Effects of surgeon volume and hospital volume on clinical outcomes of breast cancer patients

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SUMMARY

Cancer presents significant hurdle in the goal to increase the life expectancy of the world population. In 2020 breast cancer has become the leading cause of global cancer in the female population, ahead of lung cancer. Over the past half century, approach to the treatment of breast cancer has changed dramatically that led to improvement of survival rates and quality of life of patients. In particular, the changes affected the surgical treatment of breast cancer. The modern tactics of treating breast cancer patients has become more complex and requires a multidisciplinary approach led by an oncological surgeon. It requires the availability of specialized material and equipment in medical institutions and practical skills of surgeons that provide medical care to breast cancer patients. However, breast cancer patients may not receive the entire range of modern treatment options, due to limited capabilities of medical institution and/or surgeon that leads to deterioration in duration and quality of life of patients.

The quality of medical care for breast cancer patients is directly proportional to the number of cases performed annually at a medical institution (hospital volume) or by a surgeon (surgeon volume). The results of this study can serve as a basis for further investigations of the relationship between the surgeon and hospital volume and other factors affecting the quality and diversity of medical care for breast cancer patients.

KEY WORDS: *surgeon volume, hospital volume, breast cancer, cancer care, cancer treatment, breast cancer-specific mortality, survival*

INTRODUCTION

Oncological diseases present a significant hurdle in the goal to increase the life expectancy of the world population. According to the estimates of the World Health Organization (WHO) in 2019 malignant tumors became the leading (1st and 2nd) cause of death under the age of 70 in 112 out of 183 evaluated countries. The burden of cancer morbidity and mortality is growing rapidly worldwide, due to population growth and aging as well as socio-economic changes in the prevalence and distribution of major cancer risk factors (1). In 2020 breast cancer took the leading position in the global cancer incidence in the female population, ahead of lung cancer. Large number (2.246.419 new cases) of breast cancer were registered in the world in 2020, which accounts for 11.7% of all registered cases of malignant tumors. In 2020 mortality caused by breast cancer reached 6.9% (684.996 cases) that ranks it as fifth among cancer deaths worldwide. In female population, breast cancer accounts for 1 out of 4 cancer cases and 1 out of 6 deaths from cancer, ranking it as first in morbidity in 159 out of 185 countries and in mortality in 110 out of 185 countries (1). Over the past decades, approach to breast cancer treatment has been changing dynamically, but with surgical intervention remaining the leading one. The purpose of surgical treatment is to achieve control of the disease, prevent loco-regional recurrence and increase the survival rate of patients even in patients with primary metastatic breast cancer (2). A modern treatment strategy for breast cancer patients is becoming highly complex, requiring a multidisciplinary approach. The genetic heterogeneity of the molecular types of breast cancer determines the approach to systemic treatment. Results of a large number of clinical trials make it possible to adjust treatments in routine clinical practice. In addition, patient's desire to preserve femininity (organ-conserving surgery, one-stage reconstructions, etc.) and activity (biopsy of sentinel lymph nodes, axillary reverse mapping, etc.) initiates significant adjustments to the plan of surgical treatment and radiation therapy (3). The involvement of a multidisciplinary team led by an experienced surgical oncologist who performed at least 50 breast cancer surgeries led to a 5-year decrease in mortality from breast cancer and from all causes by 18% and 11%, respectively. Therefore, most providers of cancer care are focused on a multidisciplinary approach to treatment that provides highly specialized care for breast cancer patients (4).

METHODS

The purpose of this literature review was to analyze existing studies that investigated the relationship between hospital and surgeon volume with treatment outcomes and survival of breast cancer patients. Thirty meta-analyses, prospective and retrospective studies reporting cancer outcomes influenced by surgeon or hospital volumes were evaluated. A total of 10 studies were selected for the use in this review, randomized trials being the preferred choice. Results were presented as effect of surgeon volume and effect of hospital volume on clinical outcomes.

EFFECT OF SURGEON VOLUME ON CLINICAL OUTCOMES

Skinner K. et al. (2003) investigated the impact of oncology specialist and type of hospital on survival after breast cancer treatment. The study included 29.666 breast cancer patients in the period from 1990 to 1998, information about which was obtained from the Cancer Surveillance Program database for Los Angeles County. Multivariate analysis showed that patients treated by oncology surgeons had a 33% lower risk of death 5 years after surgery than patients treated by non-surgical oncologists (OR = 0.77; CI = 0.67-0.88). Also, a tendency was revealed for the more frequent use of organ-conserving operations by surgical oncologists that work in multidisciplinary medical institutions (5) (Table 1).

