

# Variations in the treatment of early-stage breast cancer in Quebec between 1988 and 1994

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## Abstract

**Background:** The influence of organizational factors on the process and outcomes of the treatment of breast cancer has been extensively investigated. Although the quality of care is presumed to be better in larger centres, evidence is inconsistent. This study was conducted to determine whether therapies for patients with breast cancer varied according to hospital caseload.

**Methods:** Women newly diagnosed between 1988 and 1994 with early-stage node-negative primary breast cancer were randomly selected from the Quebec tumour registry and the Quebec hospital discharge database. Data were collected from medical charts, and only women having undergone dissection of the axilla were included in the analyses. Logistic regression analysis was used to adjust for case mix and organizational variables.

**Results:** The final sample included 1259 patients with node-negative stage I or II primary breast cancer. The proportion of women who underwent breast-conserving surgery increased significantly with hospital caseload (from 78.0% in hospitals admitting fewer than 25 new cases each year to 88.0% in those admitting 100 patients or more;  $p$  for trend  $< 0.001$ ). This trend remained significant even after statistical adjustment for case mix and organizational factors ( $p$  for trend = 0.001). Of the 1039 women who underwent breast-conserving surgery 965 (92.9%) received radiotherapy. Use of systemic adjuvant therapy (tamoxifen or chemotherapy, or both) increased with the number of patients treated in a given centre (from 60.1% to 68.5%), but this trend disappeared after adjustment for case mix and other factors. The proportion of patients receiving systemic adjuvant therapy consistent with published consensus guidelines tended to increase with caseload for those treated in hospitals participating in multicentre clinical trials but decrease with caseload for patients in hospitals not involved in clinical research.

**Interpretation:** The care of patients in Quebec with early-stage breast cancer is characterized by a high prevalence of both breast-conserving surgery and systemic adjuvant therapy. Large centres, especially those actively involved in clinical research, rapidly adopt innovative therapeutic modalities.

The reform of the Quebec health care system has vastly modified the delivery of care in hospital settings. The merging of resources into networks of affiliated hospitals, initially justified by economical incentives, is also consistent with the notion that the quality of care is better in larger centres.

Organizational factors related to the patterns of treatment and treatment outcomes in oncology and, more specifically, those related to breast cancer have been thoroughly investigated. Hospital characteristics that have been reported to significantly affect treatment and outcomes include the teaching status<sup>1-11</sup> and location<sup>1,8,12-15</sup> of the hospital, patient volume,<sup>5,7,8,12,14,16-22</sup> and the onsite availability of specialized services needed for treatment.<sup>1,7,10,20,23,24</sup> In addition, more favourable outcomes have been demonstrated among women treated by physicians who have larger caseloads or more experience with patients with breast cancer.<sup>16,18,25-28</sup>

The influence of organizational factors on the management of breast cancer



## Evidence

## Études

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in Canada was investigated by Iscoe and colleagues;<sup>29</sup> they analysed the number of patients undergoing breast-conserving surgery by county and by hospital in Ontario and found a strong hospital effect but no effect of hospital caseload. In a survey of breast cancer cases in Ontario and British Columbia, Goel and associates<sup>11</sup> reported a significant association between breast-conserving surgery and radiation therapy and the academic affiliation of both the hospital and the attending physician, but not with the number of beds in a given hospital. Finally, in a report on systemic adjuvant therapy for breast cancer in British Columbia, Olivotto and colleagues<sup>24</sup> concluded that compliance with provincial practice guidelines was more likely to occur in a cancer centre than in a community hospital.

The goal of this study was to investigate whether treatment for breast cancer in hospitals in Quebec varied by hospital caseload and whether patients treated in larger centres were more likely to receive optimal treatment.

## Methods

Details on sample selection and data collection are provided elsewhere.<sup>30,31</sup> In brief, patients with breast cancer living in various regions of Quebec were randomly selected from the Quebec tumour registry for the periods Apr. 1 to Mar. 31, 1988/89 and 1991/92, and from the Quebec hospital discharge database, Apr. 1 to Mar. 31, 1993/94. The sample was restricted to women who underwent dissection of the axilla and had node-negative stage I or II disease. The sample was stratified according to whether the hospital participated in multicentre clinical trials; trials sponsored by the pharmaceutical industry were excluded.

