



# What Changes are Mandatory in Breast Surgery Training? An International Survey and Recommendations of the French Academy of Surgery and the Senologic International Society

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## ABSTRACT

**Objective:** Breast cancer management has significantly evolved, particularly in surgical techniques, but breast surgery training remains unstandardized worldwide. This study, promoted by the Senologic International Society (SIS) and the French National Academy of Surgery (FNAS) aimed to evaluate training variability in the world and to provide ten recommendations to improve breast surgery training.

**Materials and Methods:** A 32-question electronic survey was sent between July-August 2023 to the SIS and FNAS network, covering personal experience, training practices, accreditation programs, and fellowship requirements.

**Results:** A total of 121 breast specialists from 42 countries participated, including mainly general surgeons (56%) and gynecologists (23%). Most respondents (66%) had over 15 years of experience, and 75% were male. While 50% reported that breast surgery fellowships were not mandatory, countries with requirements often stipulated a one or two-year experience and a minimum cases number. Multidisciplinary training was often lacking, with only half of countries requiring rotations in radiology, oncology, or pathology. Disparities in training quality and accreditation were evident, particularly in regions without formal breast surgery programs.

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**Conclusion:** High-volume centers and specialized surgeons consistently demonstrated improved outcomes, including lower mortality and recurrence rates for patients treated for breast cancer. Rising breast cancer incidence, combined with advances in surgical and multidisciplinary care, highlights the urgency for standardized training. Evidence shows that structured programs with volume thresholds, multidisciplinary approach, and modern surgical techniques improve patient survival and satisfaction. The survey underscores the need for international guidelines to ensure equitable, high-quality care. SIS and FNAS recommend a standardized breast surgery education framework with ten actionable proposals to address disparities, optimize training, and enhance global care quality.

**Keywords:** Breast surgery training; multidisciplinary approach; standardization

### Key Points

- This study highlights the differences in breast surgery training worldwide and emphasizes the need for standardization in this field.
- Gaps in training, such as the lack of multidisciplinary approaches and specialized programs, create challenges in providing high-quality care.
- Senologic International Society and the French National Academy of Surgery present ten recommendations aimed at standardizing breast surgery education and improving global care quality.

## Introduction

Breast cancer is the leading cancer in women, with 2,296,840 new cases worldwide in 2022, and the first cause of cancer-related death, with around 666,103 deaths annually (1). Breast cancer incidence and mortality constantly rise, with over three million new cases and more than a million deaths expected by 2040. In parallel with these epidemiological changes, the management of breast cancer has considerably changed over the last two decades. The evolutions have been numerous, including pre-operative diagnosis with extending screening, and developments in imaging modalities such as the use of magnetic resonance imaging (MRI), tomosynthesis, and positron emission tomography-MRIs; similarly, surgical modalities have evolved and include oncoplastic surgery, immediate reconstruction, skin-sparing mastectomies (SSM), nipple-sparing mastectomies, sentinel lymph node biopsy, and target axillary dissection. Treatments have also advanced with adjuvant and neo-adjuvant therapies (immunotherapy, CDK4/6 inhibitors) and new radiotherapy regimens (brachytherapy, hypo-fractionated radiotherapy) (Figure 1). Every patient, as the focal point of the healthcare system, should receive the appropriate diagnostic procedures, tailored surgeries, and personalized treatments at each stage of their care. These services should be delivered at the right time, by a skilled team, in the best possible setting. Over recent decades, as breast care has evolved globally, the focus on breast surgery as a specialized field has grown. Is there evidence suggesting that breast cancer treatment in high-volume centers by specialists leads to better survival rates and enhanced quality of care for patients? What would be the ideal education for future breast specialists? In light of these questions, the Senologic International Society (SIS) and the French National Academy of Surgery (FNAS) developed this survey with the goal of creating a global overview of surgical practices and training, as well as formulating tailored and optimal recommendations for a breast surgery educational program.

## Materials and Methods

Members of the SIS and FNAS were invited to participate in an online survey with a Microsoft Forms questionnaire in English. Between July and August 2023, participants were invited to answer the questionnaire via email. The answers were directly recorded into an online database and only one response per participant was allowed. More than one response was authorized for each country.

The online survey consisted of 32 questions divided into four sections. Section 1 (10 questions) was discussing personal experiences and data concerning breast management. In section 2, 8 questions examined the training of breast surgery in different countries. Section 3 (10 questions) was about the accreditation and quality criteria of breast surgery centers. Finally, in section 4 (4 questions), the participants were asked for their recommendations about how to enhance breast surgery training and whether they think that breast surgery should be considered as a specialty. The questionnaire content is available in Tables 1, 2 and 3.

## Results

Four hundred and sixty-six questionnaires (in English) were sent, based on SIS and FNAS mailing lists. A total of 121 breast specialists (26% response rate) completed the survey, composed of 103 surgeons and 18 physicians from non-surgical specialties. Among the respondents, 68 (56%) general and oncologic surgeons, 28 (23%) gynecologists, 3 plastic surgeons, 2 (2%) gastrointestinal surgeons, and 2 (2%) thoracic surgeons responded to the survey. Medical oncologists, radiation oncologists, and breast radiologists constituted 18 non-surgical specialties (Table 1).