Nattinger A. *et al.* (2007) examined the potential bias in the relationship between surgeon volume and mortality from breast cancer or other causes. For this study data were taken from the National Cancer

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Institute's population-based Surveillance, Epidemiology, and End Results (SEER) registry and included 12.216 women, aged 66 years and older that were diagnosed with stage I or II invasive breast cancer between January 1st 1994 and December 31st 1996. The surgical volume was considered small if less than 5 breast cancer operations were performed *per* year and medium or large if 5-10 or more than 10 were performed, respectively. The median follow-up was 50 months. Among 12.216 breast cancer patients, 2.753 deaths were found (22.5% or 54.4 cases *per* 1000 person-years), of which 760 cases were from breast cancer (6.2% or 15.6 cases *per* 1000 person-years) and 1.894 cases were from other causes (15.5% or 38.8 cases *per* 1000 person-years). Cause of death of 99 patients (0.8%) was unknown. As a result, it was found that the mortality rate from breast cancer among patients operated by oncological surgeons with small and large volume scores was 17.4 *versus* 13.0 cases *per* 1000 person-years, respectively. Mortality rate from other causes was 46.0 versus 31.7 deaths *per* 1000 person-years for surgeons with small and large volume scores, respectively. After adjusting the mortality rates for demographic and prognostic factors, comorbidity and hospital volume, it was found that the surgeon's volume affected the risk of death from breast cancer. Namely, in patients that received treatment from surgeons with large surgical volume score, the risk of death from breast cancer was 14% lower compared to patients that received treatment from surgeons with small volume score. A feature of this study was that among all patients differences in both clinical parameters and socio-demographic parameters were clearly defined. This, in turn, suggested that the level of the surgeon's workload and the above factors are interconnected by characteristics (6) (Table 1).

In the study by Gilligan M. *et al.* (2007) relationship between the characteristics of the surgeon and the results of treatment of early stages of breast cancer in a population-based, geographically diverse sample of older women was investigated. Patient data was obtained from the SEER database in USA, which is linked to the Medicare claim database (SEER-Medicare). Geographically, the study included data from breast cancer patients from Connecticut, Detroit, Michigan, Iowa, New Mexico, Utah, Atlanta and Georgia. The American Medical Association (AMA) Physicians' Professional Database (PPD) was used to characterize the surgeons, which contained age, gender, demographic, educational, and current data. The analysis of the indicators of the medical work of 1045 surgeons that performed operations on 9449 women aged 65 years and older, with stage I and II breast cancer in the period from 1993 to 1996 was carried out. In this study, an appropriate volume of treatment for early stages of breast cancer, according to the recommendations of the National Institutes of Health (NIH; Bethesda, Maryland, USA) was recognized as breast-conserving surgery (BCS) with axillary lymphadenectomy (ALD) followed by radiation therapy or mastectomy with ALD. The compliance of the treatment to the NIH standards was studied. Namely, implementation of ALD in patients with BCS and mastectomy; and the conduct of adjuvant radiation therapy for patients who underwent BCS. The performance of axillary lymphadenectomy was evaluated separately in connection with the growing tendency to avoid it in elderly patients. A surgeon was defined as "academic" if he worked in a medical school or if he performed most of the breast cancer surgeries in a hospital that was an affiliate of the medical school. The average age of the surgeons included in the study was 50.4 years The majority (64.3%) were under the age of 55, and 12.2% of the surgeons were over 65 years of age. More than 80% of surgeons were Board Certified in general surgery or surgical subspecialty, almost 30% held an academic title, and 13% of surgeons were Board Certified in general surgery only. As a result of the study, it was found that patients that were treated by surgeons that had no secondary specialization (onco-surgical) were less likely to undergo surgical treatment in accordance with the recommendations, especially it they had indications for BCS. High-volume surgeons (with > 25 operations) were more likely to perform the type of surgical treatment as recommended by the NIH. They performed ALD in patients with BCS and mastectomy more often, and their patients were more likely to receive further radiation therapy after BCS. The odds ratio (OR) of 1.12 for the relationship between surgeon volume and treatment compliance with standards corresponds to a 12% increase in the likelihood of providing required medical care volume according to NIH guidelines for each doubling of the surgeon's volume (Table 1) (7).

