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## Variations in Surgical Practices in Breast Cancer Treatment in France

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In 2015, breast cancer was the most common form of cancer suffered by women in France in terms of incidence (54,000 new cases) and mortality (12,000 deaths) [Inca, 2015]. The surgical treatment of breast cancers has improved due to developments in diagnoses and therapies, as well as the reconfiguration of cancer care provision.

Conservative surgery (tumorectomy) became the principal treatment in more than 70% of the cases in the vast majority of hospitals in 2012. Between 2005 and 2012, the sentinel lymph node biopsy technique was offered in most of the healthcare facilities, and the number of patients who underwent this treatment tripled over the period. However, immediate breast reconstruction (IBR) after a total or radical mastectomy was still relatively rare, despite an increase in the number of instances where this technique was used.

The implementation of these practices varied between hospitals and *départements*. These variations may partly be linked to patients' health status and their preferences. But they also attest to differences in the organisation of services and the availability of technical platforms, as well as differences in medical practices between hospitals. All things being equal, the probability of benefitting from the sentinel lymph node technique or immediate breast reconstruction is greater in the Cancer Centres (Centres de Lutte Contre le Cancer, or CLCC), the Regional Teaching Hospitals (Centres Hospitaliers Régionaux, or CHR), and in hospitals with a high patient volume.

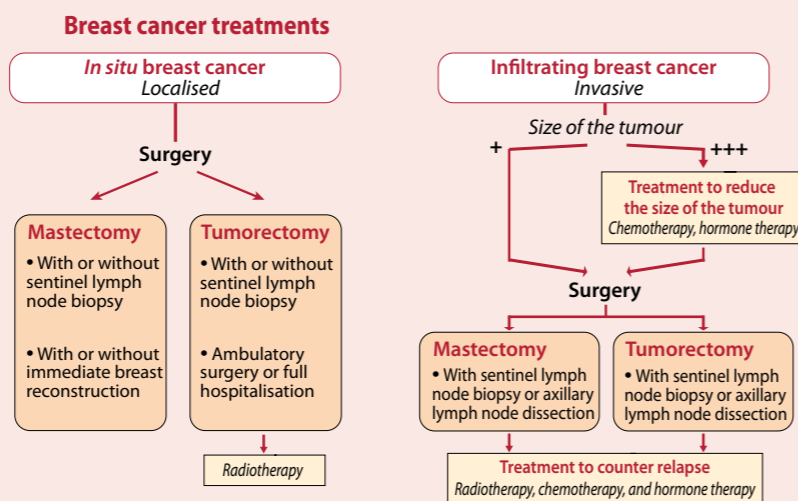
**e**ancer is the primary cause of death in France and the incidence rates for cancer continue to increase, particularly for women. However, cancer mortality rates (all locations combined) are dropping due to the implementation of prevention, detection, and diagnostic programmes and therapeutic developments. For certain cancers, the treatment options are increasing. The information on the available treatments

and their geographic accessibility within France is particularly useful, both for the patients and their families and for the health professionals and policy makers.

In France, the 2014–2019 Cancer Plan aims to accelerate the dissemination of innovations for patients and enable each person in France to receive the same quality of treatment (2014–2019 Cancer Plan, 2015). Yet, relatively little infor-

mation is available about the variations in cancer treatment practices in France. Cancer care market have been modified substantially over recent years, on the one hand due to the introduction of Activity-based Funding (Tarification à l'Activité, or T2A) as a means of funding hospitals and, on the other, after the implementation of minimal activity thresholds specific to cancer in order to have the authorisation to practise different activ-

Breast cancer care includes various types of treatment: surgery, radiotherapy, chemotherapy, and hormone therapy (see the diagram opposite). In most cases, surgery needs to be complemented by other treatments to counter the risks of relapse. Tumorectomy is a form of conservative surgery that enables the tumour to be removed while retaining most of the breast tissue. This intervention can be practised when the size of the tumour, breast size, and oncological conditions meet the right criteria. The alternative is a mastectomy, or the ablation of a breast, which is a more traumatic intervention for women but sometimes necessary for more virulent forms of cancer. Over the last two decades, medical practice has shifted to approaches involving conservative surgery, with less mastectomy operations, thanks to the systematisation of radiotherapy. The excision of the sentinel lymph node, which can be practised in the event of a mastectomy or tumorectomy, involves removing the primary lymphatic nodes in the armpit that are closest to the tumour to verify whether or not they contain cancerous cells. This less invasive technique means that axillary lymph node dissection could be limited to the tumours that required this intervention, and avoid the secondary effects of axillary lymph node dissection (Lyman et al., 2014). However, this technique was not always available in every healthcare fac-



ility. Lastly, immediate breast reconstruction after a mastectomy is offered to perform an aesthetic repair in just one intervention, enabling the patient to avoid a further operation (Reuben et al., 2009). It is generally proposed when no adjuvant therapy

(chemotherapy or radiotherapy) is necessary. The clinical recommendations encourage the clinicians to discuss immediate reconstruction with all the patients who are being advised to have a mastectomy (HAS, 2010; NHS, 2011).

ities (Bonastre et al., 2017). The aim of these reforms was to improve the overall quality and efficiency of health care facilities but, as yet, little is known about their impact on medical practices and the quality of cancer treatments.

Breast cancer is the most common type of cancer suffered by women, followed by colorectal cancer and lung cancer. In 2015, there were around 54,000 new cases of breast cancer, representing 31% of the cancers suffered by women in mainland France (Institut National du Cancer, 2015). The prevention and treatment of breast cancers have improved over time. However, these developments

may also lead to variations in treatment of patients with similar pathologies. The literature on breast cancer treatments indicates that patients with tumours with similar characteristics may be treated very differently, depending on the doctor or hospital responsible for the treatment, and according to their place of residence and socio-economic status (Richardson et al., 2015).

