ORIGINAL ARTICLE

Case Numbers and Process Quality in Breast Surgery in Germany

A Retrospective Analysis of Over 150 000 Patients From 2013 to 2014

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SUMMARY

Background: Numerous studies from around the world have shown a positive association between case numbers and the quality of medical care. The evidence to date suggests that conformity to guidelines for the treatment of patients with breast cancer is better in German hospitals that have higher case numbers.

Methods: We used data obtained by an external program for quality assurance in inpatient care (externe stationäre Qualitätssicherung, esQS) for the years 2013 and 2014 to investigate seven process indicators in the area of breast surgery, including histologic confirmation of the diagnosis before definitive treatment, axillary dissection as recommended by the guidelines, and an appropriate temporal interval between diagnosis and operation. Case numbers were categorized with the aid of various threshold values. Moreover, subgroup analyses were carried out for patients under age 65, patients in good general health, patients without lymph-node involvement, and patients with a tumor size pT0 or pT1 or an overall tumor size less than 5 cm.

Results: Data on 153 475 patients from 939 hospitals were analyzed. Six of seven indicators had values that were better overall, to a statistically significant extent, in hospitals with higher case numbers. Although this relationship was not consistently seen, the worst results were generally found in the category with the lowest case numbers. Similar though less striking results were obtained in the subgroup analyses. An exception to the general finding was that, in hospitals with higher case numbers, the interval between diagnosis and operation was more often longer than three weeks.

Conclusion: Guideline adherence is higher in hospitals that treat more cases. The present study does not address the question whether this, in turn, affects morbidity or mortality. To improve process quality in peripheral hospitals, the quality assurance program should be continued.

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Some 70 000 new cases of breast cancer each year make this particular cancer the most common one in women in Germany. A further 6500 patients are affected by ductal carcinoma in situ (DCIS) (1). Stringent application of scientifically based standards in the treatment of breast cancer can overall result in a better individual prognosis in affected women as well as improvements in their quality of life (2).

Following on from a seminal study of the association between the number of surgical procedures and mortality (3), numerous studies have investigated the influence that the number of therapeutic procedures performed or the numbers of patients treated have on the quality of care in hospitals (3–12). Many of these studies dealt with surgical procedures used to treat cancers, such as breast surgery (4, 10–17). Most of these studies (4, 10, 11, 13–17) investigated associations between case numbers and survival rates; their results mostly found a positive association between case numbers and the quality of the results (13–17). Such volume effects may also be assumed for process quality in the surgical treatment of breast cancer (12, 18). The possible reasons that have been named for this include hospitals' greater experience and routines and surgeons who have operated on more patients (3, 13). Furthermore it may be assumed that hospitals with greater case numbers are better placed to provide the necessary multidisciplinary treatment and infrastructure; for this reason, treatment in centers with large case numbers is favored (12, 19–21). In Germany, one of the structural requirements for certified breast cancer centers is a minimum number of more than 100 primary cases per year at first certification (22).

In spite of the trend shown in different studies, the extent of the association and the direction of causality between the frequency of operations and the quality of care are not always straightforward, because the results depend, among other factors, on the procedure under analysis, the outcome measure, and the set threshold, and these may vary considerably (4–6, 23). Furthermore, selection bias may provide an explanation for observed associations with survival rates, as, for example, patients with comparatively high

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risks may increasingly attend smaller hospitals (11). The present study analyzes the association between case numbers and process quality in breast surgery in Germany, using current data.

Methods

We used data from an external program for quality assurance in inpatient care (externe stationäre Qualitätssicherung, esQS) from the service sector breast surgery. Since 2002, it has been compulsory within the context of the esQS for all acute inpatient hospitals in Germany to maintain case related quality documentation for male and female patients with breast cancer and to pass this on to the responsible quality assurance office (24).

