❖ Fisher’s exact test to compare alcoholism, ethnicity,

Lauren’s histological types, location of the tumor in the stomach, and type of surgery.

- ❖ Analysis of Variance (ANOVA) with a Fixed Factor comparing the number of lymph nodes resected by oncologist surgeons between different centers (hospitals).
- ❖ Comparative survival analysis with Log-Rank test.

The used alpha significance level was 5% in all inferential analyses.

The definitions of the nature of hospitals (cancer or general) were carried out by their teams based on criteria for evaluating the characteristics of different hospitals. The definition of specialist surgeon uses the criteria for conducting a specific medical residency in Surgical Oncology (minimum duration of three years, in addition to a previous residency in General Surgery) defined by the Ministry of Education of Brazil, Brazilian Federal Council of Medicine, and the Brazilian Society of Surgical Oncology.

#### **Results**

From an initial sample of 104 patients, after excluding all those operated at private care hospitals (7 patients) and by surgeons without specific residency in surgical oncology (25 patients), a total of 72 patients remained; 34 (47.2%) were women and 38 (52.8%) men. The mean age of these patients at the time of surgery was 58.3 years, ranging from 29.4 to 87.1 years, with a standard deviation of 13.0 years. There are more users of alcoholic beverages in the HGA and HC centers, there are more afro-descendants in the HGA center, and income is higher in the HGB center, but these variables are known to be unrelated to QoL in our sample (Table 1) (6).

Considering the item “additional concerns” (GaCS) from the FACT-Ga questionnaire, according to the self-report of specific symptoms or complaints of gastric cancer, and the information “not at all”, “a little”, “more or less”, “very”, “very much”, of increasing degree, the percentages of the answers were recorded, denoting their relevant impact on QOL (Table 2).

*Helicobacter pylori* infection was present in 41.3% of patients. Lauren’s intestinal histopathological type was the most frequent, observed in 43 (60.6%) patients, with no significant differences between the different hospitals, corroborating the homogeneity of the sample (Table 3).

Type of surgery, tumor staging, lymph node staging (TNM), metastases, and degree of cell differentiation

**Table 1** Characteristics of patients in the three hospital centers

Characteristics	HGA		HGB		HC		Total		P value
	n	%	n	%	n	%	n	%	
Gender									
Female	10	43.5	18	50.0	6	46.2	34	47.2	0.884 <sup>a</sup>
Male	13	56.5	18	50.0	7	53.8	38	52.8	
Total	23	100.0	36	100.0	13	100.0	72	100.0	
Schooling									
Illiterate	2	9.5	10	27.8	3	23.1	15	21.4	0.500 <sup>b</sup>
1st grade	14	66.7	13	36.1	9	69.2	36	51.4	
2nd grade	3	14.3	10	27.8	–	–	13	18.6	
3rd grade	2	9.5	2	5.6	1	7.7	5	7.1	
Post-graduate	–	–	1	2.8	–	–	1	1.4	
Total	21	100.0	36	100.0	13	100.0	70	100.0	
Smoking									
Yes	14	63.6	21	60.0	4	30.8	39	55.7	0.129 <sup>a</sup>
No	8	36.4	14	40.0	9	69.2	31	44.3	
Total	22	100.0	35	100.0	13	100.0	70	100.0	
Alcoholism									
Yes	7	31.8	2	5.7	3	23.1	12	17.1	0.026 <sup>c</sup>
No	15	68.2	33	94.3	10	76.9	58	82.9	
Total	22	100.0	35	100.0	13	100.0	70	100.0	
Ethnicity (in Brazil)									
White	1	4.5	17	47.2	7	53.8	25	35.2	0.002 <sup>c</sup>
Black	5	22.7	4	11.1	2	15.4	11	15.5	
Pardo (mixed race)	16	72.7	15	41.7	4	30.8	35	49.3	
Total	22	100.0	36	100.0	13	100.0	71	100.0	
Income (official Brazilian minimum wages)*									
No income	2	9.5	1	2.8	–	–	3	4.3	0.037 <sup>b</sup>
Up to 2	14	66.7	18	50.0	10	76.9	42	60.0	
2.1 to 4	3	14.3	3	8.3	3	23.1	9	12.9	
4.1 to 10	2	9.5	12	33.3	–	–	14	20.0	
10.1 to 20	–	–	2	5.6	–	–	2	2.9	
Total	21	100.0	36	100.0	13	100.0	70	100.0	

\*, minimum wage - official measure determined by the Brazilian government. <sup>a</sup>, Pearson's Chi-Square; <sup>b</sup>, Kruskal-Wallis test; <sup>c</sup>, extension of Fisher's Exact test. HGA, general hospital A; HGB, general hospital B; HC, cancer hospital.