In a study by Chang C. *et al.* (2012) hypothesis that cancer patients treated by low volume surgeons in low volume hospitals have lower survival rates compared to patients treated by high volume surgeons in high volume hospitals was evaluated. The study analyzed data from patients with breast cancer, colorectal cancer, lung cancer, prostate and head and neck cancer that underwent surgical treatment in 2002. Data from 2002 to 2006 was obtained from the National Health Insurance (NHI) Research Database, which covers claims for medical benefits for 23 million Taiwan residents (97% of the island's population). Among the selected 11.677 patients that were included in the study, 3.957 were treated for breast cancer. A distinctive feature of this study from the previous ones was that combined effect of the volume of a medical institution and the surgeon's workload on survival outcomes was assessed. The basic socio-demographic data of the patients, depending on which the adjustments were made, included age, gender, geographic location, method of treatment, stage of disease and socio-economic status. Patients who were treated in low volume hospitals were more likely to be older, living in suburban or rural areas, and had comparatively lower socio-economic status. As a result of this study, it was found that patients that were treated by low volume surgeons in low volume hospitals had a lower 5-year survival rate of 81.1% *versus* 87.5% in patients who underwent surgical treatment by high volume surgeons in high volume hospitals HR = 1.65 (95%; CI = 1.32-2.06; p <0.001) (8) (Table 1).

In a population-based prospective study Pezzin L. *et al.* (2015) studied the relationship between surgeon and hospital volumes and mortality in breast cancer patients from any cause. The study included 2.408 women over 65 years old, with breast cancer from four US states (Florida, Illinois, New York and California) that were treated under the Medicare program from April to September 2003. The volume of the surgeon was determined on the basis of the total number of surgical interventions for breast cancer performed by the surgeon, within 12 months. If fewer than 12 surgeries *per* year were performed, the volume of the surgeon was considered low, if 12-28 surgeries were performed the volume

Study	Study size (total number of patients)	Average age of patients	Surgeon volume			Results
			Low	Medium	High	
Skinner K. *et al.* (5)	29.666	n.r.	< 5**	6-15	>15**	33% lower risk of death after 5 years in patients treated with surgical oncologist
Nattinger A. *et al.* (6)	12.216	75.6	< 5**	5-10**	> 10**	Treatment by high volume surgeons reduces patients' risk of dying from breast cancer by 14%
Gilligan M. *et al.* (7)	9.449	≥65	<4***	NR	>25***	High volume surgeons more often performed surgical treatment according to standards, more often performed axillary lymph node dissection, patients more likely to receive radiation therapy after BCS
Chang C. *et al.* (8)	3.957	59	<15**	-	>15**	5-year survival rate for low volume surgeons in low volume hospitals (81.1%), for high volume surgeons in high volume hospitals (87.5%) low volume surgeons in low volume hospitals (81.1%), for high volume surgeons in high volume hospitals (87.5%)
Pezzin L. *et al.* (9)	2.408	72.9	<12*	12-28*	>28*	Surgeon volume did not affect 5-year mortality affect 5-year mortality

*For 24 months, ** For 12 months, *** within 4 months of the surgeon's diagnosis for a specific patient under SEER-Medicare, OS – overall survival, RFS – recurrence-free survival, BCS – breast-conserving surgery, n.r. – not reported

Table 1. Effects of surgeon volume on breast cancer treatment

was considered moderate, and if 28 or more operations *per* year were performed surgical volume was classified as high. Research results were adjusted for socio-economic and demographic factors, but the relationship between surgeon volume and mortality in breast cancer patients was not found in this study (9) (Table 1).

EFFECT OF HOSPITAL VOLUME ON CLINICAL OUTCOMES

The work of Skinner K. *et al.* (2003) aimed to study the impact of surgeon and hospital specialization on survival after breast cancer treatment. The study included 29.666 breast cancer patients in the period from 1990 to 1998, information about which was in the Cancer Surveillance Program database for Los Angeles County. The study found that treatment in a specialized center did not affect patient survival. But, there was found a tendency towards more frequent use of organ-conserving operations by oncology surgeons working in high multidisciplinary medical institutions (5) (Table 2).