This study examines developments in surgical breast cancer treatments between 2005 and 2012. A comparison between the two years allowed to assess the situation prior to and after the implementation of Activity-based Funding (T2A) and activity thresholds for cancer care. Aside from the predominant role it plays in female mortality by cancer, the focus on breast cancer is explained by the existence of several surgical treatment options for women requiring breast cancer surgery (see the inset above). The study concentrates on three surgical interventions that are considered as better options for patients suffering from this pathology: conservative surgery or tumorectomy, the sentinel lymph node technique, and immediate breast reconstruction after a complete mastectomy. More specifically, the utilisation rates of these treatments were observed in different types of hospitals and across départements in order to compare variations in practices throughout France (see inset: Sources and

Methods). The use of these three surgical interventions may be influenced by various factors, such as the health status and the preferences of the patients and doctors, as well as the availability and organisation of technical platforms, and local medical practices. We use multilevel models to estimate the determinants of the utilisation rates of these interventions by analysing simultaneously the observable characteristics of the patients and hospitals.

### The concentration of breast cancer surgery market was accompanied by a wider dissemination of these interventions

Between 2005 and 2012, the number of breast cancer surgery admissions increased by 13%, with a greater increase in conservative surgery (+16%) and a more moderate increase in mastectomies (+6%). Over the same period, a third of the facilities carrying out breast cancer surgery no longer did so in 2012 (526 hospitals in 2012 versus 804 in 2005). The reconfiguration cancer market was particularly marked in the private for-profit sector, with a 40% reduction in private facilities carrying out breast cancer surgery. In terms of volume of activity, the role played by the private for-profit sector also slightly decreased during this period, but the clinics remained the principal

## SOURCES AND METHODS

The analyses are based on the Hospital episode statistics (Programme de Médicalisation des Systèmes d'Information, or PMSI) in 2005 and 2012. The breast surgery cases were extracted using diagnostic codes and Homogenous Patient Groups (DRG) [C, D05, and the surgery GHM with the letter 'C' as the 3<sup>rd</sup> digit]. Surgical interventions (Common Classification of the Medical Acts, or CCAM) were used to classify the hospital cases according to the type of surgery.

The rates of tumorectomy and sentinel lymph node biopsy in a hospital correspond to the proportion of patients who underwent these interventions amongst the patients who underwent surgery (the sum of tumorectomies and mastectomies), excluding, in the case of the sentinel lymph node biopsy, the patients with an in situ carcinoma, for whom a sentinel lymph node biopsy was not always required. The number of cases of immediate breast reconstruction was equal to the percentage of patients who had an immediate reconstruction amongst those who had had a total mastectomy. In order to limit the variability resulting from hospitals with very low volume of activity, facilities with less than five breast cancer surgery cases per year were excluded.

On the *département* level, the rates correspond to the proportion of patients living in the *département* who underwent one of these interventions amongst the patients who were operated upon. In the case of immediate breast reconstruction, it relates to the proportion of patients living in the *département* who underwent this intervention amongst the patients who had had a complete mastectomy. The facilities practising breast cancer surgery were identified by using the French Annual Hospital Statistics (Statistique Annuelle des Établissements de Santé, or SAE) database and the authorisations available on the site of the Institut National du Cancer (INCA) (Bonastre et al., 2016). The distance travelled by patients to receive treatments was calculated using Odomatrix and corresponded to the distance in kilometres by road between the patients' place of residence and the town or city in which the healthcare facility was located. The extreme values were excluded, up to 5% of the distribution.

### Multilevel modelling

The modelling evaluates the probability of undergoing a sentinel lymph node biopsy (SLNB) or immediate breast reconstruction (IBR) after a mastectomy, using the individual data from patients treated in different hospitals. We estimated multilevel logistic regressions that allows to control simultaneously the (clinical) characteristics of patients and hospitals.

Concerning patients, we included the age, severe comorbidity (the Charlson index), the type of tumour (in situ or infiltrating), and the median income in the patients' town or city of residence. In addition, included certain clinical characteristics: the type of surgery for the SLNB (complete mastectomy); and the practice of axillary lymph node dissection and chemotherapy treatment for the IBR. With regard to the hospitals, aside from the hospital category, we included the volume of activity (number of surgical interventions for breast cancer per year).

providers of conservative surgery: 43% of the interventions were carried out in private clinics in 2012, compared with 47% in 2005. This relative decrease in surgical interventions seemed to have benefitted the private not-for-profit sector.

Although conservative surgery was practised in all the facilities in which breast cancer treatments were available, only a third of them used the sentinel lymph node biopsy technique and immediate reconstruction after a mastectomy in 2005. The proportion of hospitals practising the sentinel lymph node biopsy (on at least one patient during the year) greatly increased between 2005 and 2012, rising from 37% to 85% (*i.e.* 152 additional facilities). This practice, which in 2005 was very common in the Cancer Centres and Regional Teaching Hospitals, subsequently spread to the other healthcare facilities, with more than 80% of the general public hospitals (Centres hospitaliers, or CH) and private for-profit hospitals practising this technique in 2012. The number of patients who underwent this technique tripled over the period 2005-2012 (see Table 1).