The average time taken to complete the questionnaire was 24 minutes and 17 seconds.

Of the respondents, 92 (76%) were male and 29 (24%) were female. Thirty-nine (32%) were over 60 years old, 24 (20%) were between 30–40 years old, 23 (19%) were between 40–50 years old, 23 (19%) were between 50–60 years old, and 10 (7%) were under 30 years old (Table 1). The survey included participants from 42 countries: Algeria, Argentina, Azerbaijan, Benin, Bolivia, Brazil, Cameroon, Canada, Chile, China, Colombia, the Dominican Republic, Ecuador, El Salvador, France, Germany, Greece, Guatemala, Italy, Israël, Japan, Lithuania, Mali, Morocco, Nigeria, Peru, Poland, Portugal, Puerto Rico, Qatar, Russia, Rwanda, Saudi Arabia, Senegal, South Africa, Sudan, Sweden, Tunisia, Türkiye, the United Arab Emirates, Ukraine, and the United States (Figure 2).

Among the respondents, 48 (40%) identified as presidents of national professional societies or organizations. Sixty-six (55%) had been practicing breast surgery for over 15 years, while 28 (23%) had been doing so for 5 to 15 years. Regarding the types of cases treated, breast surgery made up more than 50% of daily practice for 78 (64%)

respondents. Thirty-two percent worked in university hospitals, 20% in private hospitals, 25% in public hospitals, and 18% in regional centers; some professionals worked across multiple sites (Table 1). On average, each surgeon performed 190 breast cancer surgeries annually, with a standard deviation of 88. In terms of fellowship or specific training requirements, responders from 10 countries (USA, Canada, Colombia, Ecuador, Peru, Chile, Russia, Lithuania, Bolivia, and Azerbaijan) reported a requirement for such training. While Brazil does not offer a fellowship program, it has a specialization in mastology, which has been available since 1978 with certification (2).

Among the countries requiring fellowship training, 32% required a minimum number of surgeries during fellowship training, with an

average of 50 surgeries per year. In over 45% of respondents, rotations at non-surgical specialties, such as pathology, breast imaging, nuclear medicine, radiotherapy, and oncology were mandatory (Table 2).

Regarding quality control and accreditation, only 33 respondents (27%) indicated that it was necessary to obtain national accreditation to perform breast surgery with an average of accreditation duration of 4 to 5 years. Concerning international accreditation, 36 respondents (30%) worked in centers accredited internationally (with a minimum threshold of 70 to 150 surgeries by year and 3 surgeons by center) (Table 3).