Data were obtained from medical charts and other sources (e.g., oncology registries and pharmacy databases) after the necessary approvals were obtained from the Commission d'accès à l'information du Québec, the directors of professional services and the research ethics committees of the collaborating institutions. Information was abstracted about the patient, the attending physician, the hospital of primary care, characteristics of the tumour and the treatments received within 6 months of diagnosis for patients who received chemotherapy or within 12 months for those who received radiation and tamoxifen therapy. Locoregional management consistent with consensus recommendations was defined according to the National Institutes of Health<sup>32</sup> as total mastectomy with lymph node dissection or breast-conserving surgery with both dissection of the axilla and radiotherapy. We assessed the consistency of systemic adjuvant therapy with published standards using the St. Gallen 1992 consensus statement for node-negative cases<sup>33</sup> as a reference. Patients under experimental protocols were automatically classified as having had treatment consistent with standards. The criteria defined by the American Joint Committee on Cancer<sup>34</sup> were used for staging, and the highest grade assigned by any method was used in the analysis. This information was missing for 33.5% of the cases, however. Data on breast cancer caseload for each hospital were obtained from the Quebec tumour registry; caseload was divided into 4 categories: fewer than 25 newly diagnosed cases of breast cancer per year, 25–49 new cases, 50–99 new cases and more than 100 cases.

The association of each treatment with caseload was assessed by univariate methods and multivariate logistic regression analysis. Data were examined using successive categorizations of case-

load into 2, 4, 5, 6 and 16 groups. Multivariate models also included patients' age, tumour size and grade, histology and estrogen receptor level, availability of onsite radiotherapy, number of years in practice of the attending physician and the date and location of treatment. Because of collinearity between hospital caseload and teaching status, the teaching status of the hospital was omitted from the analysis. Variances were adjusted for the large sampling fraction.<sup>35</sup> Results of categorical analyses were contrasted with those of generalized additive models with smoothing splines<sup>36</sup> using data from individual patients and adjusting for differences in case mix. Trends with caseload and the frequency of specific therapies were assessed by visual inspection of the curves. When results of both types of multivariate analyses were consistent aggregated data on treatment according to caseload are presented.

## Results

The study population included 1259 women with invasive breast cancer; 421 (33.4%) had their cancer diagnosed in 1988/89, 377 (29.9%) in 1991/92 and 461 (36.6%) in 1993/94. In all, 374 (29.7%) were less than 50 years of age, 653 (51.9%) were between 50 and 69 years, and 232 (18.4%) were 70 years or older. Two-thirds (66.7% [840]) had stage I cancer, and about one-third (31.3% [394]) had stage II cancer; staging could not be done for 25 (2.0%) patients because of insufficient information in the charts. Adjustment for the sampling scheme did not substantially modify the results and was therefore ignored.

The distribution of cancer patients by hospital caseload was as follows: 168 patients (13.3%) were admitted to hospitals that saw fewer than 25 new cases of breast cancer each year, 344 (27.3%) to centres that admitted between 25 and 49 cases, 287 (22.8%) to hospitals that admitted between 50 and 99 cases, and 460 (36.5%) to hospitals with 100 or more new cases of breast cancer each year. Of the 1259 women 186 (14.8%) were cared for by a physician with less than 10 years of experience, and 206 (16.4%) were cared for by one who had been in practice for 30 years or more. Overall, 1039 (82.5%) of the women had breast-conserving surgery, and among them 965 (92.9%) also received radiotherapy. Adjuvant systemic therapy with tamoxifen or chemotherapy, or both, was prescribed to 809 (64.3%) women.

The proportion of patients receiving each of the treatments considered in this study tended to increase with hospital caseload (Table 1). This trend was most significant for patients who underwent breast-conserving surgery: from 131 (78.0%) of 168 patients in centres with fewer than 25 new cases each year to 405 (88.0%) of 460 cases in hospitals admitting 100 patients or more ( $p$  for trend < 0.001). The trend remained highly significant even after differences in case characteristics and other organizational factors were taken into account ( $p$  for trend = 0.001). Among the women who had breast-conserving surgery the proportion who also received radiotherapy was very high and varied little with hospital caseload (Table 1).

