Variation in breast cancer surgery in Ontario

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Objectives: To analyse the extent of variation by county and hospital in the use of breast-conserving surgery in the initial management of breast cancer and to assess some factors that might explain the observed variation.
Design: Population-based retrospective cohort study.
Setting: Ontario.
Patients: All women with breast cancer newly diagnosed from Jan. 1, 1989, to Dec. 31, 1991.
Main outcome measure: Proportion of women undergoing unilateral breast cancer surgery who had breast-conserving surgery in each hospital and county.
Results: Of the 14 570 women with newly diagnosed breast cancer 12 815 (88.0%) underwent unilateral breast cancer surgery. The mean proportion of breast-conserving procedures by county was 52% and ranged from 11% to 84%. The proportion of breast-conserving procedures in individual hospitals with one or more cases of breast cancer per month ranged from 6% to 84%. The variations in the rates between hospitals was greater than that expected by chance alone ($p < 0.0001$).
Conclusions: There was marked variation at the hospital and county level in the use of breast-conserving surgery in the initial management of breast cancer. This variation was strongly associated with the hospital where the surgery was performed.

Objectifs : Analyser l'importance de la variation, selon le comté et l'hôpital, du nombre d'interventions chirurgicales non mutilantes pratiquées comme traitement initial du cancer du sein et évaluer certains facteurs qui pourraient expliquer la variation observée.
Conception : Étude rétrospective de cohortes fondée sur la population.
Contexte : Ontario.
Patientes : Toutes les femmes atteintes d'un cancer du sein qui venait d'être diagnostiqué, entre le 1er janvier 1989 et le 31 décembre 1991.
Principale mesure des résultats : Proportion des femmes devant subir une intervention chirurgicale contre un cancer du sein unilatéral qui ont subi une intervention non mutilante dans chaque hôpital et chaque comté.
Résultats : Parmi les 14 570 femmes chez lesquelles on a diagnostiqué un cancer du sein, 12 815 (88,0 %) ont subi une intervention chirurgicale contre un cancer du sein unilatéral. La

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moyenne des interventions non mutilantes selon le comté s'est établie à 52 % et a varié de 11 % à 84 %. La proportion des interventions non mutilantes dans chaque hôpital qui a traité un ou plusieurs cas de cancer du sein par mois a varié de 6 % à 84 %. Les variations des taux entre les hôpitaux ont été supérieures à ce que l'on pouvait attribuer du hasard seulement ($p < 0,0001$).

Conclusions : On a constaté, au niveau des hôpitaux et des comtés, une variation importante quant au nombre d'interventions chirurgicales non mutilantes pratiquées comme premier traitement du cancer du sein. La variation était liée de près à l'hôpital où l'opération s'est faite.

In 1985 the report of the National Surgical Adjuvant Breast Project (NSABP) B-06 trial revealed that women with early-stage breast cancer who underwent breast-conserving surgery and postoperative radiation of the residual breast tissue had the same clinical outcomes as women who underwent mastectomy.[1] This meant that a woman willing to receive postoperative breast irradiation and in whom the tumour was no larger than 4 cm in diameter could legitimately choose to have a breast-conserving procedure, provided the tumour could be excised with clean margins and a satisfactory cosmetic result could be achieved. Data from the Ontario Cancer Registry for 1980 to 1989 showed that surgeons performing breast cancer surgery in Ontario responded to the trial's findings by changing how they treated breast cancer.[2] The extent to which they used breast-conserving procedures at the end of the decade exceeded that of their US counterparts.[3,4]

Using procedure data linked to the diagnosis of breast cancer, we sought to determine the current variation in the use of breast-conserving procedures throughout Ontario. Is practice fairly homogeneous or are there hospitals or regions where practice proceeds as if the NSABP trial had never occurred? Data from the United States suggest that some states lag far behind others in adopting breast-conserving surgery.[3,4] If significant variation exists, could identifiable factors be associated with a particular practice style? For example, would the frequency of breast-conserving surgery be related to the involvement of the institution in the NSABP trial, the academic affiliation of the institution, the presence of either radiation or chemotherapy treatment programs, the number of cases of breast cancer managed or the size of the community?