In a study by Simunovich M. *et al.* (2006) studied the effect of hospital volume and Teaching Center status on postoperative mortality and long-term survival in patients with cancer of the colon, breast, lung, esophagus, and liver. Data for the study were obtained from the Ontario Cancer Registry (Ontario, Canada), between 1990 and 2000. For a given period, information was retrieved for 14.346 women, with an average age of 61 years that underwent breast cancer surgery. There were no statistically significant differences in tumor size (T) and lymph node region status (N) in study group. The average postoperative mortality in breast cancer patients was 0.2%, the probability of postoperative mortality among patients that were treated in low volume institutions was OR = 10.0, 95% (CI = 1.1-91.8, p = 0.04). Among studied localizations of malignant neoplasms (cancer of the colon, lungs, liver esophagus), there was a statistically significant relationship between the volume and postoperative mortality in breast cancer, despite the fact that the death rate was rather low. Hospital volume influenced the rates of long-term breast cancer death. Namely, the risk ratio was significantly increased in low volume hospitals compared to high volume hospitals with hazard ratio HR = 1.2 (95%; CI = 1.0-1.4; $p < 0.05$). For all hospitals, there were no statistically significant differences in the risk of postoperative or long-term mortality of patients depending on the status of the Teaching Center. This study suggested that centralized cancer care can significantly reduce mortality rates and improve survival among patients with malignant neoplasms (10) (Table 2).

In a population study, Kuo R. *et al.* (2012) studied the influence of the quality of medical care at the patient level and at the level of the medical institution on the indicators of overall and recurrence-free survival of breast cancer patients. The study included women registered in Taiwan's Cancer Database that were diagnosed with breast cancer in the period from 2003 to 2004. The quality of medical care was assessed according to ten criteria, for each patient. Patients who did not undergo surgical treatment, or there was no data on the operation, or were treated but more than two years after the diagnosis of breast cancer, or who underwent surgery in medical institutions with a volume of less than 30 cases during the observation period were excluded from the study. Thus, the study included data from 6.396 breast cancer patients, whose average age was 51.4 years. As a result of the study, it was found that high comorbidity and low quality of medical services reduce the 5-year overall and recurrence-free survival rates ($p < 0.001$). There was no statistically significant effect of hospital volume on patient survival ($p < 0.181$), which was most likely due to the inclusion in the study of medical institutions in which 177 or more breast cancer surgeries were performed *per* year. The recurrence rate detected within 5 years after treatment, in patients that were treated by specialized surgeons was 20.4% compared to 30.2% ($p = 0.056$) among patients who underwent surgery by non-specialized surgeons. The 5-year overall survival rates were 87.9% and 61.9% ($p < 0.001$) among patients treated with specialized and non-specialized surgeons, respectively. It was also found that

Study	Study size (total number of patients)	Average age of patients	Total number of hospitals	Surgeon volume			Results
				Low	Medium	High	
Skinner K. *et al.* (5)	29.666	n.r.	n.r.	<35**	36-125	>125**	Increase in frequency of BCS in high volume hospitals
Simunovic M. *et al.* (10)	14.346	61	152	<102**	103-264**	>265**	Lower postoperative and long-term mortality in high volume hospitals
Kuo R. *et al.* (11)	6.396	51.4	26	<177**	178-337**	>338**	Hospital volume did not affect patient survival
Vrijens F. *et al.* (12)	25.178	60.8	111	<50 (very low volume)	100-149**	>150**	5-year OS: 74,9% (very low volume), 78,8% (low volume), 79,8% (medium volume), 83,9% (high volume) Increased risk of death in very low and low volume hospitals. Use of neoadjuvant treatment: 7.3% (very low volume) vs 19.4%h (high volume)
Pezzin L. *et al.* (9)	2.408	72.9	-	50-99 (low volume)**	40-81*	>81*	Predicted 5-year mortality: 1.1% (high volume hospitals) vs 8.9% (low volume hospitals)
Yen T. *et al.* (13)	573.571	60	1.755	<40*	104-112*	259-274*	High volume hospitals were more likely to perform primary biopsy, to obtain negative surgical margin status and timely locoregional adjuvant treatment
Greenup R. *et al.* (3)	1.064.251	60	>1500	68-71.5 *	148-298*	>298*	5 year OS: 91% (high volume), 90% (medium volume), and 87% (low volume). 10 year OS: 77% (high volume), 75% (medium volume), and 70% (low volume).

*For 24 months, ** For 12 months, *** within 4 months of the surgeon's diagnosis for a specific patient under SEER-Medicare, OS – overall survival, RFS – recurrence-free survival, BCS – breast-conserving surgery, n.r. – not reported, n.a. – not applicable

Table 2. Effects of hospital volume on breast cancer treatment

mortality depended on the level of the surgeon's operational volume (11) (Table 2).