**Table 2** Characteristics of patients considering symptoms of the functional assessment of cancer therapy-gastric domain

"Additional concerns" (GaCS)*	Not at all 0		A little 1		More or less 2		Very 3		Very much 4	
	n	%	N	%	n	%	n	%	n	%
I am losing weight	35	48.61	18	25.00	7	9.72	9	12.50	3	4.16
I have a loss of appetite	32	44.44	10	13.88	16	22.22	11	15.27	3	4.16
I am bothered by reflux or heartburn	42	58.33	11	15.27	9	12.50	6	8.33	4	5.55
I am able to eat the foods that I like	7	9.72	15	20.83	16	22.22	14	19.44	20	27.77
I have discomfort or pain when I eat	36	50.00	19	26.38	8	11.11	6	8.33	3	4.16
I have a feeling of fullness or heaviness in my stomach area	33	45.83	16	22.22	9	12.50	12	16.66	2	2.77
I have swelling or cramps in my stomach area	47	65.27	14	19.44	6	8.33	4	5.55	1	1.38
I have trouble swallowing food	50	69.44	14	19.44	4	5.55	3	4.16	1	1.38
I am bothered by a change in my eating habits	34	47.88	15	21.12	6	8.45	11	15.49	5	7.04
I am able to enjoy meals with family or friends	2	2.77	9	12.50	14	19.44	16	22.22	31	43.05
My digestive problems interfere with my usual activities	42	58.33	17	23.61	6	8.33	5	6.94	2	2.77
I avoid going out to eat because of my illness	33	45.83	9	12.50	8	11.11	13	18.05	9	12.50
I have stomach problems that worry me	37	51.38	12	16.66	9	12.50	8	11.11	6	8.33
I have discomfort or pain in my stomach area	33	45.83	23	31.94	10	13.88	4	5.55	2	2.77
I am bothered by gas (flatulence)	26	36.11	14	19.44	15	20.83	11	15.27	6	8.33
I have diarrhea (diarrhea)	38	52.77	10	13.88	11	15.27	6	8.33	7	9.72
I feel tired	30	41.66	18	25.00	12	16.66	8	11.11	4	5.55
I feel weak all over	36	50.00	14	19.44	9	12.50	9	12.50	4	5.55
Because of my illness, I have difficulty planning for the future	44	61.11	11	15.27	9	12.50	5	6.94	3	4.16

\*, Additional Concerns – GaCS (FACT-Ga Questionnaire Item).

are available in *Tables 3,4*, in which we record descriptive analyzes of hospital centers, suggesting that the groups are homogeneous for comparison. The degree of cell differentiation was significantly higher in cancer hospital, but as suggested previously in our series (6), this feature does not affect QoL in our population (*Table 4*).

When analyzing the initial sample of 104 patients without applying the exclusion criteria, we found that patients treated at a hospital specialized in cancer had higher means in all scores of the FACT-Ga questionnaire when compared to patients operated on by oncology specialists inserted in general hospitals, with significant differences in the scores physical well-being (PWB,  $P=0.006$ ), functional well-being (FWB,  $P=0.011$ ) and FACT-G total score ( $P=0.023$ ). The mean scores of the SF-36v2 questionnaire showed similar behavior, but without reaching a significant difference (*Table 5*).

After applying the exclusion criteria, following an attempt to homogenize the sample for comparison, we noticed a trend towards the superiority of the means of all scores and domains of the FACT-Ga questionnaire and some MOS-SF-36 domains for those operated on in the cancer hospital compared to the sum of patients operated on in general hospitals (*Table 6*), this superiority being statistically significant in the emotional well-being domain (EWB,  $P=0.034$ ).

Assessing the samples from each hospital center separately (*Table 7*), a significant difference is also perceived in the emotional well-being domain (EWB,  $P=0.047$ ) of the FACT-Ga questionnaire, with higher mean scores for the cancer hospital. The SF-36 domain scores showed no significant differences.