Methods

The Ontario Cancer Registry was established by the Ontario Cancer Treatment and Research Foundation in 1964 to provide data on cancer incidence and prevalence rates in Ontario. Information in the registry is compiled from data describing hospital inpatient separations in which cancer is given as any diagnosis (data supplied by the Hospital Medical Records Institute [HMRI]). These data are linked to patient registration information obtained from one of eight regional cancer centres or the Ontario Cancer Institute–Princess Margaret Hospital as well as from inpatient and outpatient pathology reports and death registration reports in which cancer is mentioned. The linkage has been reported to be over 95% complete, varying from 91% for cutaneous melanoma to over 98% for cancer of visceral digestive organs.[5]

The registry file for Jan. 1, 1989, through Dec. 31, 1991, was searched for cases of invasive breast cancer, as defined by the International Classification of Diseases, 9th revision (ICD-9 code 174).[6] Inpatient procedure codes were identified according to the Canadian Classification of Diagnostic, Therapeutic and Surgical Procedures[7] (Appendix 1). Because any patient could have had multiple procedures associated with the initial diagnosis a hierarchy of procedures was predetermined to select the definitive or most invasive procedure used within 90 days after diagnosis of the breast cancer.

The procedures were grouped into bilateral breast-ablative procedures, unilateral breast-ablative procedures, unilateral breast-conserving procedures, other procedures and no procedure. The ratio of breast-conserving procedures to all unilateral procedures was defined as the BCS proportion. The inclusion of only patients who underwent a unilateral procedure restricted the enquiry to patients in whom the extent of breast cancer surgery was most likely to be an option. However, we did examine the ratio of patients undergoing any unilateral procedure to all patients with breast cancer by county to determine whether the omission of the patients not undergoing a unilateral procedure would introduce a bias.

Since the intent was to examine practice variation rather than access to treatment, the location of the procedure, not the residence of the patient, was used to classify the case to a specific Ontario county or hospital. To provide summary information about counties and hospitals with very low case volumes, counties and hospitals were divided into quartiles according to their total volume of incident cases of breast cancer over the study period. For descriptive purposes high-volume counties or hospitals were those with one or more cases per month.

All counties with five or fewer cases were omitted from the assessment of practice by caseload. The Ontario Cancer Registry has a requirement to preserve hospital anonymity in publications. To meet this requirement hospital groupings of three or more had to be maintained for geographic analysis. Therefore, counties with fewer than three hospitals were combined with an

adjacent county that had the closest BCS proportion. These combined regions were referred to as counties.

Hospitals were coded (a) as being affiliated with a medical school if they regularly had trainees in postgraduate surgery programs, (b) as having a chemotherapy program if there was the ability to deliver routinely cytotoxic chemotherapy to cancer patients and (c) as having radiation treatment facilities if they were adjacent to one of the eight regional cancer centres or the Princess Margaret Hospital. Because the three hospitals participating in the NSABP B-06 trial may have behaved differently as a result of their accumulated experience in the trial, a dichotomous code for trial participation was used.

A previous analysis, for the period 1980 to 1989, demonstrated that there was an interaction between the impact of the NSABP B-06 trial and patient age.[2] The greatest impact of the trial was for women under the age of 75; women older than that had a higher BCS proportion before the publication of the trial. As a result, we examined the BCS proportions by county for women less than 75 years of age at diagnosis.

The BCS proportions between levels of each of the predictive factors were compared with the use of the χ^2 test. Multiple logistic regression analysis was used to examine the simultaneous effects of predictive factors. Since many of the factors were clustered by hospital, use of patient-level data in a regression model would have underestimated variances. We therefore used a robust regression procedure to correct for this clustering.[8] To test whether variation by county and hospital arose by chance the log-likelihood ratio was tested against the null hypothesis that the logistic regression coefficients for each county and for each hospital were equal to each other. This test permits adjustment for factors that may account for differences between counties, such as patient age. A p value of less than 0.05 was considered statistically significant.

Results

During the study period 14 570 cases of breast cancer were newly diagnosed. Two of the cases did not have a county identifier and were excluded from further analysis.

Variation between counties

Overall, 52.4% of the women undergoing a unilateral procedure had breast-conserving surgery. Fig. 1 shows the distribution of BCS proportions by county caseload. Fig. 2 illustrates the geographic distribution across Ontario. The variation between counties with very low caseloads may be attributed in part to the small numbers involved. The BCS proportion ranged from 11% (based on 44 cases) to 84% (based on 37 cases). The proportion was 30% or less in 3 counties, 31% to 40% in 3 counties, 41% to 50% in 12 counties, 51% to 60% in 13 counties, 61% to 70% in 4 counties and more than 70% in 3 counties.