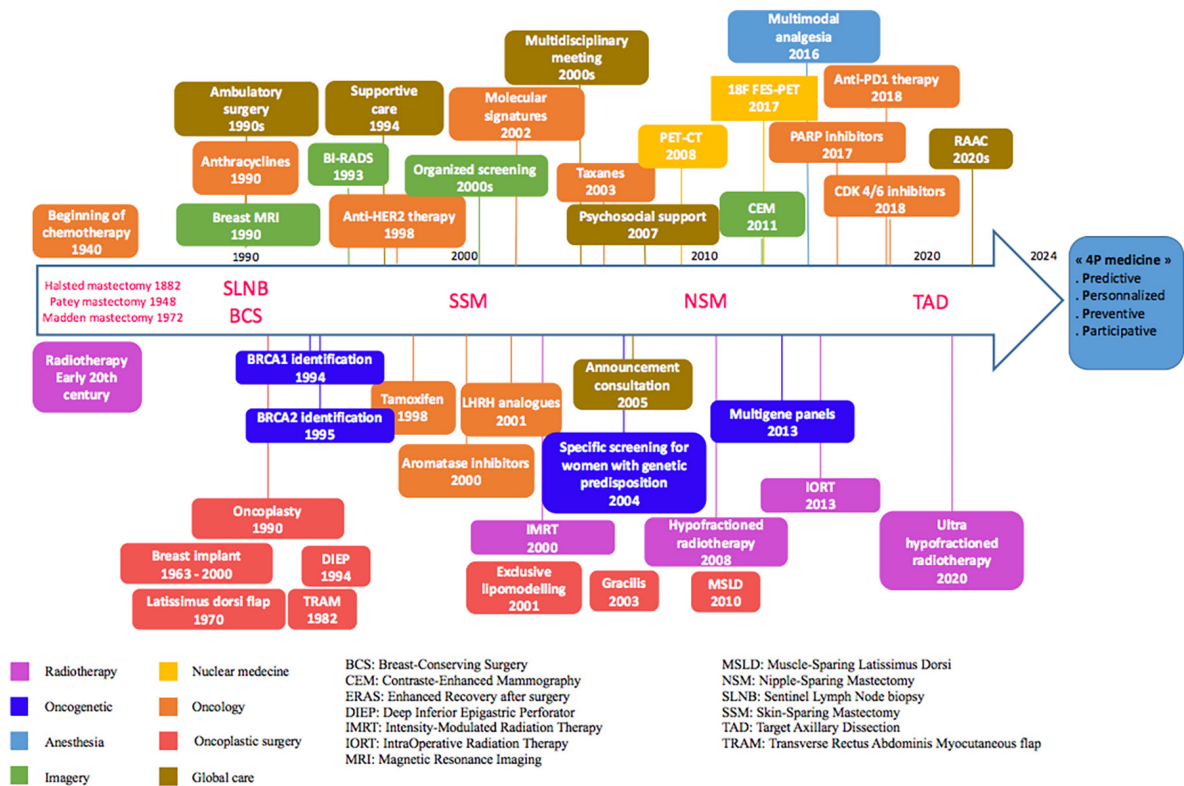


Figure 1. Multidisciplinary developments in breast cancer care

Table 1. Survey, variability in breast surgery training worldwide, first section: Personal surgical practice	
Questions	Propositions (answers, n)
Your name (optional)	(90 answers) <ul style="list-style-type: none"><li>• &lt;30 years (10)</li><li>• 30-40 years (24)</li></ul>
Age group	<ul style="list-style-type: none"><li>• 40-50 years (23)</li><li>• 50-60 years (23)</li><li>• &gt;60 years (39)</li></ul>
Gender	<ul style="list-style-type: none"><li>• Woman (29)</li><li>• Man (92)</li><li>• Non-binary</li><li>• Prefer not to say</li></ul>

**Table 1. Continued**

Questions	Propositions (answers, n)
Country and region (i.e. France, Paris)	<ul style="list-style-type: none"> <li>• (119 answers, 42 countries: Algeria, Argentina, Azerbaijan, Benin, Bolivia, Brazil, Cameroun, Canada, Chile, China, Colombia, Dominican Republic, Ecuador, El Salvador, France, Germany, Greece, Guatemala, Israel, Italy, Japan, Lithuania, Mali, Morocco, Nigeria, Peru, Poland, Portugal, Puerto Rico, Qatar, Russia, Rwanda, Saudi Arabia, Senegal, South Africa, Sudan, Sweden, Tunisia, Türkiye, United Arab Emirates, Ukraine and United States of America)</li> </ul>
Number of years of experience of performing breast cancer surgery as a consultant/fully trained surgeon/attending surgeon?	<ul style="list-style-type: none"> <li>• 0–5 years (21)</li> <li>• 5–10 years (18)</li> <li>• 10–15 years (10)</li> <li>• 15–20 years (15)</li> <li>• &gt;20 years (51)</li> </ul>
During your routine surgical activities, how much do the breast cases represent?	<ul style="list-style-type: none"> <li>• &lt;25% (17)</li> <li>• 25–50% (22)</li> <li>• 50–75% (20)</li> <li>• 75–100% (29)</li> <li>• 100% (29)</li> </ul>
What is your primary specialist discipline?	<ul style="list-style-type: none"> <li>• General surgery (68)</li> <li>• Obstetrics and gynecology (28)</li> <li>• Digestive surgery (2)</li> <li>• Plastic surgery (3)</li> <li>• Thoracic surgery (2)</li> <li>• Other (18)</li> </ul>
How many cases of breast cancer did you (as surgeon) perform annually?	<ul style="list-style-type: none"> <li>• (Average rate of 190±88 surgeries)</li> </ul>
How many cases of breast cancer did your center perform annually?	(111 answers: from 200 to 1200)
Type of hospital where you practice:	<ul style="list-style-type: none"> <li>• Public hospital (30)</li> <li>• University hospital (39)</li> <li>• Regional cancer center (22)</li> <li>• Private hospital (32)</li> <li>• Other</li> </ul>

**Table 2. Survey, variability in breast surgery training worldwide, second section: Training pattern in your country**

Questions	Propositions (answers, n)
How many surgical specialties do you have in your country?	(111 answers)
What are the surgical specialties through which it is possible to perform breast cancer surgery?	<ul style="list-style-type: none"> <li>• General surgery (98)</li> <li>• Obstetrics and gynecology (60)</li> <li>• Digestive surgery (12)</li> <li>• Plastic surgery (54)</li> <li>• Thoracic surgery (11)</li> <li>• Other (19)</li> </ul>
Is breast surgery fellowship (or post graduate training) required to perform breast cancer surgery?	<ul style="list-style-type: none"> <li>• Yes (59)</li> <li>• No (56)</li> </ul>
If yes, what is the duration of breast surgery fellowship (or post graduate training)?	1 to 2 years
What is the minimal number of breast cancer surgeries required annually during your fellowship?	(Average of 50 surgeries per year)