We based our analysis on fully inpatient cases having their first surgical procedure for a primary tumor and histology showing “invasive breast cancer” or “ductal carcinoma in situ (DCIS),” with patients admitted in 2013 or 2014 and discharged between 1 January 2013 and 31 January 2015. The total number of cases included came to 153 475 (*Table 1*). In analogy to an earlier study investigating the association between hospital case numbers and mortality, we categorized the resulting case numbers by quintiles (7). The hospitals were ranked by case numbers and classified into five groups with roughly identical case numbers; the size of the groups was determined by the number of cases under consideration, not the number of hospitals (*Table 1*). The second form of categorization was done—taking our direction from the technical requirements for breast cancer centers (14)—on the basis of groups of case numbers defined previously. We defined categories <50 cases, 50–99 cases, 100–149 cases, and ≥ 150 cases per institution and per year (*Table 1*). By using these two forms of categorization, we classified 939 hospitals by case number categories. We calculated the quality indicators for each case number category. In order to test the association between case numbers and the results from the institutions, we used quality indicators relating to process quality. We used the current algorithms for the indicators of the esQS for the year 2014 (25), as long as they could be applied to the 2013 data. Indicator 2, “intraoperative specimen radiography with sonographic wire marking,” was calculated by using the algorithm for the year 2013 (26). We did not present the indicator “intraoperative specimen radiography with sonographic wire marking,” as a change of the algorithm with the 2013 specification could not yet be implemented. Furthermore, we did not report on indicators newly introduced in 2014.

The indicators were calculated for all patients of the hospitals included in the relevant category. The following list shows the indicators included in the analysis with their respective quality objective:

- QI 1: Pretherapeutic histological confirmation of diagnosis: as many patients as possible with pretherapeutic histological confirmation of diagnosis by means of punch biopsy or vacuum

biopsy during their first open surgery for primary invasive breast cancer or DCIS.

- QI 2: Intraoperative specimen radiography with sonographic wire marking: as large a number of interventions as possible with intraoperative specimen radiography after wire marking using sonography.
- QI 3: Primary axillary dissection in DCIS: as small a number of patients as possible with primary axillary dissection in DCIS and completed primary surgical treatment.
- QI 4: Lymph node removal in DCIS and breast conserving treatment: as small a number of patients as possible having axillary lymph nodes dissected in DCIS and breast conserving treatment after completed primary surgical therapy.
- QI 5: Indication for sentinel lymph node biopsy: as large a number of patients as possible having sentinel lymph node biopsy (SLNB) and without axillary dissection after completed primary surgical therapy and in lymph node–negative (pN0) invasive breast cancer.
- QI 6: A time interval of less than 7 days between diagnosis and operation: as small a number of patients as possible with a time interval of less than 7 days between pretherapeutic histological diagnosis and date of surgery at first open procedure for primary invasive breast cancer or DCIS.
- QI 7 Time interval of more than 21 days between diagnosis and operation: as few patients as possible with a time interval of more than 21 days between pretherapeutic histological diagnosis and date of surgery in first open procedure for primary invasive breast cancer or DCIS.

The baseline population considered in each indicator was restricted by two subgroups, and the indicators were newly calculated for the case number categories described in *Table 1*. The first subgroup for indicators 1, 2, and 5–7 refers to patients younger than 65 years with an ASA1 or ASA2, as per the ASA classification to assess preoperative risk, pN0 node status, and tumor size pT0 or pT1, according to the TNM classification. The second subgroup for indicators 3 and 4 includes patients younger than 65 with ASA1 or ASA2 and a total tumor size smaller than 5 cm.

The results of the quality indicators (QI) are shown as means with 95% confidence intervals, according to Wilson (27, 28). Additionally the results of indicators 5 (overall analysis) and 4 (subgroup analysis) per hospital, dependent on the respective case numbers of each hospital, were visualized as scatter plots, using Lowess regression (29, 30).

Results

We present the results of the different forms of categorization of hospitals by case numbers (*Table 2, eTable*). For all indicators except QI 7, “Time interval of more than 21 days between diagnosis and operation,” the overall analysis shows volume effects; in most cases

TABLE 1

Description of study population for the purpose of defining case number categories: patients having their first open surgery on this breast for a primary tumor