During the study period 52.2% of the women less than 75 years of age at diagnosis had a breast-conserving procedure. The BCS proportion by county ranged from 9% to 80% in this age group. The number of counties with one or more cases per month involving women less than 75 years of age was 34. The BCS proportions for these 34 counties were uniformly similar to those for all cases regardless of age.

Variation between hospitals

In all, 182 hospitals had at least one woman with breast cancer undergo definitive surgical management during the study period. Fig. 3 illustrates the distribution of BCS proportions by hospital caseload. The average frequency and variability of breast-conserving surgery were not related to the volume of surgical practice. Indeed, hospitals with more than one case per week (at least 157 cases over the study period) had a BCS proportion of 15% to 76%. These extremes occurred in one county, metropolitan Toronto.

Because of the large caseload in Toronto and the wide variation in breast-conserving surgery already noted, we examined this region in greater detail. Fig. 4 shows a plot of the BCS proportion against caseload groups in Toronto. Unilateral surgical procedures were performed in 4341 cases in 25 hospitals. There was little relation between caseload and the average frequency of breast-conserving surgery in metropolitan Toronto.

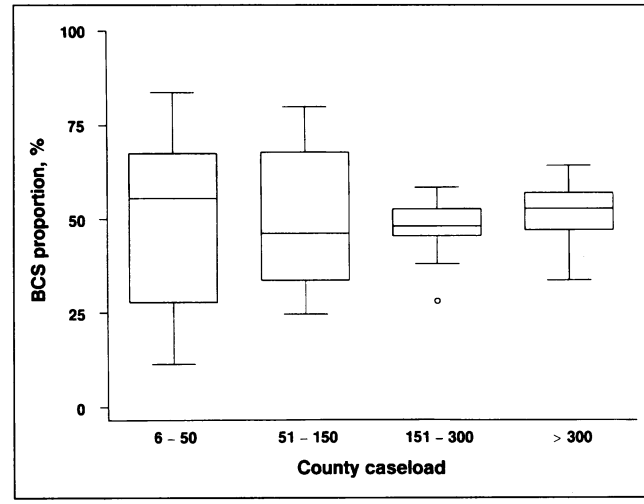

Fig. 1: Distribution of breast-conserving surgery (BCS) proportions by county caseload in Ontario from Jan. 1, 1989, to Dec. 31, 1991. The line in the middle of a box represents the median or 50th percentile, the box extending from the 25th to 75th percentile or interquartile range. The lines emerging from the box are "whiskers" and extend to adjacent values, defined as three-halves the interquartile range. Observed points more extreme than this are individually plotted. Counties with five or fewer cases during the study period are omitted.

Effect of predictive factors

Factors that could influence the use of breast-conserving surgery are reported in Table 1. The number of hospitals in each group, the number of cases of unilateral breast cancer and the BCS proportions are presented. The important predictors were participation by the hospital in the NSABP B-06 trial, affiliation of the hospital with a medical school and availability of radiotherapy on site. The presence of a chemotherapy program on site was of borderline significance. Age at diagnosis was not found to be a significant factor. The population of the town or city where the surgery was performed was correlated with the other variables but was not found to be a significant predictor. None of these factors was statistically significant individually or in a multivariate logistic model using robust regression.

The model was used to examine individual counties and the effects of individual hospitals with more than one case per month. The hypothesis tested was that the BCS proportion attributed to these various groupings was distributed randomly around a baseline proportion and could have arisen by chance. The baseline proportion chosen was that for metropolitan Toronto (54%).