**Table 2. Continued**

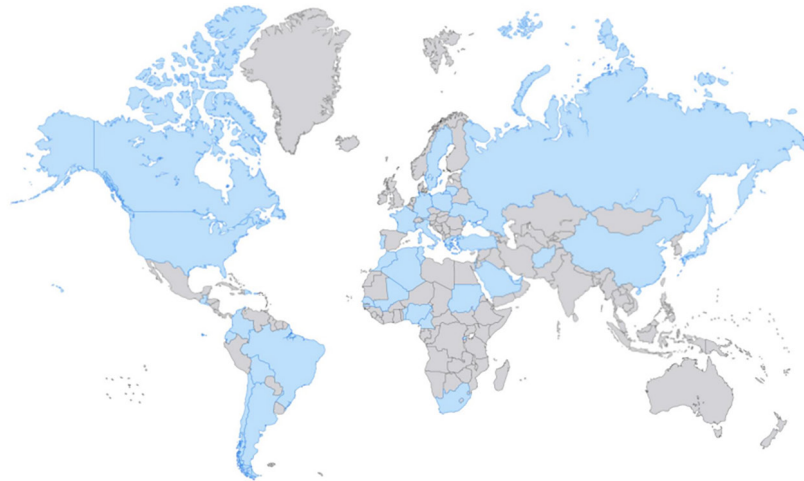
Questions	Propositions (answers, n)
Is there any mandatory rotation during your fellowship?	<ul style="list-style-type: none"> <li>• Yes (55)</li> <li>• No (46)</li> </ul>
What are the mandatory rotations during your fellowship?	<ul style="list-style-type: none"> <li>• Pathology (45)</li> <li>• Radiology (40)</li> <li>• Medical oncology (57)</li> <li>• Radiotherapy (38)</li> <li>• Plastic surgery (48)</li> <li>• Other (1)</li> </ul>

**Table 3. Survey, variability in breast surgery training worldwide, third and fourth section: Accreditation, quality and recommendations for enhancing breast surgery training programs**

Questions	Propositions (answers, n)
Is multidisciplinary team discussion of breast cancer cases mandatory in your center?	<ul style="list-style-type: none"> <li>• Yes (104)</li> <li>• No (7)</li> </ul>
Is it necessary in your country to obtain national accreditation for the breast center before treating patients?	<ul style="list-style-type: none"> <li>• Yes (33)</li> <li>• No (84)</li> </ul>
How long is the validity of your accreditation?	(33 answers: 4 to 5 years)
What type of accreditation do you have in your center?	<ul style="list-style-type: none"> <li>• Local or national (30)</li> <li>• International (13)</li> <li>• Pre-operative core biopsy (120)</li> <li>• Multidisciplinary meetings before treatment (80)</li> <li>• Multidisciplinary meetings after surgery (120)</li> </ul>
What are the domains that should be investigated during the accreditation process?	<ul style="list-style-type: none"> <li>• Nuclear medicine (for sentinel lymph node and positron emission tomography-scanners) (104)</li> <li>• Complete breast imaging possibilities (110)</li> <li>• Genetic testing (90)</li> <li>• Pathology with immunohistochemistry (120)</li> <li>• Other (60)</li> </ul>
Is a minimal number of breast cancer surgeries (per year) required for the center accreditation?	<ul style="list-style-type: none"> <li>• Yes (18)</li> <li>• No (15)</li> </ul>
If yes, how many in your center?	(33 answers: 70 to 150 surgeries by year)
Is a minimal number of breast surgeons required for the center accreditation?	<ul style="list-style-type: none"> <li>• Yes (11)</li> <li>• No (22)</li> </ul>
If yes, how many in your center?	(33 answers: minimum of 3 surgeons by center)
What types of surgery should be practiced for the center accreditation?	<ul style="list-style-type: none"> <li>• Surgery for benign diseases (60)</li> <li>• Surgery for breast cancer (86)</li> <li>• Oncoplastic and reconstructive surgery (52)</li> <li>• Other (6)</li> </ul>
Do you think that breast surgery should be a specialty?	<ul style="list-style-type: none"> <li>• Yes (70)</li> <li>• No (31)</li> <li>• Maybe (16)</li> </ul>

### Table 3. Continued

Questions	Propositions (answers, n)
What are your suggestions for the development of breast surgery training programs?	<ul style="list-style-type: none"> <li>• Training programs must become mandatory for junior surgeons who want to perform breast surgery</li> <li>• The modalities of specialized training in breast surgery must include training in breast imaging, pathology, oncology, radiotherapy, and nuclear medicine</li> <li>• Specialized training in breast surgery should be accessible to different surgical disciplines</li> <li>• The duration of specialized training should be one to two years</li> <li>• Continuing education programs for breast surgeons should be mandatory</li> </ul>
If you are a member of SIS, would you want to participate in this project as co-author?	<ul style="list-style-type: none"> <li>• Yes (74)</li> <li>• No (33)</li> </ul>
If yes, please write your mail	



**Figure 2.** Countries that took part in the survey are indicated in blue

## Discussion and Conclusion

This SIS and FNAS survey has some strengths. First, taking all countries that there were responses from, our survey represents a worldwide population of 3.29 billion people. However, some African countries did not contribute since they do not have official breast academic or scientific societies. Secondly, specialists who answered our survey had significant experience, being in charge of more than 150 new breast cancer patients each year and majority of the responders performing breast cancer treatment for more than 20 years for the majority of them.