In a retrospective population study, Vrijens F. *et al.* (2012) compared indicators of the quality of oncological care and the survival rate of breast cancer patients, in 111 Belgium hospitals of different volumes of care. Data on 25.178 women (mean age 60.8 years) treated for breast cancer from January 1st 2004 to December 31st 2006 were obtained from three databases (Belgian Cancer Registry database, Belgian population database and Administrative database containing claims data). In terms of volume, medical institutions were divided into four categories: very low volume with <50, low volume with 50-99, medium volume with 100-149 and high volume with more than 150 breast cancer cases treated *per* year. In medical institutions with a very low, low, medium and high volume 20%, 22.1%, 19.9% and 38% of patients were treated, respectively. The completeness of data on the stage of breast cancer varied depending on the hospital volume. In very low volume hospitals patients data lacked for stage (15.1%) and degree of tumor differentiation after surgery (16.4%). while in high volume hospitals these percentages were significantly lower (5.8% and 9.1%, respectively; $p < 0.001$). The overall 5-year survival rate for all patients was 80.2% (74.9%, 78.8%, 79.8% and 83.9% in patients treated in very low, low, medium and high volume hospitals, respectively). After adjusting the composition of breast cancer treatment cases, it was found that patients that were treated in very low and low volume institutions had an increased risk of death compared to patients treated in high volume hospitals *i.e.* HR = 1.26 (95%; CI = 1.12-1.42) for very low volume and HR = 1.15 (95%; CI = 1.01-1.30) for low volume hospitals). It was also found that organ-conserving surgeries in patients with stage I-II breast cancer were performed with a lower frequency in very low volume institutions compared to high volume hospitals (65.2% *versus* 71.1%, respectively). The use of neoadjuvant treatment in women with T2-T3 breast cancer in large volume facilities was 19.4% compared to 7.3% in very low volume facilities. Also, an association was found between the higher number of radiotherapy applications and the volume of the hospital in favor of high volume hospitals (effect 3.2%; 95%; CI = 1.5%, 4.9%) and high rates of further mammography follow-up in similar hospitals were found (effect 1.5%; 95%; CI = 0.6%, 2.5%) (12) (Table 2).

In a population-based prospective study, Pezzin L. *et al.* (2015) studied the relationship between hospital volume and surgeon volume and mortality in breast cancer patients from any cause. The study included 2.408 women over 65 years old with breast cancer from four US states (Florida, Illinois, New York and California) that were treated under the Medicare program from April to September 2003. The volume of the hospital was calculated on the basis of the annual average of the number of surgical procedures for the 24-month period of the patient's operation in 2003. Medical institutions were referred as a low volume, if they performed less than 40 surgical interventions for breast cancer *per* year, as medium volume in case of 40-80 interventions *per* year,

and as a high volume if there were 81 or more operations *per* year. The research results were adjusted for socio-economic and demographic factors. As a result of the analysis, it was found that mortality within 5 years after surgery for breast cancer was lower in patients treated in institutions with a high surgical load. The predicted probability of death 5 years after surgery was 1.1% for patients treated in high volume hospitals compared to 8.9% for low volume hospitals. Also, during the study, it was found that one of the main criteria influencing the choice of a medical institution by patients was geographic proximity (9) (Table 2).

Yen *et al.* (2017) investigated the impact of differences in care for breast cancer patients on overall patient and recurrence-free survival, and determined the extent to which hospital volume influenced differences in treatment. The study included data from 573.571 women with stage I-III breast cancer that received treatment in 1.755 different US hospitals from January 1st 2007 to December 31st 2011. The average age of the patients was 60 years. In 53% of patients breast cancer was diagnosed at stage I, in 35% cases at stage II and 12% at stage III. Medical institutions were ranked by volume as follows: low volume 68-71.5, medium volume 104-112 and high volume > 259-274 surgical interventions in 24 months (10%, 51% and 38% of the total patient cohort were treated in low, medium and high volume hospitals, respectively). It was found that patients treated in high volume hospitals were more likely to have a biopsy before surgery (OR = 1.30, 95%; CI = 1.14-1.49) than patients treated in low hospitals (86% and 72%, respectively), a greater probability of negative surgical margin status (OR = 1.28, 95%; CI = 1.13-1.44) and further specialized timely adjuvant locoregional treatment (OR = 1.16, 95%; CI = 1.09-1.24). Data adjustments were made for race and ethnicity, age, comorbidities, income, insurance availability, geographic location, and level of urbanization. It was found that most often women that lived mainly in the metropolitan area, who received treatment in an academic/research or complex institution, were younger, insured and had a minimum number of comorbidities, was treated in high volume hospitals (13) (Table 2).