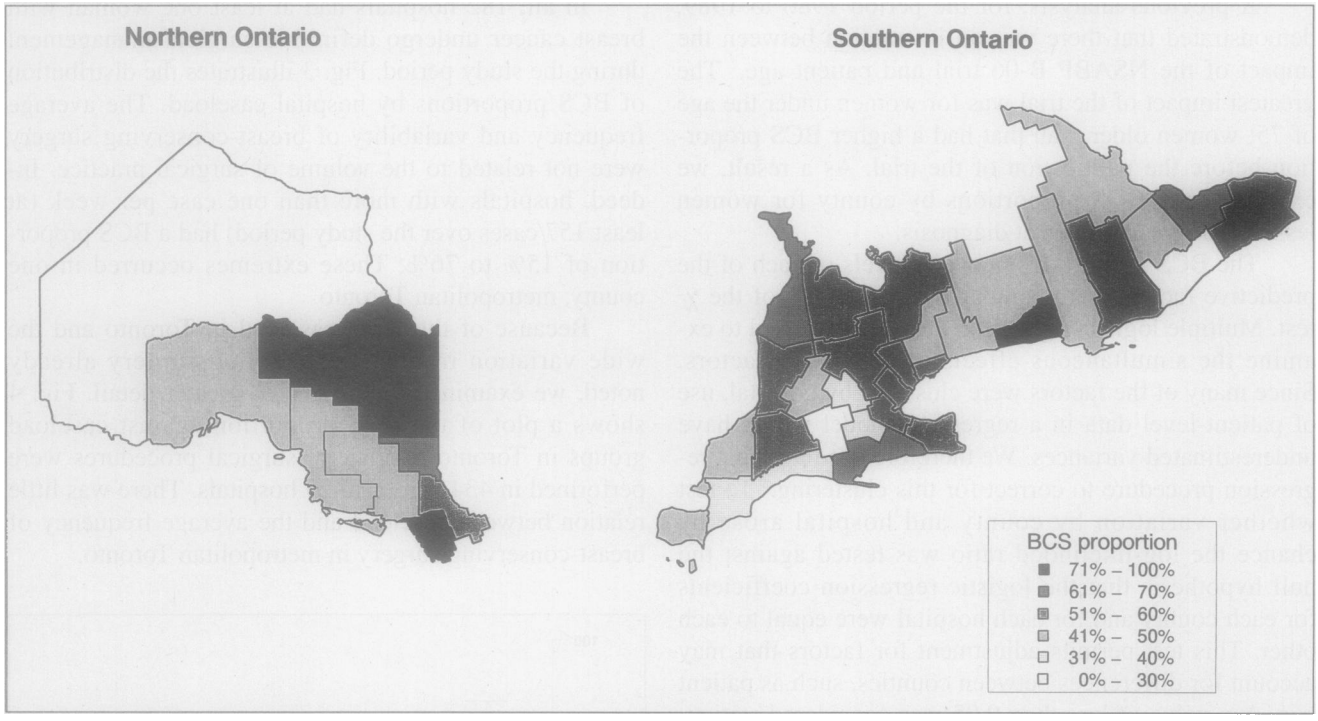

Fig. 2: Distribution of cases of breast-conserving surgery by county or region. Haliburton is excluded because no cases were registered there. Counties with fewer than three hospitals reporting breast cancer surgery are combined with neighbouring counties with the closest BCS proportion.

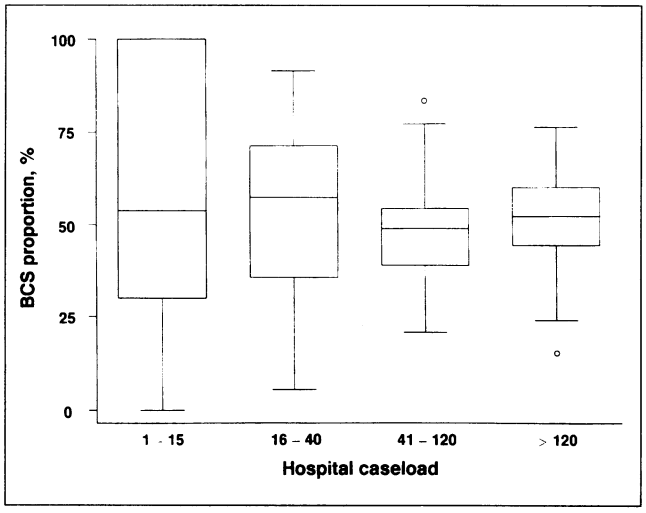

Fig. 3: BCS proportions by hospital caseload in Ontario.

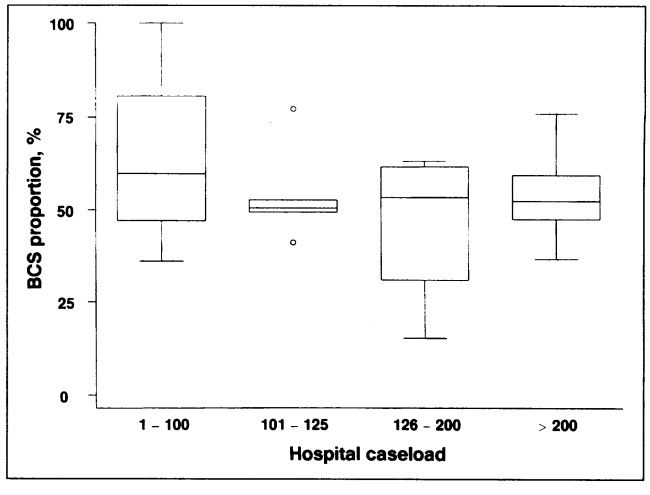

Fig. 4: BCS proportions by hospital caseload in metropolitan Toronto.

