Can We Still Afford Innovative Surgical Procedures?

A structure and process analysis of the cost coverage of surgical therapy for patients with breast cancer in Germany with health economic evaluation examples based on super-paramagnetic marking

Können wir uns innovative OP-Verfahren noch leisten?

Eine Struktur- und Prozessanalyse zur Kostendeckung der operativen Therapie der Patientin bzw. des Patienten mit einem Mammakarzinom in Deutschland mit gesundheitsökonomischen Evaluierungsbeispielen anhand superparamagnetischer Markierungen

**Authors**

Michael Patrick Lux1, 2, Michael Untch3, Hans-Christian Kolberg4, Michael Friedrich5, Marc Thill6, Florian Schütz7

**Affiliations**

1 Frauenklinik St. Louise, St. Vincenz-Krankenhaus GmbH,  
Klinik für Gynäkologie und Geburtshilfe, Paderborn, Deutschland  
2 St. Josefs-Krankenhaus, St. Vincenz-Krankenhaus GmbH,  
Klinik für Gynäkologie und Geburtshilfe, Salzkotten, Deutschland  
3 Interdisziplinäres Brustzentrum, Helios Klinikum Berlin Buch, Klinik für Gynäkologie und Geburtshilfe, Berlin, Deutschland  
4 Klinik für Gynäkologie und Geburtshilfe, Marienhospital Bottrop gGmbH, Bottrop, Deutschland  
5 Klinik für Frauenheilkunde und Geburtshilfe, HELIOS Klinikum Krefeld, Krefeld, Deutschland  
6 Klinik für Gynäkologie und Gynäkologische Onkologie, Agaplesion Markus Krankenhaus, Frankfurt am Main, Deutschland  
7 Klinik für Gynäkologie und Geburtshilfe, Diakonissen-Stiftungs-Krankenhaus Speyer, Speyer, Deutschland

**Key words**

Breast cancer, Health economics, Surgical therapy, cost recovery, sentinel node biopsy

**Schlüsselwörter**

Mammakarzinom, Gesundheitsökonomie, Operative Therapie, Kostendeckung, Sentinel-Node-Biopsy

**Bibliography**

Senologie 2023; 20: 141–150  
DOI 10.1055/a-2045-0609  
ISSN 1611-6453  
© 2023. The Author(s).
including primary case numbers, structures, and questions about tumor and sentinel marking and surgical procedures.

**Results** 142 hospitals or breast centers took part in the survey. 93% of the hospitals were certified. The average number of primary cases was 264.6 per year. In over 60% of the hospitals, the surgical procedure and surgery planning were influenced by capacity limitations of cooperation partners. “Targeted axillary dissection” was performed in 83.5% of the hospitals, and radioactive markers were most commonly used for sentinel lymph node marking. Over 60% of participating hospitals were highly satisfied with the marking method used.

**Conclusion** This structure and process analysis now makes it possible to reflect on the costs involved for hospitals of different sizes, in different regions, and with different funding models, and to use this as a basis for the economic evaluation of new surgical procedures within an overall context. In general, it is possible to make savings through innovative procedures in the surgical treatment of breast cancer.

**ZUSAMMENFASSUNG**

**Einleitung** Aktuell stehen Kliniken vor großen finanziellen Herausforderungen. Aufgrund seiner hohen Inzidenz ist das Mammakarzinom mit seinem komplexen Leistungsspektrum im Hinblick auf die operative Versorgung besonders relevant bei der Frage nach der Kostendeckung bewahrter und innovativer Verfahren durch die Leistungserbringer. Das Ziel dieser Studie ist es, die aktuelle Situation von Kliniken in Deutschland im Hinblick auf ihre unterschiedlichen Strukturen und Prozesse bei der brusterhaltenden Therapie aus einem gesundheitsökonomischen Blickwinkel zu beleuchten.