Characteristics	Number of patients (%)	Characteristics	Number of patients (%)
Age (in quintiles)		Sex	
<51 years	34 958 (22.78%)	Female	152 364 (99.28%)
51–58 years	28 110 (18.32%)	Male	1111 (0.72%)
59–66 years	31 340 (20.42%)	Type of cancer	
67–75 years	31 948 (20.82%)	DCIS	
>75 years	27 119 (17.67%)	Invasive breast cancer	138 413 (90.19%)
ASA		First open surgery on this breast for a primary tumor	
1	40 229 (26.21%)	n	153 475 (100%)
2	85 609 (55.78%)		
3	26 852 (17.50%)		
4	737 (0.48%)		
5	48 (0.03%)		
Defining case number categories on the basis of quintiles			
Category (quintile)	Number of patients	Number of hospitals	
≤ 105	30 121	650	
106–162	31 347	117	
163–227	31 795	82	
228–326	30 969	58	
≥ 327	29 243	32	
Total	153 475	939	
Defining case number categories on the basis of case number groups defined beforehand			
Category (case number groups)	Number of patients	Number of hospitals	
<50	11 223	525	
50–99	17 052	116	
100–149	24 172	97	
≥ 150	101 028	201	
Total	153 475	939	
Node status (TNM classification) in primary invasive breast cancer or DCIS and completed primary surgical therapy		Tumor size (TNM classification) in primary invasive breast cancer or DCIS and completed primary surgical therapy	
pN0, ypN0	74 667 (60.72%)	pT0, ypT0	3485 (2.83%)
pN1, ypN1	22 839 (18.57%)	pT1, ypT1	60 260 (49.01%)
pN2, ypN2	7 726 (6.28%)	pT2, ypT2	36 852 (29.97%)
pN3, ypN3	5 076 (4.13%)	pT3, ypT3	5968 (4.85%)
pNX, ypNX	12 658 (10.29%)	pT4, ypT4	4854 (3.95%)
Total	122 966 (100.00%)	pTX, ypTX	460 (0.37%)
		pTis, ypTis	11 087 (9.02%)
		Total	122 966 (100.00%)
Overall tumor size in primary DCIS and completed primary surgical therapy			
≤ 0.5 cm	1905 (17.18%)		
>0.5 cm bis 1 cm	1888 (17.03%)		
>1 cm bis 2 cm	2741 (24.72%)		
>2 cm bis 5 cm	2801 (25.26%)		
>5 cm	959 (8.65%)		
No data	793 (7.15%)		
Total	11 087 (100.00 %)		

ASA 1 = normal healthy patient; ASA 2 = patient with mild systemic disease; ASA 3 = patient with severe systemic disease; ASA 4 = patient with severe systemic disease that is a constant threat to life; ASA 5 = moribund patient who is not expected to survive without operation. DCIS = ductal carcinoma in situ

the category of the lowest case numbers shows the worst results (*Table 2*). According to type of categorization—that is, categorizing the mean case numbers by hospital and year by quintiles or the case number groups defined beforehand—the results of the lowest category differs significantly from the results of the other category for four (Q11, Q12, Q15, Q16) and five (Q11, Q12, Q13, Q15, Q16) of the indicators under study. For example, hospitals with larger case numbers more often undertake pretherapeutic histological confirmation of diagnosis by using punch biopsy or vacuum biopsy than hospitals with smaller case numbers (Q1 1).

In the subgroup analysis, the volume effects between hospitals with smaller case numbers and hospitals with larger case numbers are not as clear as in the overall analysis (*eTable*).

For indicators 6 and 7, for the time interval between diagnosis and operation, the results of the overall analysis and those of the subgroup analysis indicate a continuous association: hospitals with smaller case numbers operate comparatively more patients within 7 days and hospitals with larger case numbers operate comparatively more patients later than 21 days after the diagnosis.

The observed volume effects are shown as examples in *Figure 1* for indicator 5, “indication for sentinel lymph node biopsy” and in *Figure 2* for indicator 4, “lymph node removal in DCIS and breast conserving treatment.” The indicator result is visualized as a dot per hospital. Additionally, results from the Lowess regression are shown. The steady rise or fall in the curve shows a positive association between the numbers of cases treated in an institution and the result achieved by that institution.

Discussion

Overall the results indicate a better quality of care in hospitals dealing with larger case numbers. Six of the seven process indicators show more favorable profiles for hospitals with larger case numbers than for hospitals with smaller case numbers. However, these associations are not consistently steady: the worst result is mostly seen in the lowest case number category. This result is confirmed, albeit in a less pronounced way, by the subgroup analyses. Restricting patients by classifying them into two subgroups has yielded a homogeneous, healthier patient population, so that it may be assumed for these analyses that the observed results in smaller hospitals cannot be explained with sicker patients or patients with more advanced breast cancer. Since the indicators in the service sector breast cancer without exception describe processes that should be applied in the same manner at least to all patients in the subgroup, further risk adjustment was not required.