We found that the degree of variation in the BCS proportions could not have arisen by chance alone: it was due to the differences associated with individual hospitals ($\chi^2 = 613.9$, $p < 0.0001$) and not differences between counties after the effect of individual hospitals was controlled for ($\chi^2 = 1.8$, $p > 0.05$) (Table 2).

Checks against imprecision and bias

Because we were interested primarily in the proportion of women undergoing unilateral breast cancer surgery who had a breast-conserving procedure, we examined the ratio of the sum of unilateral breast-conserving and breast-ablative procedures to the number of cases of breast cancer in order to exclude the possibility of bias in subsequent analyses. During the study period 12 815 (88.0%) of all women underwent a unilateral procedure. Only three counties had a ratio below 0.80, and only one of these counties, with a ratio of 0.79, had a large number of cases (136). Ten counties had a ratio between 0.80 and 0.85, 12 between 0.85 and 0.89, 16 between 0.90 and 0.94 and 5 greater than 0.94. Given the

Table 1: Proportion of cases of unilateral breast cancer surgery that involved a breast-conserving procedure (BCS proportion) in Ontario from Jan. 1, 1989, to Dec. 31, 1991, by predictive factor

Factor	No. of hospitals	No. of cases of unilateral surgery	BCS proportion,* %
Hospital participated in NSABP B-06 trial†			
Yes	3	1 048	59.5
No	179	11 767	51.8
Hospital affiliated with medical school			
Yes	22	4 266	56.7
No	160	8 549	50.2
Radiotherapy available at hospital			
Yes	8	1 155	58.8
No	174	11 660	51.8
Chemotherapy program at hospital			
Yes	47	7 309	53.3
No	135	5 506	51.2
Age of patient at diagnosis, yr			
< 50	–	3 003	51.9
50–64	–	4 188	51.4
65–74	–	3 194	52.8
≥ 75	–	2 386	53.4

*No statistically significant difference was found in robust regression.
†NSABP = National Surgical Adjuvant Breast Project.

Table 2: Results of log-likelihood ratio test to determine whether variations in BCS proportions by county and hospital arose by chance

Null hypothesis	Crude χ^2 value (and degrees of freedom)	*p* value
All county rates are the same	422.6 (43)	< 0.0001
All high-volume hospital* rates are the same	870.9 (93)	< 0.0001
County rates are the same after controlling for individual hospitals	1.8 (2)	0.407
Hospital rates are the same after controlling for individual counties	613.9 (61)	< 0.0001

*Hospitals with one or more cases of breast cancer per month.

high degree of uniformity, particularly in counties with high caseloads, we believe that there was no meaningful bias introduced by our examination of the proportion of all unilateral surgical procedures that were breast-conserving procedures.

The data reported do not include outpatient surgical procedures. To assess the stability of our data the HMRI inpatient and outpatient data files for the fiscal year May 1, 1991, to Apr. 30, 1992, were examined. This was the first year for which complete ambulatory procedure records were available. We used the same rules as those for selecting the most definitive procedure, and the data for only counties with more than 11 cases in this interval were compared with our 1989–91 data. Unilateral procedures were performed in 6171 women with breast cancer. Of the 47 counties 42 had caseloads ranging from 12 to 1826. Of the nine high-volume counties in the 1989–91 set of data with a BCS proportion below 40%, eight remained among the nine with the lowest proportion on the basis of the HMRI data. The seven counties with a BCS proportion of more than 60% according to the 1989–91 data remained at the same level or were at a higher one on the basis of the HMRI data.

Discussion

Descriptions of regional variations in the delivery of medical services have been cited by critics as indicative of the need for better management of medical practice. However, analysts interested in variations in procedure rates have faced difficulties in determining whether there is any right rate against which practice patterns should be compared. In one striking example, Rand Corporation researchers could not find consistent correlations between rates of procedure utilization and the proportion of those procedures deemed appropriate when explicit criteria were applied in chart audits.[9] These results do not support the hypothesis that "more care means poorer care."