The specialists from the HGA center had a higher mean in the reading of lymph nodes (*Table 8*) when compared to

**Table 3** *Helicobacter pylori* status, Lauren's histopathological type, tumor site, and type of gastrectomy by hospital center

Characteristics	Center (hospital)								P value
	HGA		HGB		HC		Total		
	n	%	n	%	n	%	n	%	
<i>Helicobacter pylori</i> status									
Positive	6	33.3	11	57.9	2	22.2	19	41.3	0.137 <sup>a</sup>
Negative	12	66.7	8	42.1	7	77.8	27	58.7	
Total	18	100.0	19	100.0	9	100.0	46	100.0	
Lauren histopathological type									
Diffuse	5	22.7	12	33.3	6	46.2	23	32.4	0.485 <sup>c</sup>
Intestinal	16	72.7	20	55.6	7	53.8	43	60.6	
Mixed	1	4.5	4	11.1	–	–	5	7.0	
Total	22	100.0	36	100.0	13	100.0	71	100.0	
Tumor site									
Cardia	3	13.0	8	22.2	1	7.7	12	16.7	0.327 <sup>c</sup>
Proximal	5	21.7	10	27.8	1	7.7	16	22.2	
Distal	15	65.2	18	50.0	11	84.6	44	61.1	
Total	23	100.0	36	100.0	13	100.0	72	100.0	
Type of gastrectomy									
Proximal	–	–	1	2.8	–	–	1	1.4	0.116 <sup>c</sup>
Total	10	43.5	18	50.0	2	15.4	30	41.7	
Partial	13	56.5	17	47.2	11	84.6	41	56.9	
Total	23	100.0	36	100.0	13	100.0	72	100.0	

<sup>a</sup>, Pearson's Chi-Square; <sup>c</sup>, Extension of Fisher's Exact test. HGA, general hospital A; HGB, general hospital B; HC, cancer hospital.

specialists from the HC and HGB centers (P=0.006).

There was no significant difference in survival among the three hospitals (P=0.214).

## Discussion

Gastric cancer requires complex multimodal planning of therapy, whose trajectories may be associated with a delay in response time, which may affect QoL. Well-defined and prompt access to treatment is crucial in determining a positive impact when simplified and structured (34). Services with additional support and adequate education are necessary to meet the broader needs of cancer patients, sometimes neglected in general hospitals. Essentially, enlightening information and relevant empowerment offered in hospitals of reference may improve the QoL

and other health outcomes (35). The construction of a line of care with a systematic screening and early detection of cancer service, as well as the frequent measurement of functional and performance results of patients are a desirable part of the conduct, and the information from such assessments helps to improve their QoL through appropriate intervention and counseling. Precise and patient-centered health management and policies can determine an increase in the general QoL (36). Health professionals and managers must be trained to identify risks and offer more resources and support to patients and their caregivers in situations of risk and frailty, increasing so is your QoL by developing appropriate interventions. Caregivers must be in good health to not compromise the care they provide to patients (37).

Possibly more timely diagnosis and therapeutic decisions

**Table 4** Characteristics of patients considering the degree of cell differentiation and staging by hospital center

Characteristics	HGA		HGB		HC		Total		P value
	n	%	n	%	n	%	n	%	
Tumor stage <sup>1</sup>									
0	–	–	1	2.8	–	–	1	1.4	0.675 <sup>b</sup>
1	1	4.5	2	5.6	1	7.7	4	5.6	
1a	2	9.1	2	5.6	–	–	4	5.6	
1b	3	13.6	4	11.1	2	15.4	9	12.7	
2	4	18.2	7	19.4	1	7.7	12	16.9	
3	5	22.7	15	41.7	5	38.5	25	35.2	
4	3	13.6	1	2.8	–	–	4	5.6	
4a	4	18.2	3	8.3	4	30.8	11	15.5	
4b	–	–	1	2.8	–	–	1	1.4	
Total	22	100.0	36	100.0	13	100.0	71	100.0	
Lymph node stage <sup>1</sup>									
0	15	68.2	15	41.7	7	53.8	37	52.1	0.271 <sup>b</sup>
1	–	–	11	30.6	4	30.8	15	21.1	
2	6	27.3	3	8.3	1	7.7	10	14.1	
3	1	4.5	3	8.3	–	–	4	5.6	
3a	–	–	3	8.3	1	7.7	4	5.6	
3b	–	–	1	2.8	–	–	1	1.4	
Total	22	100.0	36	100.0	13	100.0	71	100.0	
Metastases <sup>1</sup>									
0	22	100.0	34	94.4	12	92.3	68	95.8	0.432 <sup>c</sup>
1	–	–	2	5.6	1	7.7	3	4.2	
Total	22	100.0	36	100.0	13	100.0	71	100.0	
Tumor grade									
I	–	–	3	9.1	1	8.3	4	6.2	0.042 <sup>b</sup>
II	17	85.0	13	39.4	3	25.0	33	50.8	
III	3	15.0	17	51.5	8	66.7	28	43.1	
Total	20	100.0	33	100.0	12	100.0	65	100.0	

<sup>b</sup>, Kruskal-Wallis test; <sup>c</sup>Extension of Fisher's Exact Test; <sup>1</sup>, Pathologic stage groups (pTNM); HGA, general hospital A; HGB, general hospital B; HC, cancer hospital.