However, there was only a slight increase in the number of hospitals practis-

ing immediate breast reconstruction: a total of 275 in 2012, which represents only thirty more facilities compared with 2005. Immediate reconstruction, which was frequently practised in Cancer Centres (100% of these facilities carried out immediate breast reconstruction) and in the Regional Teaching Hospitals (87% of the CHR) in 2012, gradually spread to the other types of facilities. Only 35% of the public hospitals (CH), 50% of the private not-for-profit facilities, and 55% of the private clinics practised at least one immediate reconstruction. Although the number of interventions increased by 25% between 2005 and 2012, only 12% of the women who underwent a mastectomy benefitted from immediate reconstruction in 2012, and most of these were practised in the Cancer Centres (39%) and private clinics (42%). Overall, the slight increase in the use of the technique of immediate breast reconstruction over this period may have been linked to the dissuasive pricing of this practice. Until 2011, the cost of carrying out a mastectomy with or without reconstruction remained the same. The remuneration did not cover the breast reconstruction process (Source: ATIH, March 2010). A flat rate (Homogeneous groups of stays or Groupes Homogènes de Séjours – GHS) for immediate reconstruction was introduced in 2011.

### The distances travelled by patients changed little

The reconfiguration of breast cancer surgery market (provision) did not have any marked effect on the distances travelled by the patients who underwent a tumorectomy. Between 2005 and 2012, the average distance travelled increased by

## CONTEXT

This publication is part of a research project funded by the French Public Health Research Institute (Institut de Recherche en Santé Publique, or IRESP) and jointly developed by the Institut Gustave Roussy (IGR), the Higher School for Economics and Business Studies (Ecole Supérieure des Sciences Économiques et Commerciales, or ESSEC), the Institute for Research and Information in Health Economics (Institut de Recherche et Documentation en Économie de la Santé, or IRDES), and the Lab'Urban Planning Laboratory in the Université Paris-Est Marne-la-Vallée. This project set out to study the impact of regulatory policies in cancerology on care provision, access to care, and medical practices. This article follows an initial issue of Questions d'Économie de la Santé (Bonastre and al., 2017), which examined cancer treatment provision and access to it throughout France.

T1

Distribution of hospitals and cancer surgery volumes

|                            | Hospitals    |                     |                                 | Volumes      |                     |                                 |               |            |              |            |
|----------------------------|--------------|---------------------|---------------------------------|--------------|---------------------|---------------------------------|---------------|------------|--------------|------------|
|                            | Tumorectomy* | Sentinel lymph node | Immediate breast reconstruction | Tumorectomy* | Sentinel lymph node | Immediate breast reconstruction |               |            |              |            |
|                            | %            | %                   | %                               | Number       | %                   | Number                          | %             | Number     | %            |            |
| <b>2005</b>                |              |                     |                                 |              |                     |                                 |               |            |              |            |
| Public Hospital            | 248          | 100                 | 29                              | 15           | 7,067               | 17                              | 806           | 9          | 113          | 5          |
| Regional teaching hospital | 53           | 100                 | 58                              | 62           | 4,678               | 11                              | 980           | 11         | 251          | 12         |
| Cancer Centre              | 20           | 100                 | 100                             | 100          | 9,240               | 22                              | 4,859         | 52         | 825          | 39         |
| Private for-profit         | 436          | 100                 | 35                              | 33           | 19,930              | 47                              | 2,434         | 26         | 876          | 42         |
| Private not-for-profit     | 47           | 100                 | 32                              | 33           | 1,483               | 3                               | 195           | 2          | 40           | 2          |
| <b>Total</b>               | <b>804</b>   | <b>100</b>          | <b>37</b>                       | <b>31</b>    | <b>42,398</b>       | <b>100</b>                      | <b>9,274</b>  | <b>100</b> | <b>2,105</b> | <b>100</b> |
| <b>2012</b>                |              |                     |                                 |              |                     |                                 |               |            |              |            |
| Public Hospital            | 163          | 100                 | 83                              | 35           | 8,333               | 17                              | 4,506         | 15         | 201          | 8          |
| Regional teaching hospital | 46           | 100                 | 100                             | 87           | 5,177               | 10                              | 3,327         | 11         | 317          | 12         |
| Cancer Centre              | 20           | 100                 | 100                             | 100          | 11,890              | 24                              | 9,470         | 31         | 1,118        | 43         |
| Private for-profit         | 257          | 100                 | 84                              | 55           | 20,998              | 43                              | 11,680        | 39         | 820          | 31         |
| Private not-for-profit     | 40           | 100                 | 73                              | 50           | 2,904               | 6                               | 1,326         | 4          | 167          | 6          |
| <b>Total</b>               | <b>526</b>   | <b>100</b>          | <b>85</b>                       | <b>53</b>    | <b>49,302</b>       | <b>100</b>                      | <b>30,309</b> | <b>100</b> | <b>2,623</b> | <b>100</b> |

\* Conservative Breast Surgery.

Reading: In 2005, 29% of the general public hospitals (CH) practised the sentinel lymph node technique, compared with 58% of the Regional Teaching Hospitals (CHR). Public hospitals (CH) carried out 9% of the sentinel lymph node interventions in 2005, compared with 15% in 2012.

Sources: PMSI MCO, SAE (2005, 2012).

Download the data



one kilometre (from 21.2 to 22.4 kilometres) and remained stable in two thirds of the départements.

However, the dissemination of the sentinel lymph node technique was accompanied by a significant decrease in the distances travelled by the patients. On a national scale, the journeys to receive this treatment decreased by four kilometres between 2005 and 2012. At the département level, the distances decreased on a nationwide scale and, in particular, in the regions where the distances were greater (the average distance for the départements in the last decile decreased from 88 to 69 kilometres).