**Material und Methoden** Es wurde ein Online-Fragebogen mit 46 Fragen entwickelt und Kliniken mit Mitgliedschaft bei der Kommission Mamma der AGO e. V., der AWOgyn e. V. und der AG Zertifizierter Brustzentren bereitgestellt. Die Fragen decken verschiedene Parameter für die gesundheitsökonomische Evaluation ab, darunter die Primärfallzahlen, Strukturen sowie Fragen zu Tumor- und Sentinelmarkierung und Operationsabläufe.

**Ergebnisse** 142 Kliniken bzw. Brustzentren nahmen an der Befragung teil. 93% der Häuser waren zertifiziert. Die Primärfallzahl lag im Durchschnitt bei 264,6 pro Jahr. In über 60% der Kliniken beeinflussten Kapazitätsgrenzen der Kooperationspartner den Operationsablauf und die Operationsplanung. Die „tageted axillary dissection“ wurde in 83,5% der Kliniken durchgeführt und die Markierung von Sentinellymphknoten erfolgte am häufigsten radioaktiv. Die Zufriedenheit über die angewendeten Markierungsverfahren war bei über 60% der Teilnehmenden hoch.

**Schlussfolgerung** Diese Struktur- und Prozessanalyse ermöglicht es nun, die Kostenseite für Kliniken unterschiedlicher Größe, Trägerform oder Region zu reflektieren und auf Basis dessen neue operative Verfahren im Gesamtkontext ökonomisch zu bewerten. Dabei sind auch Einsparungen durch innovative Verfahren im Rahmen der operativen Versorgung des Mammakarzinoms generell möglich.

---

**Introduction**

A structure and process analysis of the cost coverage for surgical treatment of breast cancer patients in Germany, with examples of analysis from the field of healthcare economics based on the use of superparamagnetic marking.

In Europe, 2.45 million people develop cancer every year. As the most common cancer affecting women, breast cancer represents a social and economic burden that should not be neglected. Out of a total of €126 billion spent every year on oncological diseases in the European Union, €28.4 billion of which is for inpatient care, an average of €13 per inhabitant per year is spent on breast cancer. In countries such as Lithuania and Bulgaria, this figure is as low as €2 per inhabitant per year. In comparison, at €29 per inhabitant per year, spending in Germany is significantly higher [1]. As service providers, hospitals also face a high financial burden in the context of the healthcare economy [2]. Tariff wage adjustments and increases in value added tax are major factors adding to cost pressures. In addition, hospitals have to meet legal requirements and comply with other regulations, such as flat-rate case costs (G-DRG system) or quality assurance requirements. And that’s not all – unpredictable and hard-to-calculate events such as the current Covid-19 pandemic, rising purchase prices as a result of inflation, and the enormous increase in energy prices also present the service providers with major financial challenges. In view of this tense situation, the question arises as to whether service providers are in fact able to cover the costs of introducing new diagnostic and surgical innovations, especially in the inpatient setting.