**Table 5** Summary measures of the domains of the functional assessment of cancer therapy-gastric and 36-item short-form health survey, according to the hospital centralization, all general hospitals (including private practice) compared to the cancer hospital

Questionnaires	Domains	HC		P value*
		No (n=66)	Yes (n=38)	
		Score average	Score average	
FACT-Ga <sup>1</sup>	PWB	21.6	23.9	0.006
	SWB	21.6	22.6	0.271
	EWB	19.3	19.7	0.425
	FWB	18.6	21.7	0.011
	GaCS	56.7	59.4	0.393
	TOI	96.8	105.1	0.093
	FACT-G total score	81.1	88.0	0.023
	FACT-Ga total score	137.7	147.4	0.106
MOS-SF-36 <sup>2</sup>	Physical functioning	72.3	67.0	0.185
	Role-physical	63.8	64.1	0.986
	Bodily pain	77.7	80.6	0.683
	General health	72.2	73.2	0.903
	Vitality	73.0	73.7	0.941
	Social functioning	79.9	76.6	0.285
	Role-emotional	73.9	74.3	0.596
	Mental health	75.4	78.7	0.483

\*, Mann-Whitney test; <sup>1</sup>, Functional Assessment of Cancer Therapy – Gastric; <sup>2</sup>, Medical Outcomes Study 36-Item Short-Form Health Survey. HC, cancer hospital; PWB, physical well-being; SWB, Social/family well-being; EWB, emotional well-being; FWB, functional well-being; GaCS, gastric cancer subscale; TOI, trial outcome index; FACT-G, FACT-general.

in specialized hospitals may likely have a greater or lesser impact on different types of cancer. There is still a scarcity of studies that can report the patient's experience and perceptions of "delay" in the conduct, QoL, and psychological outcomes. There is some evidence of the association between a shorter time to diagnosis and obtaining favorable results (38). It seems reasonable to assume that the efforts often present in referral centers to speed up diagnosis and management will likely benefit patients in terms of improved survival, early-stage diagnoses, and improved QoL. However, these benefits may vary between different types of cancers (38). Surgeons should also be trained to discuss patient expectations about symptoms and treatment influences on QoL, informing these aspects before surgery to minimize the treatment's physical, emotional, and psychological impact (39).

Centralized care in some countries has improved

morbidity and mortality in oncological procedures and improve the quality of care, particularly in resource-limited settings (40). By concentrating high-risk procedures in high-volume hospitals, more than 30 resections per year (18), we can reach better surgical quality (18). Multicenter studies investigating the association between hospital volume and surgical quality of stomach resections are still scarce. Information on specialized surgeries, such as adequate lymph node removal, is generally unavailable in national registries, although adequate lymphadenectomy is one of the parameters to assess the quality of surgical care (18-25,40-45).

In our study, patients treated at a specialized cancer hospital had higher means in all FACT-Ga questionnaire scores, when compared to patients operated in not specialized public and private practice hospitals (even if they were also conducted by specialist oncology teams), with significant differences in physical well-being (PWB),

**Table 6** Summary measures of the functional assessment of cancer therapy-gastric and 36-item short-form health survey domains, according to surgical oncologists at public hospitals (public general hospitals added together compared to cancer hospital)

Questionnaires	Domains	HC		P value*
		No (n=59)	Yes (n=13)	
		Score average	Score average	
FACT-Ga <sup>1</sup>	PWB	21.3	23.7	0.108
	SWB	20.3	21.8	0.638
	EWB	19.3	21.4	0.034
	FWB	18.4	21.1	0.168
	GaCS	55.8	59.9	0.298
	TOI	95.5	104.7	0.205
	FACT-G total score	79.2	88.0	0.080
	FACT-Ga total score	135.0	147.9	0.164
MOS-SF36 <sup>2</sup>	Physical functioning	70.9	59.2	0.190
	Role-physical	61.5	60.6	0.959
	Bodily pain	76.2	75.2	0.855
	General health	71.9	69.2	0.747
	Vitality	73.0	74.0	0.953
	Social functioning	79.9	76.0	0.562
	Role-emotional	72.6	73.7	0.637
	Mental health	75.6	84.6	0.144