In our study, however, we examined variations in the choice of a surgical procedure, not in whether physicians act upon a given diagnosis. We found a wide variation in the use of breast-conserving surgery in Ontario during 1989–91. We could not find any meaningful external influences on the observed variation when we examined the relation of the hospital or county BCS proportion to the presence of a postgraduate surgical training program, an on-site chemotherapy program or an on-site radiation treatment facility or whether the hospital was an active participant in the NSABP B-06 trial. We did find, however, that the extent to which breast-conserving surgical practices were adopted was not primarily a function of these local environmental factors; rather, it was strongly linked to individual hospital practices. For many counties both the number of hospitals and the number of surgeons were limited, and the county profile reflected individual hospital profiles very closely. In counties with large numbers of hospitals, such as metropolitan Toronto, the influence of any individual hospital on the county's overall BCS proportion was less. We observed as much variation in Toronto as in the entire province.

Are there sources of error in the information or other factors that explain some or all of the variation observed? Northern Ontario was characterized by small caseloads and great distances (Figs. 1 and 2). The low BCS proportions observed in many areas of the north may be the result of two factors. First, because of the great distances, patients may present to their health care workers with disease that is too advanced for breast-conserving surgery. We do not have any readily available data on the extent of disease at diagnosis and cannot comment on the appropriateness of the type of operative procedure selected. Second, the follow-up of patients may be extremely difficult. In this context any procedure that reduces the complexity of follow-up and the chance of recurrence would be very beneficial. The two therapeutic options that reduce the risk of local recurrence are breast-ablative surgery, and breast-conserving surgery followed by irradiation of the remaining breast tissue. Because radiation treatments are restricted to cities that may be far from the patient's residence breast-ablative surgery may rightly be a more attractive option. However, in northern Ontario the BCS proportions varied greatly, some regions having some of the highest in the province. Therefore, geography alone is not the overriding criterion when the type of breast cancer surgery is selected.

Even if the low BCS proportions in some regions of northern Ontario can be partly explained by geography, the same cannot be said for southern Ontario. Distances to health care workers and treatment centres do not pose the same difficulties in the south as in the north. It could be argued that patients in some areas present with disease that occupies too much of the breast, rendering breast-conserving surgery inappropriate. For this to be a major source of the observed variation in the BCS proportions we would have to postulate that women in various regions of Ontario have different body builds or that some areas have a disproportionate number of women with more advanced primary lesions in the breast. Although these factors undoubtedly occur, we believe that they would explain only a small fraction of the observed variation.

Our examination of procedures was based on the location of the most invasive procedure. Therefore, excision of a breast mass followed by mastectomy would have been identified only once, as mastectomy. This guards against the counting of two-stage procedures twice and the false elevation of the BCS proportion.

Could patient referral outside the local hospital or the county of residence account for some of the observed variation? The number of hospitals in which breast-conserving surgery was performed argues against this

procedure being a highly specialized one, such as organ transplantation, for which patients are referred to particular locations. We examined the HMRI data and found similar levels of variation in the BCS proportion by county when the data were analysed by the patient's county of residence rather than by place of procedure. Therefore, we do not believe that referral patterns explain the extent of the variation observed.

The BCS proportion for counties and hospitals with low volumes will inherently be unstable because of the small numbers involved. The range of variation was still large even when only the high-volume counties and hospitals were considered. Therefore, although some of the extreme values observed for smaller counties and hospitals may have arisen by chance, the variation observed in the large centres was still much greater than expected by chance alone.

If the observed variation was not primarily due to geography or patient factors, could it have been due to errors in the data? We do not believe that any source of error can be attributed to data linkage at the Ontario Cancer Registry. If this had occurred the effects of linkage problems would have systematically affected the entire province and not a limited number of regions. Some hospitals may have had more errors in data abstraction before the data were sent to HMRI. We do not have quality-control information on the accuracy of data abstraction at the hospital level; however, hospitals employ carefully trained coders. A recent study showed that 87.7% of procedures were coded correctly in HMRI files.[10] There is no reason to believe that the data for breast cancer would be more or less valid than the data for other illnesses.