The inpatient care of breast cancer patients is a particular case in point, and not only because of the high incidence. Diagnosis, treatment, and follow-up care require an extremely complex, time-consuming range of services involving a high personnel cost. Although providing care in the setting of a certified breast center is particularly important in the healthcare sector, funding continues to be a problem that often remains unresolved [3, 4]. The certified breast centers require additional human and material resources in order to meet the required quality parameters. At the same time, inpatient services are being consolidated, leading to a drop in revenue due to shorter inpatient stays. In the context of medical service examinations, days of inpatient care are increasingly not being recognized, which means that these visits fall below the lower threshold for the length of stay. From the point of view of the payors, aspects such as psycho-oncological care, radioactive marking for sentinel node biopsies, discussions with patients and their relatives, sociomedical advice, and other offered care support services do not justify an inpatient stay. The lack of mapping of complex surgical procedures is another problem given the currently increasing cost pressures in the healthcare sector – the DRG system is mostly lagging years behind in terms of mapping costs. This is a particular problem right now due to inflation and energy prices.
As a result of these circumstances, it may turn out that the care provided in certified breast centers is not adequately remunerated, and that surcharges are necessary in order to cover the costs of the work [5, 6]. This is particularly problematic for surgical therapies. Breast-conserving therapy (BCT) is considered standard in both invasive breast carcinoma and ductal carcinoma in situ (DCIS) [7]. Nevertheless, secondary resections are necessary in over 10% of patients; in DCIS, they occur in almost 30% of cases [8]. In addition to cosmetic and oncological safety aspects, consolidation of cases without an additional increase in revenue requires a better procedure for assessing the resection margin, as well as optimization of sentinel and tumor marking. Accordingly, the use of innovative surgical methods is steadily increasing. Breast centers are faced with numerous new techniques: alternative marking methods such as radionuclide marking, radar reflection, and magnetic markers, as well as alternative markers for lymph node biopsy (SLNB), such as indocyanine green (ICG) or iron oxide [9]. There is also a steady increase in the number of targeted axillary dissections (TAD), for which different clips are available – these are also associated with corresponding costs [10].

With regard to these innovative procedures, the question arises as to whether they can be mapped in the flat-rate-per-case payment system in a way that covers costs, what level of subsidiization is needed in order to implement these innovations, and whether these innovations can lead to cost savings from the point of view of the breast centers, the funding bodies, and society. Currently, however, it is evident that there are no data available for Germany on the structures and processes used by different service providers to perform the different therapies. Therefore, in order evaluate new procedures from a health economics perspective, it is first necessary to take stock of the current situation. Accordingly, the aim of this health economics study was to present the current situation of hospitals and breast centers, and then use this as a basis to compare the different surgical procedures, taking into account the various different marking methods used.

Materials and Methods

Online Questionnaire

In order to collect data from hospitals and breast centers, we developed an online questionnaire which was sent to the service providers via the email distribution lists for members of the AGO Breast Committee and AWOgyn, as well as AG-certified breast centers. The questionnaire consists of 46 questions on different parameters for health economics analysis. These include the regional location of the service provider, case numbers and funding body, questions about tumor marking in BCT, TAD and SLNB, including workflows, patient movements in the context of the surgery, and capacity limits, as well as questions about secondary resection, including rates and case consolidation. The questionnaire consists of both open-ended questions and closed questions with one or with several possible answers.

Statistical Analysis

The analysis was primarily descriptive and was performed using SPSS (28.0.0.0). Percentages and average values (mean and median) are based on the total number of responses per question.

Results

Participating Cohort

From November 11, 2021 to May 15, 2022, 142 hospitals or breast centers from all over the Federal Republic of Germany took part in the survey. The highest response rate was from Bavaria with 25 completed questionnaires (18.25%), and the lowest response rate was from Bremen and the Saarland with just one com-