**Regional disparities in conservative surgery rates persist**

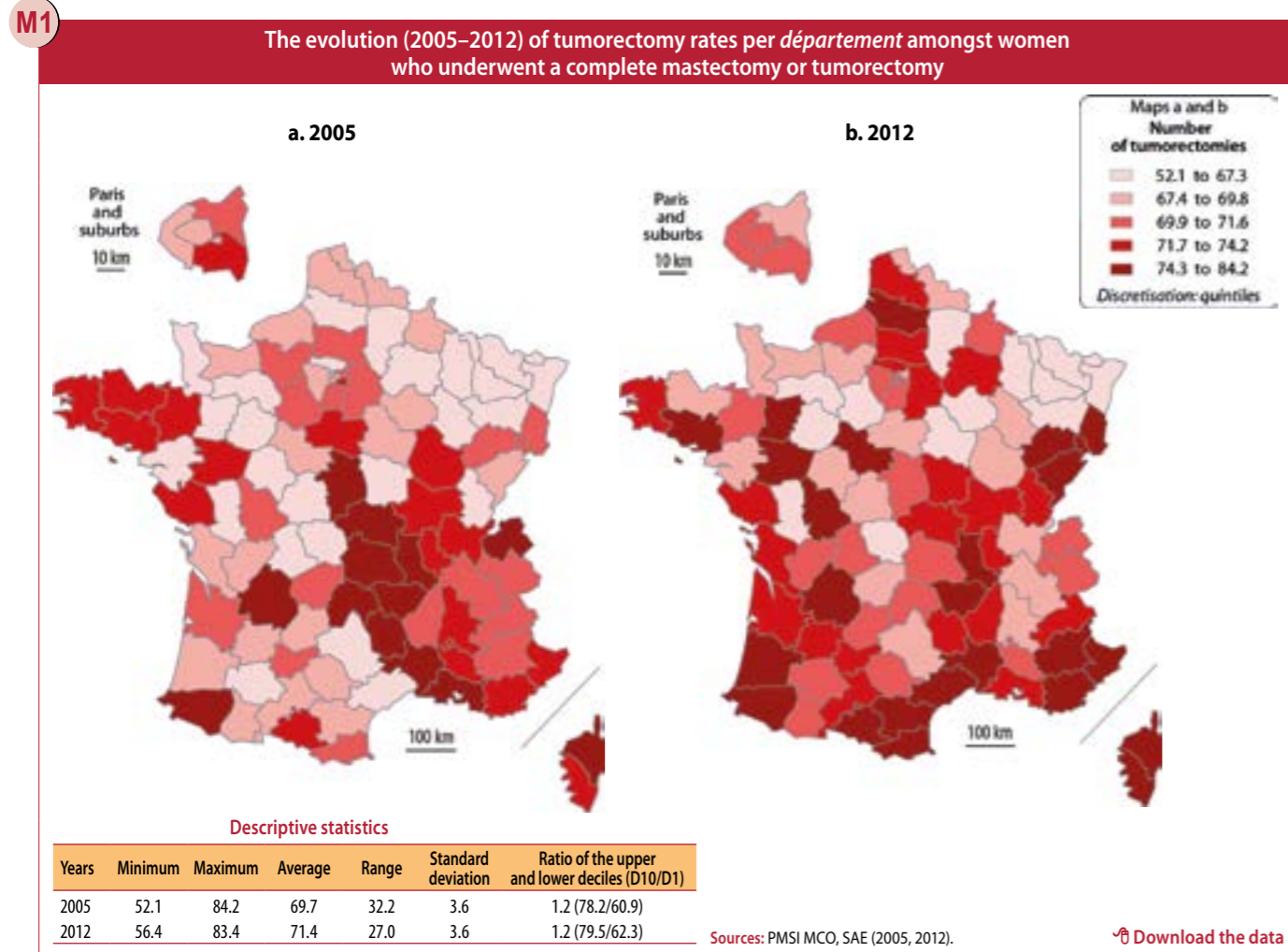
Although the number of patients undergoing conservative surgery increased from 69.7% to 71.4% on the national

level, in 2012 the percentages varied from 56% in the Vosges region to more than 83% in southern Corsica, depending on the patient's place of residence (Map 1). Between 2005 and 2012, the disparities between départements remained stable, but the variation in 2012 was still significant: on the département level, the percentages of patients (diagnosed with breast cancer) undergoing conservative surgery varied between 52% and 84% depending on their place of residence. In these analyses, the rates of tumorectomy for women operated for breast cancer was calculated from the point of view of the patients, by calculating the rates in relation to their place of residence rather than the département where the treatment was provided (see Sources and Methods inset). The regional disparities observed may reflect differences in capacities for prevention and diagnosis (advanced or multiple tumours requiring a mastectomy), as well as variations in surgical practices. Mainly the départements located to the north of the Loire,

and, in particular, several départements in the north-east and south of Normandy had the lowest number of tumorectomies.

**Regional variations in the use of sentinel lymph node biopsy were attenuated in 2012, but remained significant**

Between 2005 and 2012, the dissemination of the sentinel lymph node technique — particularly in public hospitals (CH) and private for-profit facilities — attenuated the regional variations in the use of this technique. In 2012, patients suffering from breast cancer were far more likely to benefit from the sentinel lymph node technique than in 2005, wherever their place of residence: on the national level, the percentage of patients who benefitted from this intervention rose from 15% to 46% over the period. This average increase was complemented by a reduction in disparities between the



départements: the ratio between the averages in the départements in the upper and lower deciles decreased from 7 to 2 (Map 2). However, regional disparities were not negligible in 2012: the percentage of women who benefitted from this intervention varied from 13% in the Hautes-Pyrénées and 23% in the Marne to more than 62% in the Jura, Loire, and Haute-Saône regions. The regional disparities in the application of the sentinel lymph node biopsy should be taken by caution, because some of the variations observed might be linked to differences in coding practices in the different facilities that use the sentinel lymph node technique. Nevertheless, the extent of the variations between départements raises questions.