## Do the Surgeon's Experience and Volume of Activity Influence Patient Mortality?

We investigated whether a minimum number of breast surgeries should be encouraged for the training of breast surgeons during their fellowship, then, in their practice and in the care structures in which they practice. Most of the surgeons were in favor of a high surgical threshold, ranging from 20 to 150. Indeed, it has been shown that the volume of activity performed by a breast surgeon and a breast unit has an impact on patient mortality. International publications

demonstrated improved surgical safety and mortality when the volume of activity, for both facilities and surgeons, increases. For example, in 1995 Sainsbury et al. (3) conducted a retrospective study of 12,861 patients treated for breast cancer in Yorkshire, UK, between 1979 and 1988, and highlighted that patients managed by surgeons operating on at least 30 cases of breast cancer per year had a significantly higher survival rate [risk ratio = 0.85, 95% confidence interval (CI) 0.77–0.93], compared with patients managed by surgeons operating on fewer cases of breast cancer per year (3).

In 1996 in Scotland, Gillis and Hole (4) conducted a retrospective study of 3786 female patients aged under 75 years old, with histologically verified breast cancer operated between 1980 and 1988 (before breast screening began). Patients were identified from the cancer registry and from pathology records of all hospitals in the urban west of Scotland. The follow-up was up to 13 years. The five-year survival rate was 9% higher and the 10-year survival 8% higher for patients treated by specialist surgeons. A reduction in risk of dying of 17% (95% CI 0.74–0.92) was found after adjustment for age, tumor size, socioeconomic status, and nodal involvement. The benefit of specialist care was apparent for all age groups, for small and large tumors, and



for tumors that did and did not involve the nodes and was consistent across all socioeconomic categories.

In 2003, Skinner et al. (5) conducted an insightful study using data from the Cancer Surveillance Program database in Los Angeles, covering the years 1990 to 1998. The study included 29,666 breast cancer cases, along with detailed information on surgeons, hospitals, and staging. Patients were stratified based on surgeon and hospital specialization, as well as by age, race, stage, surgical procedure, surgeon and hospital case volume. Survival analysis with its dependence on these factors was performed. Results showed that being a surgical oncologist (defined by being a member of the Society of Surgical Oncology requiring among other factors to treat at least 50 oncological cases per year) was an independent predictor of survival (risk ratio = 0.77, 95% CI 0.67–0.88), as were both hospital and surgeon case volume. Treatment by a surgical oncologist resulted in a 33% reduction in the risk of death at 5 years.

In 2003, Stefoski Mikeljevic et al. (6) examined 11,329 breast cancer patients diagnosed between 1989 and 1994 in Yorkshire, UK. The study found that patients treated by high-workload surgeons had better overall survival rates. The 5-year survival rate was 68% for those managed by surgeons handling more than 50 patients per year, 64% and 66% for those managed by surgeons with 10–29 and 30–49 patients per year, respectively, and 60% for those treated by surgeons with fewer than 10 patients annually. The relative risk of death increased by 15% (risk ratio = 1.15, 95% CI 1.03–1.28) for patients treated by surgeons with workloads under 10 cases per year, and by 10% (risk ratio = 1.10, 95% CI 1.02–1.18) for those managed by surgeons with 10–29 cases, compared to patients treated by surgeons with workloads over 50 cases annually.

A French study (7) conducted by the *Assurance Maladie* (French public health insurance) and published in 2019 also highlighted the impact of facility characteristics on breast cancer mortality. Between 2012 and 2014, about one-third of centers in France performed fewer than 30 breast cancer surgeries per year. Analyzing data from 43,274 breast cancer patients, the study found that the mortality rate in the year following surgery was 1.41%. Facilities with fewer than 30 surgeries per year had a mortality rate of 2.52%, which was twice as high as those with over 100 surgeries annually (1.21%). Mortality was also 20 to 30% higher in centers with intermediate activity levels (30–100 surgeries). Furthermore, mortality in the first year was more than twice as high in facilities that were not authorized to treat breast cancer patients. This difference persisted beyond the first year of follow-up. This study was carried out prior to the introduction of thresholds for authorization to perform breast surgery in France. In 2018, Greenup et al. (8) analyzed patients aged 18 to 90 with stages 0 to III unilateral breast cancer, diagnosed between 2004 and 2012, using data from the American College of Surgeons National Cancer Data Base. Over one million patients met the inclusion criteria. Hospitals were categorized into three groups based on volume: low-volume (<148 cases/year), moderate-volume (148 to 298 cases/year), and high-volume (>298 cases/year). Treatment at high-volume centers was linked to an 11% reduction in overall mortality (risk ratio = 0.89, 95% CI 0.84–0.96), with the greatest benefit observed in patients with stage 0–I, estrogen receptors (ER)+/progesterone receptors (PR)+ or ER+/PR- breast cancers.

In the UK, Kingsmore et al. (9) conducted a comparative study involving 2,146 women with breast cancer treated in specialized

versus non-specialized units. Patients in specialized units had a significantly lower risk of inadequate treatment for breast tumors (24% vs. 47%,  $p < 0.001$ ), inadequate axillary staging (8% vs. 40%,  $p < 0.001$ ), and inadequate definitive axillary treatment (4% vs. 38%,  $p < 0.001$ ). Local recurrence rates were 57% lower (13% vs. 23% at eight years,  $p < 0.001$ ), and the risk of death from breast cancer was 20% lower for women treated in specialized units.