Lacking structural requirements—for example, in the provision of a multidisciplinary team or technical equipment—provide a further reason for the identified differences in quality (5, 19, 20, 31). The structured dialogue—a process in which the causes of indicator results that have thrown up mathematical abnormalities

are analyzed in a dialogue with the respective hospitals—confirmed that pretherapeutic confirmation of the diagnosis or sentinel lymph node biopsy (SLNB) could not be adequately undertaken in some hospitals with smaller case numbers owing to lacking technical equipment or cooperation (32). Furthermore, there are indications that guideline recommendations and their changes penetrate more slowly to hospitals with smaller case numbers, and, therefore, guideline adherence is poorer in such hospitals than in those with comparatively larger case numbers. Individual authors have confirmed that the reasons of why hospitals with large case numbers offer a higher quality of care—in the shape of longer long-term survival—include better knowledge and awareness of current research results (31). Furthermore, there are indications that better adherence to guidelines is associated with improved recurrence-free survival and total survival in breast cancer (33, 34).

Regarding the observed volume effects, indicator 7, “Time interval of more than 21 days between diagnosis and operation,” constitutes an exception. In hospitals with larger case numbers, this indicator shows longer waiting times before surgery. This is important, less in terms of the prognosis, but in terms of the possible psychological burden on the patients. Selection effects are a possible reason for longer waiting times. Patients in the mammography screening program are mostly referred to certified breast centers for treatment. Because of the structural divide between outpatient screening diagnostics by radiologists in private practice and the service provided under inpatient conditions in hospital, such patients are probably admitted to hospital with a notable delay after histological confirmation of the diagnosis. On the other hand, the significantly reduced time interval between diagnosis and operation (Q1 6) in hospitals with smaller case numbers supports the assumption that the time taken up by the preoperative diagnostic evaluation or explanations of alternative treatment options is much shorter because of the lacking structures or because of a more limited range of treatments, and patients therefore undergo surgery earlier than in other centers. A shorter waiting time before surgery also limits opportunities for seeking out a second opinion.

Longer intervals between histological confirmation of the diagnosis and the start of treatment may also be seen as an indication that, on the one hand, larger centers’ treatment capacities are exhausted. On the other hand, they may mean that in Germany, the formation of breast centers with a view to their possible treatment capacity has not reached completion.

Regarding the two indicators relating to the time interval between diagnosis and operation (Q1 6 and Q1 7), the question remains unanswered whether these represent a straightforward quality deficit, since the optimal time interval between diagnosis and surgery is currently not defined in the S3 guideline (2).

Our study is subject to several limitations. The studied association between case numbers and health

TABLE 2

Means of the quality indicators by the different categories, differentiated by case number categories