\*, Mann-Whitney test; <sup>1</sup>, Functional Assessment of Cancer Therapy – Gastric; <sup>2</sup>, Medical Outcomes Study 36-Item Short-Form Health Survey. HC, cancer hospital; PWB, physical well-being; SWB, Social/family well-being; EWB, emotional well-being; FWB, functional well-being; GaCS, gastric cancer subscale; TOI, trial outcome index; FACT-G, FACT-general.

functional well-being (FWB) and FACT-G total scores. The mean scores of the SF-36 questionnaires showed similar behavior in some domains but without reaching any significant difference. It is essential to understand here that the exclusion criteria proposed in the study had not yet been applied to homogenize the different groups and mitigate the influence of other variables on the results. Two inferences can be suggested from this analysis: the study of QoL is valuable as an outcome assessment, and perhaps cancer hospitals can confirm their superiority in this field. The present study can add to morbimortality data and classic oncological outcomes, confirming that centers with the expertise and dedication to oncology present better results (9,12-30), which may also be influenced by the surgeon's training and experience. The multidisciplinary nature of oncology and its demands for constant renewal

of knowledge, combined with the exercise of welcoming and the best holistic approach to cancer patients, complete the fundamental characteristics of a reference hospital, not always present in general hospitals (such as those included in this study of high surgical volume) with several destinations (8,12-20), even when specialized and competent teams treat cancer. It is suggested here that institutions dedicated to oncology are more efficient and that classifications based only on the annual volume of surgeries, or any other isolated aspect of care, may not be sufficient to represent the complex relationships that can determine a successful experience for the patient.

When we studied our patients treated in general hospitals compared to those treated in specialized cancer hospitals, with the application of exclusion criteria, we noticed that those operated only by oncologist surgeons and in a

**Table 7** Summary measures of the functional assessment of cancer therapy-gastric and 36-item short-form health survey domains according to surgical oncologists and hospital centers

Questionnaires	Domains	Center (hospital)			P value*
		HGA (n=23)	HGB (n=36)	HC (n=13)	
FACT-Ga <sup>1</sup>	PWB	21.1	22.2	22.8	0.213
	SWB	22.3	20.6	21.5	0.618
	EWB	20.4	19.0	21.7	0.047
	FWB	19.2	18.6	20.8	0.535
	GaCS	55.4	57.4	58.1	0.416
	TOI	95.7	98.2	101.6	0.425
	FACT-G total score	83.0	80.3	86.7	0.422
	FACT-Ga total score	138.4	137.8	144.8	0.575
MOS-SF36 <sup>2</sup>	Physical functioning	74.3	71.4	59.2	0.355
	Role-physical	59.2	65.8	61.5	0.654
	Bodily pain	70.5	80.9	74.4	0.250
	General health	72.5	72.5	70.0	0.967
	Vitality	78.0	72.4	73.1	0.770
	Social functioning	85.9	79.5	72.1	0.333
	Role-emotional	81.5	70.8	74.4	0.654
	Mental health	84.1	71.3	84.2	0.056

\*, Kruskal-Wallis test; <sup>1</sup>, Functional Assessment of Cancer Therapy – Gastric; <sup>2</sup>, Medical Outcomes Study 36-Item Short-Form Health Survey; HGA, general hospital A; HGB, general hospital B; HC, cancer hospital; PWB, physical well-being; SWB, Social/family well-being; EWB, emotional well-being; FWB, functional well-being; GaCS, gastric cancer subscale; TOI, trial outcome index; FACT-G, FACT-general.