### Do the Surgeon's Experience and Volume of Activity Influence Quality of Life?

In 2007, Waljee et al. (10) conducted a meta-analysis and found that patients were more satisfied with the decision-making process and their relationship with a highly qualified breast surgeon (defined as a surgeon who dedicates over 60% of their practice to breast disease). Patients also reported greater satisfaction with breast cosmetic outcomes and physical well-being when treated by a highly qualified breast surgeon (11).

A French study published in March 2017 by IRDES (*Institut de Recherche et Documentation en Économie de la Santé*) examined variations in surgical practices for breast cancer treatment (12). The study revealed that surgical management had improved due to advances in diagnostic and therapeutic techniques, as well as the reorganization of breast cancer centers. It also showed that surgical practices varied by center, particularly in terms of their volume of activity. For instance, women treated at centers performing over 110 breast cancer surgeries per year were twice as likely to undergo immediate breast reconstruction or sentinel lymph node biopsies compared to those treated at centers performing between 50 and 110 surgeries annually.

Over the past two decades, oncoplastic surgery has gained popularity, either to avoid mastectomy in cases of large tumors or for cosmetic purposes, such as breast reduction or ptosis correction, alongside oncological surgery. To perform such procedures, it is important to have experienced surgeons skilled in both oncologic and plastic surgery, which can be a challenge for centers with fewer breast cancer surgeries.

In 2018, Peiris et al. (13) compared breast surgery practices in Canada and the UK using the classification of oncoplastic breast surgery. The study showed that specialized breast surgeons, who had more focused fellowship training in both aesthetic and oncologic surgery, were more likely to offer immediate breast reconstruction or oncoplastic surgery. Their research demonstrated that such training programs improved long-term quality of life for Canadian breast cancer patients (13). In France, an analysis of real-life data published by the French National Cancer Institute (INCa) in 2021 showed that only 14% of breast cancer patients received immediate reconstructive surgery, while only 28% had delayed reconstructive surgery (14). These rates are considered too low, and in the absence of contraindications (such as comorbidities, old age, or patient preference), women should have the option to choose reconstructive or oncoplastic breast surgery (15). Ryan et al. (16) recommended in 2023 that modern breast surgeons should: 1) perform a moderate to high volume of breast surgeries; 2) be knowledgeable in oncoplastic techniques; 3) participate in continuous education and additional training opportunities; and 4) remain members of relevant scientific societies (16).

### Is There a Standardization of Initial Training, Continuing Education and Certification of Breast Surgeons in the World?

In our survey, we explored whether there should be a minimum number of breast surgeries required for the training of breast surgeons during

their fellowship, in their regular practice, and in the care facilities where they work. In France, the minimum threshold for breast centers is set at 70 surgeries, while in the UK it is 100, in Belgium 125, and in many European countries (such as Germany, Italy, and Spain) the threshold is 150, in line with EUSOMA (European Society of Breast Cancer Specialists) recommendations. In England, the advanced breast surgery fellowship requires a minimum of 30 conservative surgeries, 25 total mastectomies (including simple and SSM), and 30 axillary procedures (17).

Currently, there is a lack of standardization in breast cancer surgery training across Europe. The ESSO-EUSOMA survey aimed to assess the current state of breast cancer surgery training in Europe. General surgeons, surgical oncologists, gynecologists, and plastic surgeons were invited to complete a custom survey with eighteen questions, distributed to 3,000 surgical oncologists across Europe. A total of 671 physicians responded (23% response rate), with 468 dedicating between 50% and 100% of their work to breast cancer treatment. Forty-four percent of respondents worked in community or university hospitals with dedicated Breast Units. However, additional breast surgery training was not universal: 20% had completed an accredited breast fellowship, 30% had worked as trainees in Breast Units, 21% had pursued additional courses, master's programs, or diplomas, and 8% had not received any extra training. The majority (61%) worked in units treating over 150 breast cancer cases annually, while 26% treated over 120 new primary cases per year, and 23% treated fewer than 50 new cases. Multivariate analysis showed that breast surgeons working in a Breast Unit and treating more than 50 cases per year were significantly more likely to perform oncoplastic procedures. This study highlighted the significant variation in breast cancer surgery training across Europe, and the authors argued that it is crucial to develop standardized, high-quality training to ensure consistent and certified surgical management across the continent (18). The differences in outcomes and access to the latest surgical techniques across Europe may partly stem from these training variations. Training in breast cancer surgery differs not only in its foundational discipline (general surgery, gynecology, or plastic surgery) but also in the duration of training and whether specialized training is required. Wyld et al. (19) stressed the urgent need for specialist training standards that should be adopted by all European member states. Excellent training models from the USA, the UK, Australia, and New Zealand can serve as a foundation for improving breast surgery training across Europe.