While it is difficult — and even impossible — to establish the appropriate levels for the use of each practice, the extreme (very low) rates should be questioned. In these analyses, we are interested in the extent of the regional variations.

**Marked differences between the north and south of France with regard to immediate breast reconstruction**

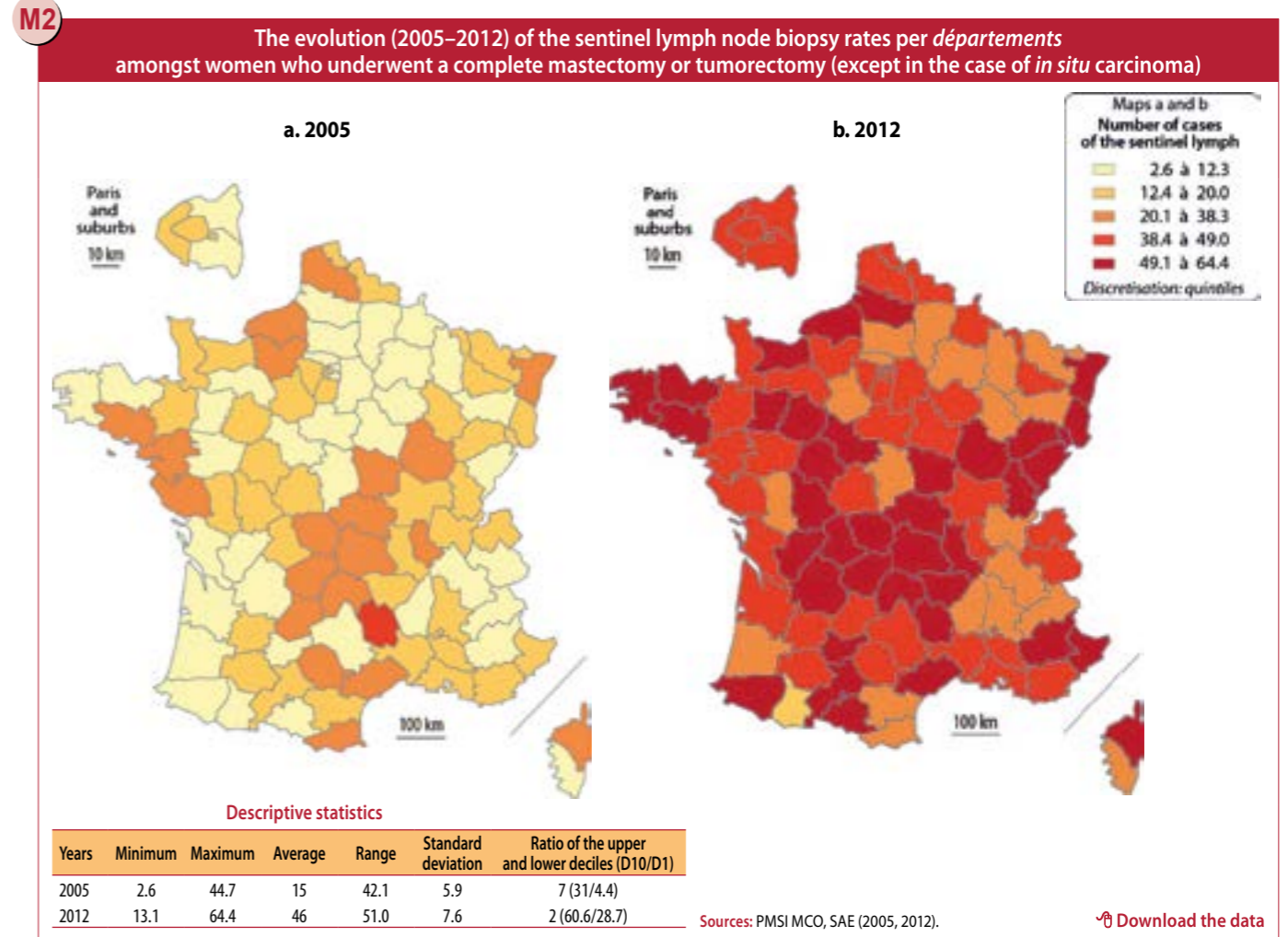
The trends in practice of immediate breast reconstruction was not uniform throughout France. There were disparities along a north-west/south-east 'fault line' that extended from Saint-Malo to Nice (see Map 3). In most of the départements located south of this axis, the proportion of women who had immediate breast reconstruction was high (over 20%), while several of the same départements had some of the lowest levels of this practice in 2005. However, in most of départements located north of this axis, the proportion of women undergoing this surgery rarely exceeded 9%, with the notable exception of Paris.

These regional variations may be linked to differences in surgical practices used

in the different types of facilities: on the level of the départements, the presence (or not) of facilities that practised immediate breast reconstruction had an impact on the number of cases of immediate breast reconstruction in the département. Therefore, regional differences in the practice reflect also the inequalities in treatment for women depending on the region where they live.