<table>
<thead>
<tr>
<th>Table 1</th>
<th>General information on service providers, n = 142 participants.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Regional location</strong></td>
<td><strong>n (%)</strong></td>
</tr>
<tr>
<td>Baden-Württemberg</td>
<td>22 (16.06)</td>
</tr>
<tr>
<td>Bavaria</td>
<td>25 (18.25)</td>
</tr>
<tr>
<td>Berlin</td>
<td>7 (5.11)</td>
</tr>
<tr>
<td>Brandenburg</td>
<td>3 (2.19)</td>
</tr>
<tr>
<td>Bremen</td>
<td>1 (0.73)</td>
</tr>
<tr>
<td>Hamburg</td>
<td>7 (5.11)</td>
</tr>
<tr>
<td>Hesse</td>
<td>15 (10.95)</td>
</tr>
<tr>
<td>Mecklenburg-Vorpommern</td>
<td>2 (1.46)</td>
</tr>
<tr>
<td>Lower Saxony</td>
<td>7 (5.11)</td>
</tr>
<tr>
<td>North Rhine-Westphalia</td>
<td>23 (16.79)</td>
</tr>
<tr>
<td>Rhineland-Palatinate</td>
<td>8 (5.84)</td>
</tr>
<tr>
<td>Saarland</td>
<td>1 (0.73)</td>
</tr>
<tr>
<td>Saxony</td>
<td>8 (5.84)</td>
</tr>
<tr>
<td>Saxony-Anhalt</td>
<td>2 (1.46)</td>
</tr>
<tr>
<td>Schleswig-Holstein</td>
<td>3 (2.19)</td>
</tr>
<tr>
<td>Thuringia</td>
<td>3 (2.19)</td>
</tr>
<tr>
<td>Not stated</td>
<td>5 (3.52)</td>
</tr>
<tr>
<td><strong>Funding body</strong></td>
<td><strong>n (%)</strong></td>
</tr>
<tr>
<td>Local government</td>
<td>50 (35.46)</td>
</tr>
<tr>
<td>Church organizations</td>
<td>30 (21.28)</td>
</tr>
<tr>
<td>Private</td>
<td>31 (21.29)</td>
</tr>
<tr>
<td>University</td>
<td>30 (21.28)</td>
</tr>
<tr>
<td>Not stated</td>
<td>1 (0.7)</td>
</tr>
<tr>
<td><strong>Certified</strong></td>
<td><strong>n (%)</strong></td>
</tr>
<tr>
<td>No</td>
<td>4 (2.84)</td>
</tr>
<tr>
<td>Yes, by the DKG</td>
<td>131 (92.91)</td>
</tr>
<tr>
<td>Yes, by ÄKzert</td>
<td>22 (15.60)</td>
</tr>
<tr>
<td>Not stated</td>
<td>1 (0.7)</td>
</tr>
<tr>
<td><strong>Number of primary cases per year</strong></td>
<td><strong>Mean (range)</strong></td>
</tr>
<tr>
<td>Missing data points n = 3 (2.11%)</td>
<td>264.62 (5–1000)</td>
</tr>
</tbody>
</table>
completed questionnaire each (0.73 %). Half of the service providers were funded by local government bodies, and with four exceptions they were all certified by ÄKzert, a certification body of the Westphalia-Lippe Medical Association, and/or the German Cancer Society (DKG). The average number of primary cases was 220 (median) per year (Table 1).

Marking for BCT

Inpatient admission prior to BCT was not uncommon. 125 (17 missing data points) of the hospitals and breast centers surveyed stated that they admitted an average of 38.3 % of their BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. 64 of the respondents were also able to indicate exactly, or give an estimate of, how often the medical service opts to dispense with this day of preoperative admission. This occurred in 40.24 % of cases. The majority of BCT patients the day before the operation. In hospitals and breast centers, sonographic wire marking was performed more often by gynecology departments than by radiology departments. On average, marking was performed by gynecology in 82 % of cases and by radiology in 35 % of cases (36 missing data points).

In over 80 % of the hospitals surveyed, the radiology providers were located on-site in the same hospital, and just as often the radiology department was located in the same building. 75 of the respondents (53.19 %) stated that transport to the radiology provider was not necessary. If required, transport was mostly provided by an internal service (24.11 %). Just one percent of respondents required an external transport service, e.g., from a...
Do capacity limits in radiology have an influence on surgery planning or on the maximum number of operations that can be performed? (Fig. 2a). The majority of hospitals and breast centers surveyed reported that capacity limitations in radiology had an influence on surgery planning and the number of operations that could be performed. In 10.19% of cases, this occurs every day or nearly every day (n = 108). Most hospitals were able to perform a maximum of 3 operations per day. In just over 10% of cases, it was possible to perform a maximum of 2 and 4 operations. The hospitals able to perform a maximum of 1 or 5 operations represented the lowest proportion (n = 65), at well below 5%. Due to capacity limitations, the hospitals surveyed reported that operations could not be performed on some days, mainly on Mondays and Fridays. The least affected day was Wednesday (n = 65). Almost 80% of hospitals and breast centers reported delays in the surgical procedure because patients were still in the radiology department. However, in 57.94% of cases, this occurred very rarely. In contrast, this occurred daily or almost daily in 3.74% of cases (n = 107). Problems affecting the surgical workflow may occur if patients have to spend longer in radiology due to delays. This occurred at times in nearly 80% of the hospitals, although only in rarer cases did it occur often or regularly (Fig. 2d).