Category (quintile)	Number of patients	Mean (95% CI)	Category (case number groups)	Number of patients	Mean (95% CI)
QI 1 Pretherapeutic histological confirmation of diagnosis					
≤ 105	28 985	93.7 (93.4–93.9)	<50	10 740	90.8 (90.3–91.4)
106–162	30 185	96.7 (96.4–96.8)	50–99	16 457	95.3 (95.0–95.6)
163–227	30 957	97.0 (96.8–97.2)	100–149	23 318	96.6 (96.3–96.8)
228–326	30 069	96.8 (96.6–97.0)	≥ 150	98 347	96.8 (96.7–97.0)
≥ 327	28 666	96.8 (96.5–97.0)			
QI 2 Intraoperative specimen radiography with sonographic wire marking					
≤ 105	6450	94.4 (93.8–95.0)	<50	1877	89.0 (87.5–90.3)
106–162	8015	98.0 (97.7–98.3)	50–99	4298	97.0 (96.4–97.4)
163–227	9158	96.5 (96.1–96.9)	100–149	5924	97.8 (97.4–98.2)
228–326	9411	98.6 (98.4–98.9)	≥ 150	31 977	97.3 (97.1–97.4)
≥ 327	11 042	96.6 (96.2–96.9)			
QI 3 Primary axillary dissection in DCIS					
≤ 105	1976	1.0 (0.7–1.6)	<50	564	2.5 (1.5–4.1)
106–162	2808	0.4 (0.2–0.7)	50–99	1265	0.4 (0.2–0.9)
163–227	3125	0.3 (0.2–0.5)	100–149	2146	0.5 (0.3–0.9)
228–326	3192	0.4 (0.2–0.7)	≥ 150	10 118	0.3 (0.2–0.5)
≥ 327	2992	0.3 (0.2–0.6)			
QI 4 Lymph node biopsy in DCIS and breast conserving treatment					
≤ 105	1478	17.2 (15.3–19.2)	<50	397	18.1 (14.7–22.2)
106–162	2178	16.5 (15.0–18.1)	50–99	985	16.4 (14.3–18.9)
163–227	2407	13.8 (12.5–15.3)	100–149	1649	17.0 (15.3–18.9)
228–326	2367	16.0 (14.5–17.5)	≥ 150	7578	14.3 (13.5–15.1)
≥ 327	2179	12.5 (11.2–13.9)			
QI 5 Indication for sentinel lymph node biopsy					
≤ 105	14 149	90.3 (89.8–90.8)	<50	5057	85.0 (83.9–85.9)
106–162	14 954	94.7 (94.4–95.1)	50–99	8174	93.3 (92.8–93.9)
163–227	15 110	95.7 (95.4–96.0)	100–149	11 646	94.3 (93.9–94.8)
228–326	14 462	95.4 (95.1–95.8)	≥ 150	47 586	95.2 (95.0–95.4)
≥ 327	13 788	94.5 (94.1–94.9)			
QI 6 Time interval of less than 7 days between diagnosis and operation					
≤ 105	24 072	15.6 (15.1–16.0)	<50	8785	21.0 (20.2–21.9)
106–162	25 544	10.9 (10.5–11.3)	50–99	13 817	12.7 (12.2–13.3)
163–227	26 062	8.4 (8.0–8.7)	100–149	19 734	11.9 (11.4–12.3)
228–326	24 784	8.0 (7.7–8.4)	≥ 150	81 002	7.3 (7.2–7.5)
≥ 327	22 876	5.2 (4.9–5.5)			
QI 7 Time interval of more than 21 days between diagnosis and operation					
≤ 105	24 072	22.0 (21.5–22.6)	<50	8785	18.1 (17.3–18.9)
106–162	25 544	25.8 (25.3–26.3)	50–99	13 817	24.0 (23.3–24.7)
163–227	26 062	29.4 (28.8–29.9)	100–149	19 734	25.3 (24.7–25.9)
228–326	24 784	30.2 (29.6–30.8)	≥ 150	81 002	31.7 (31.4–32.0)
≥ 327	22 876	37.4 (36.8–38.0)			

Explanations: The quality indicators refer to baseline totals defined by indicator definitions. For this reason the population included in the calculations is not identical to the population used to categorize case numbers (cf Table 1). Indicators 3 and 4 have larger case numbers than the case number shown in Table 1 for DCIS, as not only patients having their first operation are included in calculating the indicators.

DCIS = ductal carcinoma in situ; CI = confidence interval; QI = quality indicator

QI 5 “Indication for sentinel lymph node biopsy (SLNB)”

The quality indicator 5 was calculated on the basis of the patient population without restrictions. The result for the indicator is shown as a scatter plot. Each hospital is visualized as a blue dot. The red curve represents a non-parametric regression, which can show up non-linear associations and is based on locally weighted smoothing algorithms (Lowess regression; [30]). The x axis shows the number of inpatient cases and the y axis the indicator result. DCIS, ductal carcinoma in situ

FIGURE 1

care quality in breast cancer surgery relates to process indicators. The study of longer-term result parameters would be of additional interest—for example, mortality and morbidity after breast surgery (19)—or shorter-term result parameters—for example, secondary resection rates. The structure of the present data does not allow for such an approach, however, because follow-up data are currently not being collected. Furthermore, it may take years for local recurrences or metastases to manifest in patients with breast cancer (19), or mortality data are available for a population that is otherwise mostly healthy (12, 14). For these reasons we focused on process indicators that test guideline recommendations for the diagnostic evaluation and primary therapy.