**Cancer Centres and Regional Teaching Hospitals are distinguished by more homogenous medical practices**

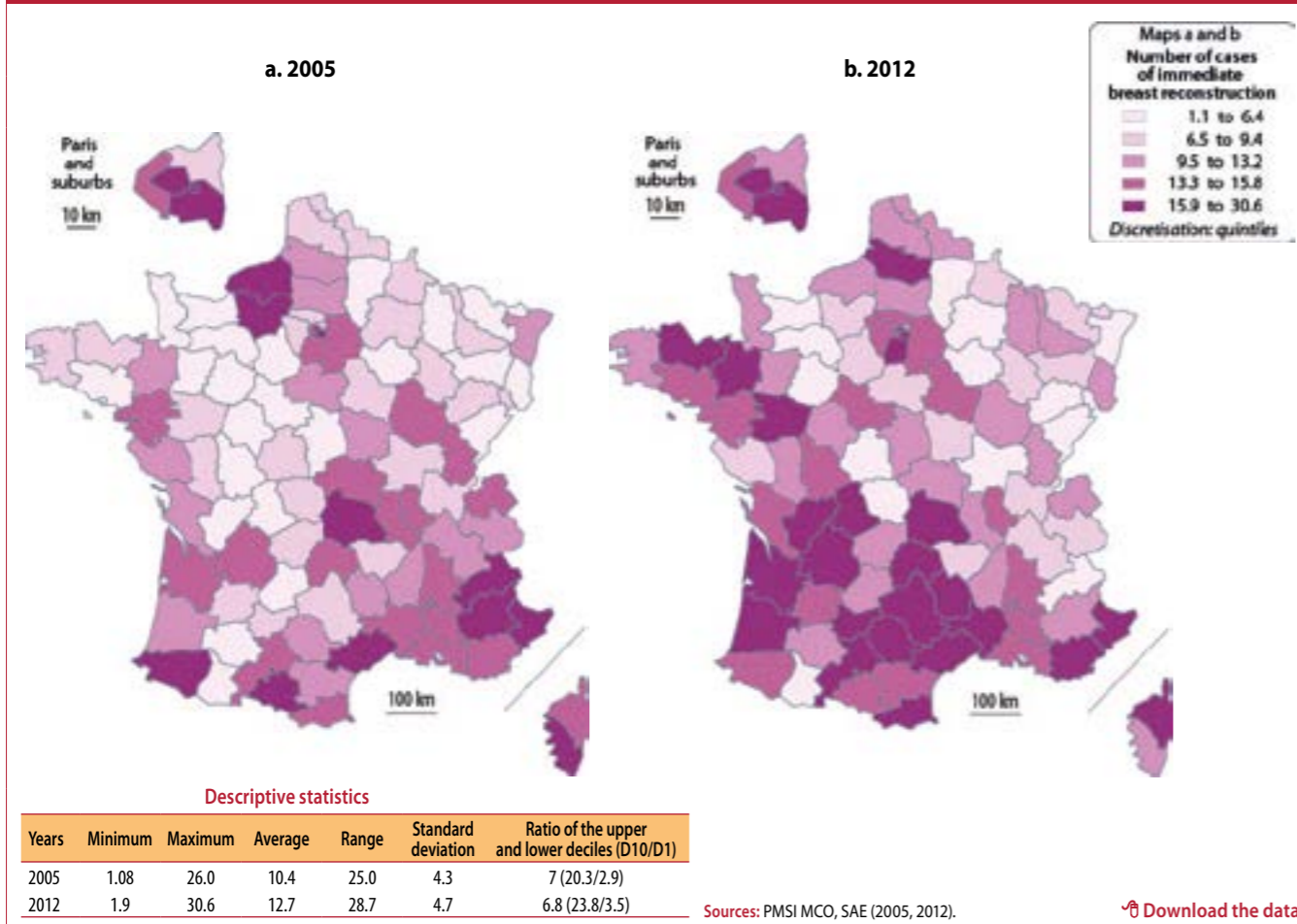
The admission rates of the interventions studied, as well as developments in these practices between 2005 and 2012, varied according to hospital category. In 2012, the average rate of conservative surgery was slightly lower in the Cancer Centres (68%) compared with the number of tumorectomies carried out in pri-





M3

The evolution (2005–2012) of immediate breast reconstruction rates per *département* amongst women who underwent a total mastectomy



vate for-profit and not-for-profit hospitals (75%). This may be explained by the fact that the Cancer Centres treated patients at more advanced stages of their cancer; hence the treatment is more likely to involve a mastectomy. While the rates of conservative surgery was similar in different types of hospitals, the variation within a category could be significant. Within the same category, the interquartile interval (IIQ) measures the variation across same type of hospitals. The greater the IIQ, the greater the variation in the Cancer Centres and the Regional Teaching Hospitals (IIQ = 65–70% and 69–74% respectively) compared with other public and private facilities (see the Graph).

With regard to the sentinel lymph node biopsy, this technique was practised in all the facilities in 2012, with a significant