Definitive locoregional treatment and the use of sys-



temic therapy increased with caseload (from 92.9% to 96.1% and from 60.1% to 68.5%, respectively), but neither trend was significant in the multivariate analysis ( $p$  for trend = 0.10 and 0.08, respectively). The same was true when patients receiving systemic adjuvant therapy consistent with published guidelines were compared by hospital caseload ( $p$  for trend after adjustment = 0.70).

The association between treatment for breast cancer and hospital caseload was compared for hospitals that were and were not involved in multicentre clinical trials (Table 2). Of the 1259 patients 682 (54.2%) were admitted to hospitals involved in multicentre trials. Despite the small number of patients in some of the groups created when patients were

compared across hospital status and caseload, the trends detected were similar, except for patients who received systemic treatment consistent with published guidelines. After adjustment for differences in case mix the proportion of patients receiving systemic treatment consistent with guidelines increased with caseload in research hospitals, whereas the opposite trend was observed in centres not involved in clinical research (Table 3).

**Table 1: Treatment received by patients diagnosed with early-stage breast cancer, stratified by hospital caseload\***

Treatment; hospital caseload	% (and no.) of patients receiving treatment	Adjusted odds ratio† (and 95% CI)
<b>Breast-conserving surgery</b>		
< 25	78.0 (131/168)	1.0
25–49	76.2 (262/344)	1.0 (0.7–1.4)
50–99	84.0 (241/287)	1.4 (0.9–2.1)
≥ 100	88.0 (405/460)	1.8 (1.2–2.8)
$p$ value for trend	< 0.001	0.001
<b>Radiotherapy‡</b>		
< 25	90.8 (119/131)	1.0
25–49	90.5 (237/262)	0.9 (0.5–1.6)
50–99	94.6 (228/241)	2.0 (1.0–3.9)
≥ 100	94.1 (381/405)	1.4 (0.7–3.0)
$p$ value for trend	< 0.001	0.07
<b>Locoregional management consistent with consensus guidelines</b>		
< 25	92.9 (156/168)	1.0
25–49	92.7 (319/344)	0.9 (0.5–1.5)
50–99	95.5 (274/287)	1.7 (0.9–3.2)
≥ 100	96.1 (442/460)	1.4 (0.7–2.9)
$p$ value for trend	< 0.001	0.10
<b>Systemic adjuvant therapy</b>		
< 25	60.1 (101/168)	1.0
25–49	61.6 (212/344)	1.0 (0.7–1.3)
50–99	63.1 (181/287)	1.1 (0.8–1.5)
≥ 100	68.5 (315/460)	1.3 (0.9–1.8)
$p$ value for trend	0.001	0.08
<b>Systemic adjuvant therapy consistent with consensus guidelines</b>		
< 25	70.6 (96/136)	1.0
25–49	65.4 (189/289)	0.8 (0.5–1.1)
50–99	64.6 (155/240)	0.7 (0.5–1.0)
≥ 100	75.0 (327/436)	1.0 (0.7–1.5)
$p$ value for trend	0.004	0.70

Note: CI = confidence interval.  
 \*Number of new cases seen each year.  
 †Adjusted for patient's age, tumour size, grade, histology and estrogen receptor level, onsite radiotherapy, years in practice of the attending physician, and year and location of treatment.  
 ‡Among women who underwent breast-conserving surgery.