**Table 8** Number of lymph nodes resected by surgical oncologists, according to the hospital center

Number of lymph nodes resected	Center				P value
	HGA	HGB	HC	Total	
n	21	34	12	67	0.006 <sup>d</sup>
Average	30.0	21.9	18.2	23.8	
Median	30.0	21.0	19.5	22.0	
Minimum	8.0	7.0	6.0	6.0	
Maximum	55.0	42.0	29.0	55.0	
Standard deviation	13.4	9.8	8.1	11.5	

<sup>d</sup>, Analysis of Variance with a fixed factor; HGA, general hospital A; HGB, general hospital B; HC, cancer hospital.

specialized cancer hospital showed higher average trends in all scores of the FACT-Ga questionnaire, when compared with patients operated on by oncology specialists inserted in general care public hospitals. Significant differences were recorded in the emotional well-being domain (EWB) scores. The mean scores of the SF-36 questionnaires showed similar behavior in some domains, not reaching significant differences. This can reinforce the relationship between care at a cancer hospital and better QoL scores. This association already appears in the literature with the use of other measurement parameters, and its non-compliance, added to the non-construction of specific professional training in oncology leading the Western countries to worse oncological results compared to eastern centers, even in countries known to be as developed and advanced care with access to cutting-edge resources (10,12). Objective data on morbidity and mortality and oncological outcomes already pointed to this aspect and now, with this study, the evidence-based on QoL, collected by validated and robust statistic tools.

Still, for some authors, hospital volume alone may not be a decisive factor concerning surgical and oncological results of patients if well-trained surgeons perform gastrectomy in an oncological setting (18,41-45). As highlighted, D2 lymphadenectomy is the standard for curative surgeries in advanced gastric cancer. In addition, other aspects of care, such as pathology and its technicians, also play a fundamental role in analyzing this surgical efficiency indicator, lymphadenectomy. The accurate and careful analysis of this quality marker relates to the entire team and not just the surgeon's performance (18), which can also be explained by the complex relationships evidenced in our study. Also along this line, oncologists from the HGA center have higher readings of the number of resected lymph nodes when compared to specialists from the HC and HGB centers; in addition, the survival curves were not different in the three hospitals, reinforcing the idea that complex superimposed relationships of factors can converge and influence the results, but still fitting the argument that centralization may be a necessity, by bringing together the already known "specialist surgeon factor" and other resources (such as advanced perioperative care, dedicated care teams) in the same virtuous environment.

The limitations of our study were its retrospective nature, small sample size and the results reflect data from the Brazilian population specifically. With due observations of the known limitations of cross-sectional design and

retrospective studies such as this one, in addition to the possible criticism of our sample size, we suggest new studies with methods directed to the theme and perhaps with larger samples, once again, the arguments for the centralization of the oncologic care and the specialization of the surgeon gain strength, now also with the importance and peculiarities of the QoL data. This fact, in our view, corroborates the need for investment in training teams focused on cancer care in specialized centers, with the definition of roles and the standardization of procedures and minimal surgical expertise being fundamental conditions for the improvement of care and its results.

Finally, our study demonstrates the positive relationship between QoL assessment scores (SF-36 and FACT-Ga questionnaires) and the centralization of care in specialized cancer hospitals. Such data can and should be used to construct public policies and planning in oncology and maybe serve as inspiration for other future studies. The influence of the cancer care in specialized hospitals on the QoL assessment scores of patients treated with gastric adenocarcinoma in Brazil, corroborates with some morbimortality data observed in the current literature. Studies with greater casuistry and prospective design are desirable in searching for better answers to the topic.

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## Footnote

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*Ethical Statement:* The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. This study was carried out under the principles of the Declaration of Helsinki (1964) and its later versions. The present study protocol was approved by Research Ethics Committees of the Base Hospital of Federal District (No. 36817120.1.3004.8153); Federal University of Amapá (No. 36817120.1.3001.0003); Federal University of São Paulo (No. 36817120.1.3003.5505) and Amaral Carvalho Cancer Hospital (No. 36817120.1.0000.5434). All participating hospitals/institutions were informed and agreed on the study. All patients signed an Informed Consent Form before enrollment.