Accredited breast surgery fellowships were first established in the UK and USA in 2002 and 2003, respectively. In the USA, organizations, such as the Society of Breast Surgical Oncology (SSO) and the American Society of Breast Surgeons offer certification after a dedicated 12-month fellowship. This fellowship includes significant training in breast and plastic surgery, as well as exposure to other departments, like breast imaging, medical oncology, radiotherapy, and pathology. At the end of the fellowship, trainees must demonstrate their competency in a range of surgical and non-surgical procedures to earn certification (20, 21).

Wilson et al. (22) conducted a study to evaluate breast surgery education in USA general surgery residency programs. The survey, conducted in 2009 with applicants to the Roswell Park Cancer Institute surgical oncology fellowship program, assessed training types, breast surgery exposure, and applicants' comfort levels with breast cancer cases. Of the 29 respondents, 83% were chief residents, and they reported feeling comfortable with breast-related cases, although their comfort level

dropped below 8/10 for modified radical mastectomies and axillary lymph node dissections. General surgery residents felt less comfortable operating in the axilla compared to the breast. The study emphasized the need for adequate breast surgery education in residency training, and noted that 25% of chief residents felt that a 5-year residency did not fully prepare them for transitioning into faculty roles, with 73% of graduates pursuing fellowships after residency (23, 24).

The first formal breast surgical oncology fellowship was established at Baylor University Medical Center in 1982, and since then, the number of such fellowship programs in the USA has grown to around 60. These programs now focus on training in breast surgery, as well as medical oncology, radiation oncology, pathology, breast imaging, and plastic surgery (25). Some fellowship programs have additional prerequisites, such as achieving a minimum score on a multiple-choice exam or meeting publication requirements to qualify for an interview. In 2023, a survey by Hedges et al. (26) showed that factors such as clinical rotation experience, research time, and the quality of interviews and recommendation letters were critical in determining an applicant's chances of being accepted into a fellowship program. To complete the SSO breast surgical oncology fellowship, trainees must perform a specified number of procedures, including partial mastectomies, total mastectomies, axillary lymph node biopsies, and axillary lymph node dissections (20).

In the UK, trainees can begin specializing in breast surgery during the last two years of their general surgery residency. Although it is not mandatory to practice breast surgery, trainees are encouraged to complete the 12-month fellowship from the Royal College of Surgeons, specializing in breast surgery (17). In Japan, the surgical training system is organized by the Japan Surgery Society as the first step for general surgeon and the Japanese Breast Cancer Society as the second step for breast surgery. In Israel, there is a one-year fellowship program since 2023 with a multidisciplinary training program that includes two months in oncology, one month in breast imaging, one month in pathology, and two months in plastic surgery. The fellow must participate at least to 100 surgeries according to a special list.

Beitsch and Whitworth (27) proposed in 2016 the importance of an adapted curriculum for specialists treating breast cancer, recognizing that the disease requires expertise across multiple disciplines. The idea of a "breast specialist" could lead to optimal diagnosis and treatment for both benign and malignant breast conditions, including risk assessment, image-guided biopsies, targeted and prophylactic treatments, as well as recurrence and survivorship monitoring (27, 28).

In Pakistan, a PubMed search from 1990 to 2021 revealed a significant increase in breast cancer research publications, from almost none before 1990 to 615 articles between 2012 and 2021. This surge can be attributed to the introduction of fellowship programs in breast surgery and related fields. In 2019, Pakistan's College of Physicians and Surgeons (CPSP) accredited a two-year breast surgery fellowship program. This program, combined with the rising incidence of breast cancer, has led to more General Surgery graduates pursuing specialized training (29).

There are different surgical specialties around the world (13 in France, for example), and some surgical specialties exist only in certain countries, such as carcinological surgery, which exists in the Maghreb and includes breast cancer surgery. In countries where this specialty does not exist, breast surgery is performed by gynecologists (France, Germany...), general, visceral or endocrine surgeons (USA, Türkiye)



and increasingly by plastic surgeons, in response to patient demand for immediate breast reconstruction.

For this reason, fellowships should be open to several specialties, as is the case in England with a joint program for plastic and general surgery. In other countries, such as Brazil, there is a specialty dedicated to the management of breast pathologies: mastology. These differences can be explained by the demographic, epidemiological and morphological diversity of patients around the world, resulting in a heterogeneity of resources.

### Should Breast Surgeon Training Take Place in an Establishment With Specific Authorization for the Activity “Cancer Treatment”?

In certain countries, healthcare facilities are required to obtain specific authorization based on regulatory requirements to ensure the quality and safety of care nationwide. This authorization system, developed through a multi-professional collaboration, is grounded in three key principles: Cross-cutting quality standards, approval criteria established by scientific societies, and minimum activity thresholds for each facility. Among the quality measures, it is emphasized that every patient diagnosed with breast cancer must receive a clear diagnosis, that therapeutic decisions are made in multidisciplinary meetings adhering to best practice guidelines, that a personalized care plan is developed, and that access to necessary support care, innovative treatments, and clinical trials are provided when required.