Secondary Resection Rate

The average secondary resection rate was 11.53% (n = 100) in the hospitals and breast centers surveyed. In cases where secondary resection was necessary, it was most often (60%) performed during a second inpatient stay less than two weeks after the initial operation. In 38% of cases secondary resection was performed more than 2 weeks after initial surgery, and in 11% of cases it was performed as an outpatient procedure. Secondary resection was only performed during the initial inpatient stay in 10% of cases. On average, secondary resections were consolidated with other procedures in 60.08% of cases (n = 78).

TAD

TAD has already been performed by 83.5% of the service providers surveyed. The most commonly used methods for preoperative or intraoperative localization of target lymph nodes (TLN) were...
clip + wire marking (77 %), clip + sonography (32 %), and clip + magnetic marker (12 %). In most cases only one TLN was marked (90 %); in one percent of cases, three or more TLNs were marked (Table 3, Fig. 3). On average, clinically relevant migration of the TAD marking was observed in 10.92 % of cases, and the marked TLN could not be found in 9.28 % of cases.

SLNB

The hospitals and centers surveyed reported that they most commonly used radioactive marking for SLNB (88 %). In 15 % of cases, radioactive marking was combined with blue dye marking; blue dye marking alone is used in only 1 % of SLNB cases. Magnetic marking with superparamagnetic iron oxide nanoparticles was already used in 14 % of cases (Fig. 4). Furthermore, the service providers surveyed used the 2-day protocol more often than the 1-day protocol to perform radioactive marking of sentinel lymph nodes (SLN) (83 % compared to 31 %).

In the context of SLNB, patients need to be taken to the nuclear medicine department. However, 47 of the respondents (47.96 %) stated that transport to the nuclear medicine department was not required. In cases where it was required, the respondents stated that transport was mostly provided by an internal service (18.37 %). In 16.33 % of cases an external transport service was needed, such as a taxi company. The cost for patient transport was reported by 23 hospitals; at € 16.96 on average, this was slightly higher than the cost for patient transport to radiology departments.

Satisfaction with Marking Procedures

To assess the satisfaction level of the service providers, i.e., the physicians, they were asked to assign scores to the marking methods. The scores followed the grading system used in German schools, in which 1 is the highest mark. The majority of marking methods used for breast lesions, TLN, and SLN were given scores of 1 and 2, although at 40.70 % the score of 2 was most often assigned for TLN markings. The weighted mean scores were 1.73 for breast lesions, 2.30 for TLN, and 1.72 for SLN (Fig. 5).

Physicians' Freedom of Choice

Over 80 % of respondents stated that it was their own decision which marking methods they used, and that they made these decisions based on their convictions and not due to economic reasons (Fig. 6a and Fig. 6b). However, it should be noted that for every 7th to 10th service provider, the physicians were not free to choose the appropriate procedure, and economic factors played a major role. In this context it is all the more important to reflect on how the cost of procedures can be covered depending on the structure and processes in place at the respective hospital or breast center.

Discussion

In order to assess traditional and newer procedures in BCT or for localization in the axilla from a health economics perspective, it was first necessary to survey the current situation among service providers. This study sheds light for the first time on the situation currently facing a representative number of hospitals and breast centers.
centers with different funding bodies and with different primary case numbers throughout Germany. This means it is now possible to analyze the different diagnostic and surgical procedures based on this data, and calculate the costs for hospitals and breast centers. Our publication thus provides a basis which serves as a prerequisite for making observations on the current situation in Germany from a health economics perspective.