In contrast to some other studies with a similar research question (12, 18), the rate of breast conserving treatments was not included as a quality indicator in the analysis. In our view, further parameters would need to be included in the consideration in order to assess the indication for breast conserving treatment, which are not part of the present data. For this reason, the indicator for breast conserving surgery has not been included in the esQS since 2013 (26).

Investigating the association between volume and care quality is subject to various problems. In principle, we can only point at an association between case numbers and care quality; we cannot prove a direct causal association (12). The results of our study confirm the discussion in the international literature, according to which the extent of the association and the direction of causality between

rates of surgical procedures and treatment outcome are not always clear. Results may, for example, depend on the procedure under analysis and the selected threshold, and may vary strongly (4–6, 23). In our view, the empirical deduction of the threshold is not convincingly possible on the basis of the available data; for this reason, we did not calculate such a value. Instead, different categorizations of case numbers of breast cancer patients were juxtaposed, in order to, if possible, circumvent the disadvantage of an arbitrary definition of case number categories. We did not differentiate any further, to keep our results comprehensible and clear.

Further evaluations would be of interest, differentiated by certified and non-certified breast centers. Such differentiation cannot be undertaken on the basis of our dataset, as we only had pseudonyms for the hospitals. Furthermore, the results can be allocated only to an institution, not an individual surgeon or team of surgeons.

In sum, volume effects exist in breast surgery in the area of process quality, which vary by the included patient population and threshold value. In particular, hospitals with fewer than 50 cases or 106 patients per year offer a poorer quality of care. At the national level, the quality of care therefore seems to be anything but consistently high. In order to further study and improve guideline adherence, nationwide quality assurance seems to be indicated even outside specialized oncological centers, which would then penetrate to hospitals with smaller case numbers.

FIGURE 2

Q1 4 “Lymph node biopsy in ductal carcinoma in situ (DCIS) and breast conserving therapy”

The indicator was calculated on the basis of subgroup 2, which includes patients younger than 65 years with ASA1 or ASA2 and a total tumor size <5 cm. The result for the indicator is shown as a scatter plot. Each hospital is visualized as a blue dot. The red curve represents a non-parametric regression, which can show up non-linear associations and is based on locally weighted smoothing algorithms (Lowess regression; [30]). The x axis shows the number of inpatient cases and the y axis shows the indicator result.

DCIS, ductal carcinoma in situ

KEY MESSAGES

- International studies have shown volume effects for several surgical procedures.
- For the first time, such volume effects were investigated on the basis of process indicators and inpatient data from Germany.
- Hospitals with larger case numbers show a more favorable process quality profile.
- The results in hospitals with large case numbers indicate better guideline adherence.
- Quality improvements should be aimed for by means of continuous quality assurance.

Conflict of interest statement

The authors declare that no conflict of interest exists.

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Supplementary material
eTable:
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Supplementary material to:

Case Numbers and Process Quality in Breast Surgery in Germany

A Retrospective Analysis of Over 150 000 Patients From 2013 to 2014

by Christina Köster, Günther Heller, Stephanie Wrede, Thomas König, Steffen Handstein, and Joachim Szecsenyi

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eTABLE

Subgroup analysis for quality indicators, differentiated by case number categories*