There are variations in the quality of breast cancer care across different regions and hospitals, which negatively impacts women's health. A study by Taban et al. (30) in 2019 retrospectively analyzed patients treated for invasive breast cancer in Geneva's private sector from 2000 to 2009. The study concluded that the relationship between post-treatment mortality and surgeon experience was partially linked to adherence to quality-of-care indicators. Experienced surgeons were more likely to comply with the quality standards set by EUSOMA, including performing histological analysis before surgery, conducting selective sentinel lymph node biopsies when appropriate, ensuring axillary clearance with an adequate number of lymph nodes, and referring patients for adjuvant radiotherapy when necessary (30).

In 2021, Maes-Carballo et al. (31) found that over half of the countries in Europe and America had not implemented clinical pathways or integrated care processes for breast cancer, and that quality indicators were inconsistent. However, four quality indicators were more commonly implemented: preoperative breast and axilla radiology and physical examination, preoperative histology confirming malignancy, preoperative and postoperative case discussions in multidisciplinary teams, and image-guided axillary staging.

In France, the INCa has worked with the Haute Autorité de Santé and clinical experts from various scientific societies to develop Indicators of Quality and Safety of Care specific to breast cancer. These benchmarks, which aim to enhance care practices and quality, include ten key indicators, focusing mainly on diagnosis, treatment timelines, follow-up, and treatment (32).

### Feminization of Surgical Professions and Consequences for Breast Surgery

Looking at our results, a quarter of responders were female. Regarding this, there are many concerns about the minority of female breast surgeons worldwide, with a rapidly inverting trend, with for example 58% of medical doctors being women in France in 2022 according to the *Direction de la Recherche, des Etudes, de l'évaluation et des Statistiques* data (33). The female representation at the American Society of breast surgeons annual meeting from 2009 to 2019 significantly increased in committee members (3.2% per year,  $p = 0.01$ ) and chairs (6.0% per year,  $p = 0.03$ ). Women represented the majority of speakership positions and the meeting-related publication rate with female senior authorship was higher than with male (41.0% vs. 36.3%,  $p = 0.04$ ) (34). Interestingly, a retrospective cohort published in August 2023, including 1,765,711 patients who underwent 1 of 25 common surgeries in various specialties, has suggested that patients treated by female surgeons have lower rates of adverse postoperative outcomes including death at 90 days and 1 year after surgery compared with those treated by male surgeons (35). A comparative study including 2236 patients showed that satisfaction with information differed, as patients of female surgeons reported greater satisfaction ( $p = 0.018$ ) (36). Moreover, a retrospective study conducted in the USA in 2021 with a cohort of 167 patients who underwent mastectomy with a reconstruction rate of 35%, female breast surgeons had 3.7 times greater odds of treating patients who had reconstruction than male breast surgeons (95% CI 1.20–11.42) (37). According to an observational study using the Surveillance, Epidemiology, and End Results-Medicare database, women who underwent breast conserving surgery were more likely to have female surgeons (odds ratio = 1.40; 95% CI 1.25–1.55) (38). However, studies on this topic are scarce and should be interpreted with caution.

### Proposal for an Initial and Ongoing Training Program

According to the results of our study and the findings of a review of the international literature concerning the diversity of management of patients with breast cancer and the training of breast surgeons, it seems imperative to propose standardized training for breast surgeons to standardize practices and offer optimal patient management. This could take the form of one to two years' initial training, whatever the initial surgical specialty. During these years of training, in addition to breast surgical oncology period, several rotations should be organized in the various departments involving breast pathology, including medical oncology, breast imaging, radiotherapy, pathology, genetics, and plastic surgery. The aim is to master all aspects of breast pathology, from breast embryology to functional pathologies, benign pathologies and breast cancers, with a view to promoting overall breast health. By developing a general view of the breast, the surgeon can avoid over-treatment and help to improve women's quality of life. Similarly, it is important to develop training for communication skills, to help patients understand, without affecting their capacity for resilience following the announcement of the disease. In addition, in view of the constant and rapid evolution of scientific data, it seems necessary to set up ongoing training for professionals practicing breast surgery. Ten Recommendations have been established by the FNAS and the SIS concerning breast surgery training (Table 4).

**Table 4. Breast surgery training: 10 recommendations of the French National Academy of Surgery and the Senologic International Society**

1. Training programs must take account of expected trends in breast cancer incidence and mortality in each country worldwide.
2. Training programs must take account of changes in breast cancer management in the recent decade.
3. Training programs must become mandatory for junior surgeons who want to perform breast surgery.
4. Breast surgery must be performed in a specialized multidisciplinary breast cancer unit with a minimal threshold of breast surgeries per year (to be defined in each country).
5. The modalities of specialized training in breast surgery must include training in breast imaging, pathology, oncology, genetics, radiotherapy, and nuclear medicine.
6. Specialized training in breast surgery should be accessible to numerous surgical disciplines (gynecology, plastic and reconstructive, oncologic, general, digestive, endocrine and thoracic surgeries).
7. The duration of specialized training should be one or two years (to be defined in each country), without slowing down the surgical training curriculum specific to each country.
8. Continuing education programs for breast surgeons should be encouraged throughout their professional careers.
9. Clinical and translational research and innovations should be encouraged in breast surgery.
10. For Europeans countries, the educational program is committed to complying with European directives on the right to better health for those suffering from breast cancer.

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#### Footnotes

##### Authorship Contributions

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