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## References

1. INCA: Instituto Nacional de Câncer José Alencar Gomes da Silva [Internet]. Rio de Janeiro: INCA; c1996-2022. Estimativa 2023: Incidências do câncer no Brasil; [cited 2023 Feb 22]; [about 1 screen]. Available online: <https://www.inca.gov.br/sites/ufu.sti.inca.local/files//media/document//estimativa-2023.pdf>
2. Pinheiro RN, Mucci S, Zanatto RM, et al. Health-related quality of life after gastric cancer treatment in Brazil: Narrative review and reflections. *World J Clin Cases* 2021;9:4123-32.
3. PDQ® Adult Treatment Editorial Board [Internet]. PDQ Gastric Cancer Treatment. Bethesda, MD: National Cancer Institute [updated 2023 Jan 30; cited 2023 Feb 22]. Available online: <https://www.cancer.gov/types/stomach/hp/stomach-treatment-pdq>
4. Rausei S, Mangano A, Galli F, et al. Quality of life after gastrectomy for cancer evaluated via the EORTC QLQ-C30 and QLQ-STO22 questionnaires: surgical considerations from the analysis of 103 patients. *Int J Surg* 2013;11 Suppl 1:S104-9.
5. Kaptein AA, Morita S, Sakamoto J. Quality of life in gastric cancer. *World J Gastroenterol* 2005;11:3189-96.
6. Pinheiro RN, Mucci S, Zanatto RM, et al. Quality of life as a fundamental outcome after curative intent gastrectomy for adenocarcinoma: lessons learned from patients. *J Gastrointest Oncol* 2019;10:989-98.
7. Alkhaffaf B, Kirkham J. Meeting the ongoing challenges of outcome selection in surgical oncology trials. *Br J Surg* 2022;109:563-5.
8. Sun Z, Zhu GL, Lu C, et al. The impact of N-ratio in minimizing stage migration phenomenon in gastric cancer patients with insufficient number or level of lymph node retrieved: results from a Chinese mono-institutional study in 2159 patients. *Ann Oncol* 2009;20:897-905.
9. Nelen SD, Heuthorst L, Verhoeven RHA, et al. Impact of Centralizing Gastric Cancer Surgery on Treatment, Morbidity, and Mortality. *J Gastrointest Surg* 2017;21:2000-8.
10. Luna A, Rebasa P, Montmany S, et al. Learning curve for d2 lymphadenectomy in gastric cancer. *ISRN Surg* 2013;2013:508719.
11. Kodera Y. Extremity in surgeon volume: Korea may be the place to go if you want to be a decent gastric surgeon. *Gastric Cancer* 2016;19:323-5.
12. Chen T, Yan D, Zheng Z, et al. Evolution in the surgical management of gastric cancer: is extended lymph node dissection back in vogue in the USA? *World J Surg Oncol* 2017;15:135.
13. Dikken JL, Wouters MW, Lemmens VE, et al. Influence of hospital type on outcomes after oesophageal and gastric cancer surgery. *Br J Surg* 2012;99:954-63.
14. Busweiler LAD, Dikken JL, Henneman D, et al. The influence of a composite hospital volume on outcomes for gastric cancer surgery: A Dutch population-based study. *J Surg Oncol* 2017;115:738-45.
15. van Putten M, Nelen SD, Lemmens VEPP, et al. Overall survival before and after centralization of gastric cancer surgery in the Netherlands. *Br J Surg* 2018;105:1807-15.
16. Jensen LS, Nielsen H, Mortensen PB, et al. Enforcing centralization for gastric cancer in Denmark. *Eur J Surg*