**Table 2: Treatment received, stratified by hospitals' involvement in clinical research\***

Treatment; hospital caseload	Hospital status; no. (and %) of patients	
	Involved in clinical research	Not involved in clinical research
<b>Breast-conserving surgery</b>		
< 25	6 (75.0)	125 (78.1)
25–49	35 (59.3)	227 (79.7)
50–99	134 (86.5)	107 (81.1)
≥ 100	405 (88.0)	–
<b>Radiotherapy</b>		
< 25	6 (100.0)	113 (90.4)
25–49	35 (100.0)	202 (89.0)
50–99	124 (92.5)	104 (97.2)
≥ 100	381 (94.1)	–
<b>Locoregional management consistent with guidelines</b>		
< 25	8 (100.0)	148 (92.5)
25–49	59 (100.0)	260 (91.2)
50–99	145 (93.6)	129 (97.7)
≥ 100	442 (96.1)	–
<b>Systemic adjuvant therapy</b>		
< 25	8 (100.0)	93 (58.1)
25–49	39 (66.1)	173 (60.7)
50–99	103 (66.5)	78 (59.1)
≥ 100	315 (68.5)	–
<b>Systemic adjuvant therapy consistent with guidelines</b>		
< 25	7 (100.0)	89 (69.0)
25–49	37 (68.5)	152 (64.7)
50–99	100 (70.9)	55 (55.6)
≥ 100	327 (75.0)	–

\*Collaboration in multicentre clinical trials other than those sponsored by the pharmaceutical industry.

**Table 3: Consistency of systemic adjuvant therapy with consensus guidelines**

Hospital caseload	Hospital status; adjusted odds ratio (and 95% CI)	
	Involved in clinical research	Not involved in clinical research
< 25	–	0.8 (0.5–1.1)
25–49	0.6 (0.3–1.1)	0.6 (0.4–0.9)
50–99	0.9 (0.7–1.3)	0.3 (0.2–0.5)
≥ 100*	1.0	–

Note: – indicates cells with fewer than 10 subjects.  
 \*Reference category.



## Interpretation

Our results suggest that the care of patients with breast cancer in Quebec hospitals varies according to hospital caseload. However, except for patients who underwent breast-conserving surgery, trends with caseload were substantially reduced after statistical adjustment for differences in case mix and characteristics of the hospitals and physicians.

Many studies support the notion that a large hospital caseload is associated with the adoption of therapeutic innovations and discourages inappropriate interventions;<sup>5,8,12,16,17,19-22</sup> not all studies support this notion, however.<sup>7,11,14,18,29,37</sup> The strong attenuation of most effects observed in this study after adjusting for potential confounding variables highlights both the relation between caseload and other hospital- and physician-related variables and the need for appropriate analytic strategies.<sup>38</sup>

Surgical management of breast cancer was the treatment most significantly associated with hospital caseload after adjustment. The clinical significance of these results and the associated policy implications can be debated. It has been shown that women receiving systemic adjuvant therapy often will agree to undergo treatments that may be of only small benefit to them.<sup>39</sup> We believe that a 10% difference (i.e., from hospitals with the smallest to those with the largest caseloads) in the probability of having breast-conserving surgery could be an important determinant in where treatment is sought.

One of the most striking observations of our study is the extremely high rate of breast-conserving surgery performed among these early-stage cancer patients: 78.0% to 88.0% of patients. This contrasts with data from the United States for all cases of breast cancer: 30% of patients underwent breast-conserving surgery between 1983 and 1986,<sup>1</sup> as did 21.2% of privately insured patients and 27.2% of Health Maintenance Organization patients between 1983 and 1990.<sup>40</sup> In 1991, 67.6% of node-negative patients in Ontario and 43.8% in British Columbia underwent breast-conserving surgery.<sup>11</sup>

Limitations of our study include the restricted availability of the data recorded in medical charts, which was likely to be more substantial for systemic adjuvant treatment than for surgical interventions. In addition, comorbidity was not assessed, and the adjustment for differences in case mix between institutions may have been incomplete. Women admitted for primary treatment in smaller centres in Quebec were usually referred to larger hospitals for subsequent evaluation, and this probably reduced the differences reported between hospitals in the proportion of patients receiving systemic adjuvant therapy. Finally, we did not evaluate survival or disease-free survival as related to caseload because the duration of follow-up would still be too short. This, however, remains the ultimate "gold standard" against which practice patterns should be judged.

In conclusion, our data suggest that large centres, especially those actively involved in clinical research, rapidly

adopt innovative therapeutic modalities for the treatment of breast cancer and support both the promotion of clinical research and the amalgamation of health care resources to ensure optimal care of women with breast cancer.

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