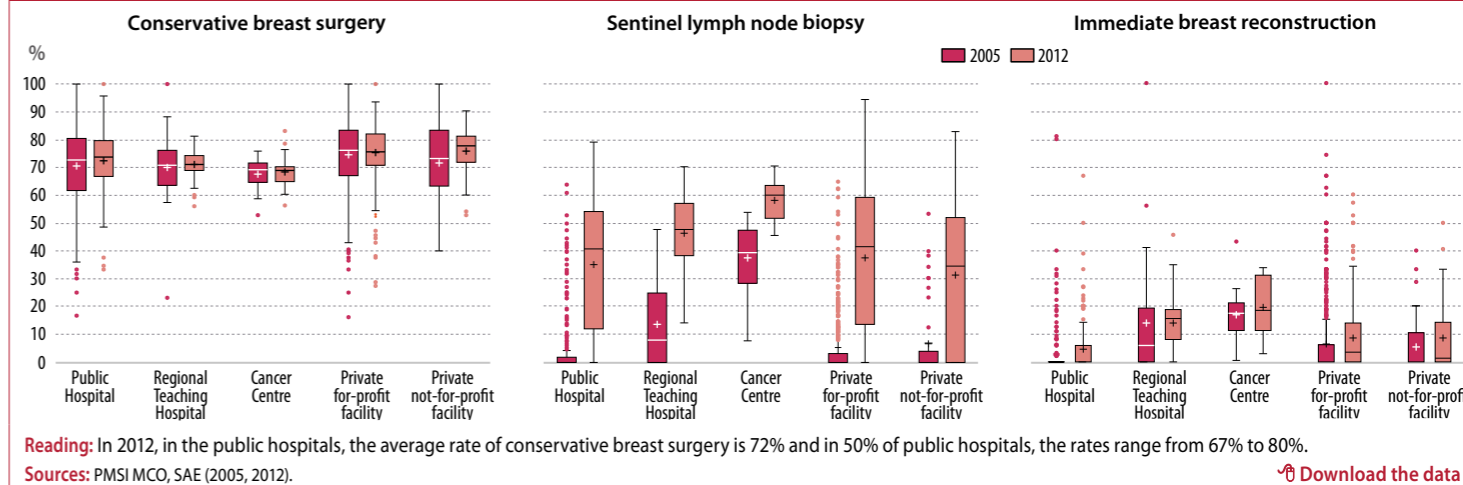
increase in the average rates of admission. But the Cancer Centres were still significantly different from the other facilities, with more than one in two women undergoing this technique (58%, IIQ= 52–64), followed by the Regional Teaching Hospitals (47%, IIQ=38–57). Although the gap between the Cancer Centres, the Regional Hospitals, and the other public and private facilities narrowed between 2005 and 2012, the average rates of sentinel lymph node biopsy remained significantly lower in private clinics, general public hospitals, and private non-profit facilities, where the intra-category variation was far greater (38% (IIQ=14–59), 35% (IIQ=12–54), and 31% (IIQ=0–52) respectively).

On average, immediate breast reconstruction was more frequently practised in Cancer Centres and Regional Hospitals, where the number of cases was respectively 20% (IIQ = 11–31%) and 14% (IIQ = 8–19%) higher than in the

other categories of hospitals. Immediate breast reconstruction was only carried out in a third of the public hospitals, where only 5% of the mastectomies were complemented by immediate reconstruction, with significant variations between healthcare facilities (IIQ=0–6%). Despite the significant number of immediate breast reconstructions carried out in private clinics (42% of the stays), only 9% of the women who underwent a mastectomy in the private clinics benefitted from an immediate breast reconstruction in 2012 (IIQ=0–14%) versus 14% in the Regional Hospitals and 19% in the Cancer Centres. Hence, in 2012, the probability of having an immediate breast reconstruction after a mastectomy was twice as high in a cancer centre as in a private clinic. This also reflect a greater heterogeneity in this practice in private facilities, as only a few hospitals offer this surgery, which requires the skills of a plastic surgeon.

G

The percentages of surgical interventions according to the category of healthcare facility



The probability of receiving an immediate breast reconstruction or sentinel lymph node biopsy was higher in Cancer Centres and Regional Teaching Hospitals

This descriptive approach is, however, insufficient, because it does not take into account any potential differences in patient characteristics in different hospitals. In order to ascertain whether the probability of undergoing a sentinel lymph node biopsy or an IBR depends on the characteristics of the healthcare facilities in which the patients are treated, we specified multilevel logistic models controlling simultaneously for the characteristics of patients and hospitals (see inset p. 3). The results of this modelling, presented in Table 2, show that, controlling for observable clinical characteristics, the probability of having an immediate reconstruction decreased with age (as of 50) and that women living in less affluent neighbourhoods were less likely to undergo this intervention. The effect of age and income was significant, but was less pronounced in 2012 compared with 2005. In 2012, patient characteristics and admission volumes being equal, the probability of benefitting from the sentinel lymph node technique was higher in Cancer Centres and Regional Teaching Hospitals, compared to other healthcare facilities; this 'hospital effect' was even greater in 2005 when this practise was as yet relatively uncommon. For immediate breast reconstruction, the situation was

a little different. All things being equal, there was a lower probability of benefitting from an immediate reconstruction in general public hospitals (CH), com-

pared with all the other categories of hospitals. Lastly, all things being equal, the probability of benefitting from the two interventions depended on the breast

T2

Determinants of admissions for sentinel lymph node biopsy and immediate breast reconstruction: multilevel regressions