Greenup R. *et al.* (2018) studied the relationship between hospital volume and breast cancer mortality. The data source for this study was the American College of Surgeons National Cancer Data Base (NCDB). The study included data on 1.064.251 women aged 18 to 90 years (median 60 years) that were diagnosed with stage 0-III unilateral breast cancer from 2004 to 2012. By volume, hospitals were divided into: low volume (less than 148 cases of breast cancer surgical treatments *per* year), medium volume (148-298) and high volume (more than 298 cases). The volume of surgical intervention, the frequency of receiving radiation-, chemo- and hormone therapy did not differ in hospitals with different volumes. The overall 5-year and 10-year survival rates were 91% and 77% (for high volume hospitals), 90% and 75% (for medium volume hospitals), and 87% and 70% (for low volume hospitals), respectively ($p < 0.001$). Patients treated in high volume hospitals had 11% lower overall mortality compared to patients treated in low volume hospitals (OR = 0.89, 95%; CI = 0.84-0.96). Patients with 0 (OR = 0.79, 95%; CI = 0.70-0.89) and stage I (OR = 0.87, 95%; CI = 0.80-0.94) that were treated in large volume hospitals had additional advantages over patients with stage II and III breast cancer (3) (Table 2).

DISCUSSION

Over the past half century, approach to the treatment of breast cancer has changed dramatically, that has led to an improvement in survival rates and in the quality of life of patients. In particular, the changes affected the surgical treatment of breast cancer. In the 1970s, breast cancer patients underwent only mastectomy with axillary lymph node dissection. Currently, in connection with the de-escalation of treatment, the number of BCS, oncoplastic interventions and reconstructive operations is increasing while sentinel lymph node biopsy (SLNB) is becoming an alternative to ALND. After neoadjuvant therapy and in case of preclinical (occult) forms of breast cancer (the frequency of which is constantly increasing) require special attention from the surgeon in determining the scope of surgical intervention, which is associated with the development of effective methods of therapy for breast cancer and the success of screening programs (14). All this requires the availability of certain material and technical means in medical institutions and certain practical skills of surgeons that provide medical care to patients with breast cancer. However, breast cancer patients may not receive the entire range of modern treatment options, but receive only those treatment procedures that are limited by the capabilities of the medical institution and/or the surgeon. This leads to deterioration in treatment results (duration and/or quality of life of patients). One of the options for solving this problem may be the centralization of medical care, which makes it possible to provide the necessary material and technical base for hospitals and on the other hand the level of practical skills of surgeons, especially in the context of limited funding for the health care system. It is believed that the quality of medical care is directly proportional to the number of cases of care provided by a medical institution (hospital volume) or by a surgeon (surgeon's volume) (15, 16). According to the requirements of the European Society of Breast Cancer Specialists (EUSOMA), the minimum volume in a specialist breast center should be 150 cases of primary and 50 cases of metastatic breast cancer *per* year and the surgeon's volume of at least 50 surgical interventions for primary breast cancer *per* year. These numbers of cases of breast cancer treatment guarantee support for the experience of each member of the multidisciplinary team and ensure the cost-effectiveness of the medical institution (17). The results of 4 out of 5 studies presented in this study indicate the existence of a relationship between the volume of the surgeon and the results of treatment of patients with breast cancer. Only in one study, Pezzin L. *et al.* (2015), higher surgeon volume was not associated with better treatment outcomes, but this study found a 7.8% decrease in predicted 5-year mortality in patients treated in hospitals with > 81 cases of breast cancer surgery for 2 years (9). In most studies, low and medium hospitals volume are less than the recommended minimum volume at a dedicated breast center, which may have influenced results. Thus, Kuo R. *et al.* (2012) did not reveal a relationship between the hospital volume and the survival rate of breast cancer patients, which may be due to the fact that the study included hospitals with a high volume of treatment for cancer patients (more than 500 cases of surgical treatment of cancer patients *per* year), and the low volume of treatment for breast cancer patients was less than 177 cases of treatment per year (11).

CONCLUSION

Most of the studies cited have shown a positive effect of high hospital volume on the outcomes of breast cancer patients. The results of this study can serve as a basis for further investigations of the relationship between surgeon and hospital volume and other factors affecting the quality and diversity of medical care for breast cancer patients.

Declaration of Interests

Authors declare no conflicts of interest.

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