The available data show, for example, that in some areas of BCT there is distinct potential for process optimization. For example, patients still have pre-surgery appointments prior to being admit-

![Fig. 5 Satisfaction with the marking methods used (n = 98).](image)

Satisfaction with the marking procedures used at the different hospitals for breast lesions, TLN, and SLN was scored based on the grading system used in German schools (1 = very good, 2 = good, 3 = satisfactory, 4 = adequate, 5 = some deficiencies, 6 = inadequate). The majority of hospitals and breast centers surveyed were satisfied with the procedures used, and gave them scores of 1 and 2. The TLN markings received a comparatively poorer rating, with a score of 3 from 20.93% and 4 from 9.3% of the hospitals.

![Fig. 6 Service providers’ decision-making freedom (n = 98).](image)

a) The vast majority of hospitals and breast centers surveyed stated that it was their own decision which marking method to use. b) The majority of the hospitals and breast centers surveyed also stated that the decisions on which marking method to choose were based on conviction. However, for TLN marking, 15.56% stated that economic considerations determine the choice of method.
Another study reported an identification rate of 95.8% for clipped false-negative rates of 4.2% and 6.8%, respectively [10, 16]. In their initial studies, Caudle et al. and Boughey et al. report (9.28%). False-negative rates in the literature are somewhat lower rate of marked TLNs that could not be detected was also reported of the recommendations of the AGO Breast Committee [13, 14].

Weak. As one of the newer, innovative procedures, this result is in-
at their clinic, even though the data on long-term safety are still
Over 80% of service providers reported that TAD was performed
od in Germany appears to be significantly higher than expected.

The respondents’ data on secondary resections revealed an
average rate of 11.53%; this is comparable to the data from the Institute for Quality Assurance and Transparency in Healthcare (IQTIG) from 2019 and 2020, in which the reported rates were
11.62% and 11.32% respectively [8]. In this context, the aspect of
case consolidation is also of relevance; according to the avail-
able data, consolidation occurs in 60% of cases. This also leads to
additional costs for histopathological diagnostics, the operation
itself, or the inpatient stay, without generating any additional rev-
ue. Accordingly, innovative procedures for optimizing the intra-
operative assessment of the incision margin may actually lead to
cost savings, even if they initially appear to create additional costs. The available data allow future calculations for each individ-
ual hospital based on different case numbers as well as structures and processes.

The results for the use of TAD are surprising. Use of this meth-
od in Germany appears to be significantly higher than expected.
Over 80% of service providers reported that TAD was performed
at their clinic, even though the data on long-term safety are still
weak. As one of the newer, innovative procedures, this result is in-
dicative of rapid adoption in clinical practice and implementation of the recommendations of the AGO Breast Committee [13, 14].

However, in addition to the frequent use of TAD, a relatively high rate of marked TLNs that could not be detected was also reported (9.28%). False-negative rates in the literature are somewhat lower [15]. In their initial studies, Caudle et al. and Boughey et al. reported false-negative rates of 4.2% and 6.8%, respectively [10, 16].

Another study reported an identification rate of 95.8% for clipped lymph nodes [17]. In light of this, there may still be a need to op-
timize this procedure in Germany. For example, a recent study from Austria showed that it had been possible to identify all TLNs marked with Magseed (40/40; 100%) for TAD procedures [18].

Accordingly, the choice of marking method could have a major in-
fluence on surgical success and possible follow-up costs.

The results for SLNB showed that radioactive marking is still by far the most commonly used method (88%; 15% for radioactive marking combined with blue dye marking versus 14% for magnetic marking). Dependence on nuclear medicine departments led to limitations (e.g., limit to the number of daily markings, no marking on certain days of the week, e.g., after weekends and public holidays); this both reduced flexibility and led to higher costs. If marking was performed with superparamagnetic iron oxide nanoparticles instead, this eliminated the costs for patient transport and nuclear medicine. This can be calculated, for example, on the basis of the available data.