- Oncol 2010;36 Suppl 1:S50-4.
17. Dikken JL, van Sandick JW, Allum WH, et al. Differences in outcomes of oesophageal and gastric cancer surgery across Europe. *Br J Surg* 2013;100:83-94.
  18. Claassen YHM, van Sandick JW, Hartgrink HH, et al. Association between hospital volume and quality of gastric cancer surgery in the CRITICS trial. *Br J Surg* 2018;105:728-35.
  19. Coupland VH, Lagergren J, Lüchtenborg M, et al. Hospital volume, proportion resected and mortality from oesophageal and gastric cancer: a population-based study in England, 2004-2008. *Gut* 2013;62:961-6.
  20. Nimptsch U, Haist T, Gockel I, et al. Complex gastric surgery in Germany-is centralization beneficial? Observational study using national hospital discharge data. *Langenbecks Arch Surg* 2019;404:93-101.
  21. Parikh D, Johnson M, Chagla L, et al. D2 gastrectomy: lessons from a prospective audit of the learning curve. *Br J Surg* 1996;83:1595-9.
  22. Kim CY, Nam BH, Cho GS, et al. Learning curve for gastric cancer surgery based on actual survival. *Gastric Cancer* 2016;19:631-8.
  23. Feinstein AR, Sosin DM, Wells CK. The Will Rogers phenomenon. Stage migration and new diagnostic techniques as a source of misleading statistics for survival in cancer. *N Engl J Med* 1985;312:1604-8.
  24. Allgayer H, Heiss MM, Schildberg FW. Prognostic factors in gastric cancer. *Br J Surg* 1997;84:1651-64.
  25. Dikken JL, Dassen AE, Lemmens VE, et al. Effect of hospital volume on postoperative mortality and survival after oesophageal and gastric cancer surgery in the Netherlands between 1989 and 2009. *Eur J Cancer* 2012;48:1004-13.
  26. Sheetz KH, Dimick JB, Nathan H. Centralization of High-Risk Cancer Surgery Within Existing Hospital Systems. *J Clin Oncol* 2019;37:3234-42.
  27. Birkmeyer JD, Siewers AE, Finlayson EV, et al. Hospital volume and surgical mortality in the United States. *N Engl J Med* 2002;346:1128-37.
  28. Birkmeyer JD, Stukel TA, Siewers AE, et al. Surgeon volume and operative mortality in the United States. *N Engl J Med* 2003;349:2117-27.
  29. Stitzenberg KB, Sigurdson ER, Egleston BL, et al. Centralization of cancer surgery: implications for patient access to optimal care. *J Clin Oncol* 2009;27:4671-8.
  30. Le A, Berger D, Lau M, et al. Secular trends in the use, quality, and outcomes of gastrectomy for noncardia gastric cancer in the United States. *Ann Surg Oncol* 2007;14:2519-27.
  31. Ammann AM, Shah SA. Unintended Consequences of Centralization? Increased Care Fragmentation and Subsequent Mortality after Complex Cancer Surgery. *J Am Coll Surg* 2021;232:933-4.
  32. Zheng C, Habermann EB, Shara NM, et al. Fragmentation of Care after Surgical Discharge: Non-Index Readmission after Major Cancer Surgery. *J Am Coll Surg* 2016;222:780-789.e2.
  33. Brauer DG, Wu N, Keller MR, et al. Care Fragmentation and Mortality in Readmission after Surgery for Hepatopancreatobiliary and Gastric Cancer: A Patient-Level and Hospital-Level Analysis of the Healthcare Cost and Utilization Project Administrative Database. *J Am Coll Surg* 2021;232:921-932.e12.
  34. Burnett AS, Mouhanna J, Ramirez-Garcialuna J, et al. Enrollment of esophago-gastric cancer patients in a clinical fast-track program and its affect on time to treatment and quality of life. *J Clin Oncol* 2018;36:180.
  35. Raymond MA, Lustig C. The gastric cancer survivorship experience: A global perspective. *J Clin Oncol* 2019;37:24.
  36. Ngoc Thi Dang D, Ngoc Thi Nguyen L, Thi Dang N, et al. Quality of Life in Vietnamese Gastric Cancer Patients. *Biomed Res Int* 2019;2019:7167065.
  37. Abdullah NN, Idris IB, Shamsuddin K, et al. Health-Related Quality of Life (HRQOL) of Gastrointestinal Cancer Caregivers: The Impact of Caregiving. *Asian Pac J Cancer Prev* 2019;20:1191-7.
  38. Neal RD, Tharmanathan P, France B, et al. Is increased time to diagnosis and treatment in symptomatic cancer associated with poorer outcomes? Systematic review. *Br J Cancer* 2015;112 Suppl 1:S92-107.
  39. Calderón C, Jiménez-Fonseca P, Hernández R, et al. Quality of life, coping, and psychological and physical symptoms after surgery for non-metastatic digestive tract cancer. *Surg Oncol* 2019;31:26-32.
  40. Effects of hospital facilities on patient outcomes after cancer surgery: an international, prospective, observational study. *Lancet Glob Health* 2022;10:e1003-11.
  41. Weitz J, Koch M, Friess H, et al. Impact of volume and specialization for cancer surgery. *Dig Surg* 2004;21:253-61.
  42. Enzinger PC, Benedetti JK, Meyerhardt JA, et al. Impact of hospital volume on recurrence and survival after surgery for gastric cancer. *Ann Surg* 2007;245:426-34.
  43. Kim EY, Song KY, Lee J. Does Hospital Volume Really Affect the Surgical and Oncological Outcomes of Gastric Cancer in Korea? *J Gastric Cancer* 2017;17:246-54.
  44. Agnes A, Biondi A, Laurino A, et al. Global updates in the

treatment of gastric cancer: a systematic review. Part 1: staging, classification and surgical treatment. *Updates Surg* 2020;72:341-53.

45. D'Ugo D, Agnes A, Grieco M, et al. Global updates in

the treatment of gastric cancer: a systematic review. Part 2: perioperative management, multimodal therapies, new technologies, standardization of the surgical treatment, and educational aspects. *Updates Surg* 2020;72:355-78.

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