|  | Breast reconstruction |             | Sentinel lymph node biopsy |             |
|--|-----------------------|-------------|----------------------------|-------------|
|  | 2005                  | 2012        | 2005                       | 2012        |
|  | Odds ratios           | Odds ratios | Odds ratios                | Odds ratios |
| Constant   | 0.001 ***             | 0.00277 *** | 0.00184 ***                | 0.03487 *** |
| <b>Patient characteristics</b>   |                       |             |                            |             |
| <b>Age</b>   |                       |             |                            |             |
| ≤ 50 years   | 22.443 ***            | 12.516 ***  | 0.996                      | 0.824 ***   |
| 50-60 years  | 14.083 ***            | 7.925 ***   | 1.107 **                   | 0.993       |
| 60-70 years  | 6.746 ***             | 4.229 ***   | 1.206 ***                  | 1.149 ***   |
| ≥ 70 years   | Ref.                  | Ref.        | Ref.                       | Ref.        |
| <b>Charlson index</b>  |                       |             |                            |             |
| 0  | 1.833 ***             | 1.916 ***   | 1.471 ***                  | 1.492 ***   |
| 1  | 1.271                 | 1.281       | 1.289 ***                  | 1.404 ***   |
| ≥ 2  | Ref.                  | Ref.        | Ref.                       | Ref.        |
| <b>In situ carcinoma</b>   |                       |             |                            |             |
| No   | 0.324 ***             | 0.377 ***   | 3.391 ***                  | 3.789 ***   |
| Yes  | Ref.                  | Ref.        | Ref.                       | Ref.        |
| <b>Complete mastectomy with axillary node dissection</b>                 |                       |             |                            |             |
| No   | 3.421 ***             | 5.918 ***   | 5.894 ***                  | 7.286 ***   |
| Yes  | Ref.                  | Ref.        | Ref.                       | Ref.        |
| <b>Chemotherapy during the year</b>                                      |                       |             |                            |             |
| No   | 2.773 ***             | 2.248 ***   | na                         | na          |
| Yes  | Ref.                  | Ref.        | na                         | na          |
| <b>Median income</b>   |                       |             |                            |             |
| Low (< 33%)  | 0.703 ***             | 0.856 **    | 0.907 **                   | 0.933 **    |
| Average (33-66%)   | 0.912                 | 0.986       | 0.943                      | 0.988       |
| High (> 66%)   | Ref.                  | Ref.        | Ref.                       | Ref.        |
| <b>Hospital characteristics</b>  |                       |             |                            |             |
| <b>Type of hospital</b>  |                       |             |                            |             |
| Regional Teaching Hospital   | 4.384 ***             | 3.347 ***   | 3.582 ***                  | 1.726 **    |
| Cancer Centre  | 5.894 ***             | 3.702 ***   | 19.259 ***                 | 2.599 **    |
| Private not-for-profit establishment                                     | 2.326                 | 3.133 ***   | 1.559                      | 0.792       |
| Private for-profit establishment   | 3.142 ***             | 2.948 ***   | 0.783                      | 0.928       |
| Public Hospital  | Ref.                  | Ref.        | Ref.                       | Ref.        |
| <b>Patient volumes (number of annual cases of breast cancer surgery)</b> |                       |             |                            |             |
| ≤ 21   | 0.280 ***             | 0.193 **    | 0.048 ***                  | 0.117 ***   |
| 22-49  | 0.355 ***             | 0.433 ***   | 0.082 ***                  | 0.479 ***   |
| 50-110   | 0.563 **              | 0.815       | 0.367 ***                  | 0.558 ***   |
| > 110  | Ref.                  | Ref.        | Ref.                       | Ref.        |
| Numbers  | 15 166                | 16 707      | 54 904                     | 62 250      |
| Intra-class Correlation Coefficient (ICC)                                | 0.501                 | 0.311       | 0.668                      | 0.412       |
| Median odds ratios (MOR)   | 5.625                 | 3.200       | 11.538                     | 4.256       |

Significance thresholds: \* 10 %, \*\* 5 %, \*\*\* 1 %.  
**Sources:** PMSI MCO, SAE (2005, 2012). [Download the data](#)

cancer surgery patient volumes of the hospital in which the patient was treated. For instance, the probability of having an IBR was twice as high in the hospitals that carried out more than 110 cases of breast cancer surgery per year compared with hospitals that practised between 50 and 110 surgical interventions.

\* \* \*

The analysis of the progress in the use of three surgical procedures for breast cancer treatment shows that surgical practices changed greatly between 2005 and 2012. The rates of conservative treatments increased, while the practice of the sentinel lymph node biopsy, which is less invasive than axillary lymph node dissection, was disseminated in most of the hospitals. Immediate reconstruction after a mastectomy was still relatively infrequent in 2012, despite the increase in the number of women who underwent this intervention (+25%). The low rates of immediate breast reconstruction, compared with North-American countries (Zhong and al., 2014), may be linked to the dissuasive payment of this practice in France. Until 2011, mastectomies with or without immediate reconstruction were remunerated at the same rate in the healthcare facilities.

Despite the dissemination of these interventions between 2005 and 2012, the use of these procedures varies across hospitals and départements (regions). The regional disparities in the practice of these three interventions suggest that the likelihood of benefitting from these treatments varied according to the patients' place of residence. These differences may partly reflect patients' health status and preferences. They may also reveal the variations in healthcare supply, and in availability of technical platforms and surgeons, as well as their medical practices. For instance, the chances of having immediate breast reconstruction, which requires the dual skills of an oncology surgeon and plastic surgeon, will be greater for patients who live near départements holding healthcare facilities that provide this kind of treatment. About the number of tumorectomies, regional disparities may also reflect differences in the local capacities for screening and

diagnosis (advanced tumours most often require a mastectomy). The availability of adjuvant treatments and their cost for the patients in terms of non-reimbursed expenditure and access times (distances) may also be factors that influence the decision to carry out conservative surgery rather than a mastectomy.

Variations observed in the practice of these interventions were also largely related to the configuration of the cancer treatment services because the practices varied according to hospital categories. The Cancer Centres (CLCC), followed by the Regional Teaching Hospitals, were distinguished by higher rates of the interventions studied (except for conservative surgery in the CLCC), as were hospitals with a high volume of activity. At the same time, significant variations within the different categories of hospitals (intra-category disparities) suggest that

there are scopes for progress. In cancer care, the treatment is multidisciplinary, but the surgeons play an important role in managing most of the decisions. The variations observed with regard to the hospitals may indicate that the surgeons work in different environments and have preferences that may vary according to local culture and practices.

Our analyses have highlighted the existence of inequalities in surgical breast cancer treatments. Surgical practices vary across hospitals and by the volume of activity. While the policy of introducing minimal activity thresholds is fully justified, it is equally important to inform patients and health professionals about the variations in existing practices to improve the care quality and to ensure that everyone has the same treatment opportunities throughout France. ♦

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