Taking into account the average cost of €16.96 for 16.33% of patients requiring external transport, transport costs alone in Germany amount to approximately €135,715 per year. Using the average case number from this survey as well as the average rates of SLNB (all cN0 cases), for an average of 167 SLNBs performed per center at a cost of €476 per SLNB for nuclear medicine plus transport costs, a total of €23,465,779 per year is spent in Germany on radioactive marking at 294 centers. In contrast, magnetic marking requires the purchase of the appropriate measuring device (Sentimag) and the iron oxide particles (Magtrace). Depreciation over 5 years, with 167 SLNBs per center per year, re-
sults in a total of €15,458,128.93, yielding potential savings of
€8,007,650.93 in total, or €27,236.91 per center. In addition, magnetic marking has already been proven several times to be no less effective than radioactive marking, and therefore repre-

tens a good alternative, not only from a health economics point of view [19, 20]. Furthermore, in this context it is also necessary to take into account bottlenecks in the supply of technetium, such as occurred in November/December 2022 [21].

The focus of surgical treatment is on guideline-compliant, mul-
timodal therapy with the active involvement of the informed pa-

tient, not on measures driven by austerity; therefore, diagnostic and surgical services must be mapped in all their complexity, and remunerated accordingly. From the perspective of the funding bodies as well as the society, there is definitely potential for sav-

ings. It is certainly the case that innovative procedures do not al-
ways lead to higher overall costs; in fact, they can even lead to
cost reductions in the overall context. In order to assess this, it is
necessary to perform health economics analyses based on the
current situation; this is now possible based on the data from this study.

One of the limitations of this kind of study is that while it is rep-
resentative of the participating hospitals and breast centers, the results are not very meaningful for those hospitals that did not participate – even if they have similar case numbers or the same funding body. Furthermore, the data collected are based on infor-
mation provided voluntarily by the participants; there was no re-
view of quality reports, control reports, or the like. In addition, there is some ambiguity relating to missing information, as it is
not possible to evaluate whether the respondents genuinely
didn’t know some of the answers, or whether they were unwilling to
answer certain questions. Furthermore, when entering individ-
ual parameters, no mutual limitation was applied, which meant

that the sum of individual values amounted to over 100% – this

… Senologie 2023; 20: 141–150 | © 2023. The Author(s).
could also be explained by the combination of different procedures in individual patients. Because the survey was anonymous, it was not possible to ask questions about this. However, these limitations are balanced by the very high number of participating hospitals and breast centers from all regions of Germany, which provide a representative picture.

Conclusion

This structure and process analysis makes it possible to reflect on the costs for hospitals and breast centers of different sizes and funding models and from different regions, and, with reference to these new procedures, to evaluate the cost of surgical care in the overall context, as shown in the present example. It is generally possible to achieve savings through innovative procedures in the context of the surgical care of breast cancer patients. In this regard, it is not only the primary costs that must be considered. To make an assessment, it is necessary to perform a cost-benefit analysis based on the hospital structure and case numbers.

Acknowledgement

We would like to thank Janine Petters (co.medical, Berlin, Germany) for her assistance in preparing the manuscript. The manuscript was prepared with financial support from Endomagnetics Ltd. We thank the participating clinics and centres for their participation as well as the information on internal structures and processes.

Conflict of Interest

MPL: Honorare für Vorträge und Advisory Board von Pfizer, Novartis, AstraZeneca, MSD, Roche, Novel, Pfizer, Eisai, Exact Sciences, Daiichi-Sankyo, Grünenthal, Gilead, Pierre Fabre, PharmaMar, pfm, Samantree und Endomag; Reisekosten von AstraZeneca, Roche und Pfizer; Editorialboard für medac.

References


