



## Original article

# Hospital organizational factors affect the use of immediate breast reconstruction after mastectomy for breast cancer in the Netherlands



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## ABSTRACT

**Objectives:** Significant hospital variation in the use of immediate breast reconstruction (IBR) after mastectomy exists in the Netherlands. Aims of this study were to identify hospital organizational factors affecting the use of IBR after mastectomy for ductal carcinoma in situ (DCIS) or invasive breast cancer (BC) and to analyze whether these factors explain the variation.

**Materials and methods:** Patients with DCIS or primary invasive BC treated with mastectomy between 2011 and 2013 were selected from the national NABON Breast Cancer Audit. Hospital and organizational factors were collected with an online web-based survey. Regression analyses were performed to determine whether these factors accounted for the hospital variation.

**Results:** In total, 78% (n = 72) of all Dutch hospitals participated in the survey. In these hospitals 16,471 female patients underwent a mastectomy for DCIS (n = 1,980) or invasive BC (n = 14,491) between 2011 and 2014. IBR was performed in 41% of patients with DCIS (hospital range 0–80%) and in 17% of patients with invasive BC (hospital range 0–62%). Hospital type, number of plastic surgeons available and attendance of a plastic surgeon at the MDT meeting increased IBR rates. For invasive BC, higher percentage of mastectomies and more weekly MDT meetings also significantly increased IBR rates. Adjusted data demonstrated decreased IBR rates for DCIS (average 35%, hospital range 0–49%) and invasive BC (average 15%, hospital range 0–18%).

**Conclusion:** Hospital organizational factors affect the use of IBR in the Netherlands. Although only partly explaining hospital variation, optimization of these factors could lead to less variation in IBR rates.

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## 1. Introduction

Current surgical treatment of breast cancer patients consists of either breast conserving surgery or mastectomy. A mastectomy is performed in about 40% of invasive breast cancer patients and in approximately 33% of patients with a ductal carcinoma in situ [1–3]. An increasing number of patients desire restoration of their

breast contour following mastectomy and consequently breast reconstruction has become an integral part of breast cancer treatment [4]. The breast can be reconstructed during the initial operation following mastectomy (immediate breast reconstruction (IBR)) or at a later time (delayed breast reconstruction) [2].

IBR has proven to be safe in terms of local recurrence and long-term survival rates compared to mastectomy only [5,6]. Moreover, IBR offers women psychological benefits in terms of recovery and improved quality of life and is associated with superior aesthetic results compared to delayed breast reconstruction [5–7]. Guidelines emphasize the importance of reconstruction after mastectomy and recommend clinicians to discuss the possibility of IBR

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### Abbreviations

MDT	multidisciplinary team
IBR	immediate breast reconstruction
NBCA	Nabon Breast Cancer Audit
BC	breast cancer

with every patient undergoing mastectomy [2,8,9].

Despite the benefits of IBR, the percentage of patients with DCIS or invasive breast cancer actually undergoing IBR after mastectomy is approximately 20% in the Netherlands. Large hospital variation in the use of IBR was found previously, ranging from 0 to 64% for invasive breast cancer and 0–83% for DCIS [10]. Comparable IBR rates were shown in other international studies; IBR was performed in 21% of the postmastectomy patients in the United Kingdom and 24% in the United States [2,11,12]. Literature has demonstrated that patient and tumor factors such as age, social economic status, multifocality, tumor type, clinical tumor stage, clinical lymph node stage, grade and previous breast surgery are predictors of the use of IBR [10,11,13–17]. However, these patient and tumor factors do not fully explain the large variation between hospitals in the Netherlands [10].

The aim of the present study was to investigate which hospital and hospital organizational factors affect the use of IBR after mastectomy for DCIS and invasive breast cancer in the Netherlands and whether these factors account for the variation seen.

## 2. Material and methods

### 2.1. Data source

Data of the NABON Breast Cancer Audit (NBCA) was used to obtain information on breast cancer patients in the Netherlands. The NBCA is a national multidisciplinary quality improvement register in which all 92 hospitals in the Netherlands participate and is supported by the Dutch Institute of Clinical Auditing (DICA) and the Netherlands Comprehensive Cancer Organization (IKNL) [18]. Information concerning patient, tumor, diagnostics and treatment is continuously collected prospectively either by the hospitals themselves or by data managers of the Netherlands Cancer Registry (NCR).