Category (quintile)	Number of patients	Mean (95% CI)	Category (case number groups)	Number of patients	Mean (95% CI)
QI 1 Pretherapeutic histological confirmation of diagnosis					
≤ 105	4160	97.7 (97.2 to 98.1)	<50	1223	96.7 (95.6 to 97.6)
106 to 162	5294	98.5 (98.1 to 98.8)	50 to 99	2607	98.0 (97.4 to 98.5)
163 to 227	5924	98.4 (98.1 to 98.7)	100 to 149	4115	98.6 (98.2 to 98.9)
228 to 326	5669	98.6 (98.3 to 98.9)	≥ 150	19 043	98.6 (98.4 to 98.8)
≥ 327	5941	98.9 (98.6 to 99.1)			
QI 2 Intraoperative specimen radiography with sonographic wire marking					
≤ 105	949	96.4 (95.0 to 97.4)	<50	234	91.0 (86.7 to 94.1)
106 to 162	1437	98.7 (98.0 to 99.2)	50 to 99	674	98.5 (97.3 to 99.2)
163 to 227	1778	96.6 (95.7 to 97.4)	100 to 149	1046	98.5 (97.5 to 99.1)
228 to 326	1718	99.0 (98.3 to 99.3)	≥ 150	6219	97.9 (97.5 to 98.2)
≥ 327	2291	97.9 (97.3 to 98.5)			
QI 3 Primary axillary dissection in DCIS					
≤ 105	932	0.2 (0.1 to 0.8)	<50	233	0.4 (0.1 to 2.4)
106 to 162	1479	0.3 (0.1 to 0.7)	50 to 99	623	0.2 (0.0 to 0.9)
163 to 227	1727	0.3 (0.2 to 0.8)	100 to 149	1134	0.2 (0.0 to 0.6)
228 to 326	1748	0.1 (0.0 to 0.4)	≥ 150	5531	0.2 (0.1 to 0.4)
≥ 327	1635	0.1 (0.0 to 0.3)			
QI 4 Lymph node biopsy in DCIS and breast conserving treatment					
≤ 105	795	15.5 (13.1 to 18.2)	<50	188	17.0 (12.3 to 23.0)
106 to 162	1270	12.7 (11.0 to 14.6)	50 to 99	546	15.2 (12.4 to 18.5)
163 to 227	1451	12.1 (10.5 to 13.8)	100 to 149	969	12.9 (10.9 to 15.2)
228 to 326	1417	12.1 (10.5 to 13.9)	≥ 150	4541	11.6 (10.7 to 12.5)
≥ 327	1311	10.2 (8.7 to 12.0)			
QI 5 Indication for sentinel lymph node biopsy					
≤ 105	4399	96.2 (95.6 to 96.7)	<50	1310	94.0 (92.6 to 95.2)
106 to 162	5430	97.5 (97.1 to 97.9)	50 to 99	2767	97.2 (96.5 to 97.7)
163 to 227	5977	97.9 (97.5 to 98.2)	100 to 149	4178	97.4 (96.9 to 97.9)
228 to 326	5741	97.6 (97.2 to 98.0)	≥ 150	19 051	97.3 (97.1 to 97.5)
≥ 327	5759	96.4 (95.9 to 96.8)			
QI 6 Time interval of less than 7 days between diagnosis and operation					
≤ 105	3543	12.6 (11.6 to 13.8)	<50	1036	19.6 (17.3 to 22.1)
106 to 162	4498	9.4 (8.6 to 10.3)	50 to 99	2240	10.0 (8.8 to 11.3)
163 to 227	4935	7.6 (6.9 to 8.4)	100 to 149	3502	10.4 (9.4 to 11.4)
228 to 326	4573	7.0 (6.3 to 7.8)	≥ 150	15 335	6.2 (5.8 to 6.6)
≥ 327	4564	3.8 (3.3 to 4.4)			
QI 7 Time interval of more than 21 days between diagnosis and operation					
≤ 105	3543	20.3 (19.0 to 21.7)	<50	1036	17.0 (14.8 to 19.4)
106 to 162	4498	23.3 (22.1 to 24.6)	50 to 99	2240	21.4 (19.8 to 23.2)
163 to 227	4935	27.2 (26.0 to 28.5)	100 to 149	3502	23.0 (21.6 to 24.4)
228 to 326	4573	28.3 (27.0 to 29.6)	≥ 150	15 335	30.0 (29.3 to 30.7)
≥ 327	4564	36.2 (34.8 to 37.6)			

*Subgroup 1 for indicators 1, 2, and 5 to 7: Patients younger than 65 years, with ASA 1 or ASA 2, node status pN0, ypN0, and tumor size pT0, ypT0, or pT1, ypT1

Subgroup 2 for indicators 3 and 4: Patients younger than 65 with ASA 1 or ASA 2 and tumor size <5 cm.

Explanations: the quality indicators refer to baseline totals that were set by means of the indicator definition. For this reason, the population in the calculations is not identical with the population used to categorize case numbers (cf Table 1). Indicators 3 and 4 have larger case numbers than the case number for DCIS shown in Table 1, as not only patients with first operations were included in calculating the indicators. DCIS = ductal carcinoma in situ; C = confidence interval; QI = quality indicator