### 2.2. Study population

All female patients diagnosed with DCIS or invasive breast cancer between January 1st, 2011 and December 31st, 2013 who underwent a mastectomy were selected.

### 2.3. Hospital organizational factors based on data from the NBCA

Hospitals were categorized as district hospitals, teaching hospital (despite educational activities, not affiliated with a medical faculty), university hospitals (hospitals having a medical faculty) and cancer specific hospitals (hospitals only treating cancer patients). According to the number of new breast cancer patients annually diagnosed in a hospital, three groups were identified (group 1: 1–150, group 2: 150–300, group 3: >300 patients per year). The percentage of mastectomies (related to all surgical excisions) were categorized in three groups (group 1: 0–30%, group 2: 30–50% and group 3: >50%).

### 2.4. Survey

All 92 hospitals were invited to complete a web-based survey regarding hospital organization factors. Questions encompassed the number of weekly MDT meetings (1, 2, >2 times per week), the presence of the various disciplines involved in breast cancer care participating the MDT meeting (e.g., nurse practitioners, pathologists, radiation oncologists, radiologists and medical oncologists), number of plastic surgeons available at institution per 100 new diagnoses of breast cancer (0–0.5, 0.5–2.5 and > 2.5), number of breast surgeons available at institution per 100 new diagnoses of breast cancer (0–1.5, 1.5–2.5 and > 2.5) and the presence of a plastic surgeon at weekly MDT meeting (never/incidental, structural). “Never” refers to hospitals where no plastic surgeon was attending the weekly MDT meetings and “incidental” only incidentally on request. Only patients of hospitals that responded to the survey were included for analyses. In case data were missing, we categorized them as unknown.

### 2.5. Statistical analyses

DCIS and invasive breast cancer were analyzed separately. Factors tested for confounding were age, social economic state (SES), multifocality, clinical tumor stage, clinical lymph node stage, grade and radiation therapy. With use of logistic regression models hospital organizational factors were related to the prevalence of IBR and were presented as odds ratio's with 95% confidence intervals (95% CIs). Factors that demonstrated to significantly affect IBR rates in univariable analyses ( $p < 0.10$ ) were included in the multivariable analyses.

Hospital performance of IBR was visualized with the use of a funnel plot. In the funnel plots the volume is based on the number of mastectomies (and not the total number of breast cancer diagnosis treated per hospital) over 3 years. Actually, in the Netherlands, 60% of the patients are treated with breast conserving surgery, so the actual hospital volume of breast cancer patients is much higher. Data were analyzed unadjusted and adjusted for patient, tumor and hospital organizational factors significantly affecting the use of IBR. Since the data is organized at more than one level and is clustered for the individual hospitals, multilevel analysis was performed. Not all organizational characteristics of the hospitals were known, but with use of a multilevel analysis, all hospital depending factors were taken into account in the adjusted data. All statistical analyses were performed in STATA (version 13.1 2013, Texas).

## 3. Results

### 3.1. Study population

Seventy-two hospitals (78.3%) responded to the survey leading to inclusion of 16,471 patients with a mastectomy for DCIS ( $n = 1,980$ ) and invasive breast cancer ( $n = 14,491$ ) (Table 1). Almost 90% of the responding hospitals were categorized as a district or teaching hospital and most (85%) of the hospitals had 0–300 diagnosis annually. In most hospitals, one MDT meeting per week was organized and one hospital reported to have a daily MDT meeting (Table 1). All disciplines related to breast cancer care (e.g., surgeons, medical oncologists, radiation oncologists, radiologists, pathologists, nurse practitioners) structurally attended the MDT meetings. In 71% of the hospitals a plastic surgeon was structurally attending the MDT meeting. In most hospitals the geneticist, psychologist and palliative care expert were incidentally present. Eighty percent of the hospitals reported to offer plastic surgical care for breast cancer patients. In 83% of the responding hospitals,

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