Our analysis was limited to inpatient procedures. Variations in practices regarding outpatient breast-conserving procedures may have accounted for some of the observed differences. However, our examination of the ambulatory data for 1991–92 suggests that the impact was minimal. Further research should address this issue in detail as well as differences in practices of one-stage versus two-stage procedures.

We believe that the data fairly represent the state of unilateral breast cancer surgery in Ontario from 1989 to 1991 for women with incident cases of breast cancer. We did not expect breast cancer surgery to have been uniformly practised in Ontario, and we do not know what proportion of women were appropriate candidates for breast-conserving surgery nor what proportion would have wanted this procedure if offered. The physician–patient relationship at the time of breast cancer diagnosis is complex. The physician has to inform the patient about the management options available to her. The nature of this information, coupled with the recent diagnosis of cancer, may make it difficult for patients and their families to select a procedure. This situation is compounded by the sense that surgery needs to be done promptly. Hence, we cannot underestimate the difficulties in arriving at the "best" decision under these circumstances.

However, the BCS proportions varied more markedly than expected. Moreover, the data demonstrated that the decision to perform a breast-conserving procedure or a breast-ablative procedure was primarily related to factors at the local hospital level. As long as breast cancer surgery is performed at Ontario's public hospitals the responsibility for quality control of this surgery rests with the medical profession and those hospitals in which the surgery is being performed. Therefore, the demonstration that physicians at some hospitals practice differently than their peers should provide the surgical community and all hospitals with the incentive to look at their own practices to see whether there is room for improvement. Information and good intentions alone are sometimes insufficient to bring about desired change,[11] and the information from our study should be viewed as the first of many steps in a continuing process of evaluating and improving medical care for women with breast cancer. Also, our study may serve as a model for continual evaluation of selected marker activities by hospitals and the professionals working in them. Finally, prehospital and posthospital factors play an important role. Physicians may be practising optimally within constraints posed by the health care system. Our data represent a positive challenge for physicians involved in the treatment of breast cancer in Ontario women not to do more, but to do better.

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Appendix 1: Unilateral surgical procedures used to treat breast cancer and codes*

Procedure	Code
Breast-ablative surgery	
Simple mastectomy	9712
Modified radical mastectomy	9714
Radical mastectomy	9716
Extended radical mastectomy	9718
Breast-conserving surgery	
Lumpectomy	9711
Quadrantectomy	9727
Partial mastectomy	9728

*Procedures coded according to the Canadian Classification of Diagnostic, Therapeutic and Surgical Procedures.[7]

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Mar. 28–31, 1994: 17th International Annual Ain Shams Medical Congress — Gastroenterology, Endoscopy and Laparoscopy
Cairo, Egypt
Official language: English
Hamdy M. Abdalla, congress secretary general, Clinical and Scientific Society, Faculty of Medicine, Ain Shams University, Abbassia, Cairo, Egypt; tel/fax 011-202-285-5441

Mar. 29, 1994: Kellogg Nutrition Symposium (sponsored by Kellogg Canada Inc.)
Toronto
Alison King, Media Profile, 400–579 Richmond St. W, Toronto, ON M5V 1Y6; tel (416) 366-8464, fax (416) 366-4042

Apr. 2, 1994: International Symposium on Neurofibromatosis (cosponsored by the International Neurofibromatosis Association)
Hong Kong
Ms Francine Morris, National Neurofibromatosis Foundation, Ste. 7-S, 141 5th Ave., New York, NY 10010-7105; tel (212) 460-8980, fax (212) 529-6094

Apr. 14–16, 1994: 3rd Canadian Congress on Utilization and Quality Management: Quality Breakthroughs in Hard Times (cosponsored by the Canadian Hospital Association, the CMA, the Canadian Nurses Association, the Hospital Medical Records Institute and the MIS Group)
Montreal
Guest speakers: Stephen Lewis and Nancy Betkowski
Professional Services, Canadian College of Health Service Executives, 402–350 Sparks St., Ottawa, ON K1R 7S8; tel (800) 363-9056 or (613) 235-7218, fax (613) 235-5451

Du 14 au 16 avr. 1994 : 3[e] congrès canadien sur l'utilisation et la qualité de l'information de gestion : Assurer la qualité en période difficile (coparrainé par l'Association des hôpitaux du Canada, l'Association des infirmières et infirmiers du Canada, l'AMC, le Hospital Medical Records Institute et le Groupe MIS)
Montréal
Conférenciers invités : Stephen Lewis et Nancy Betkowski
Services professionels, Collège canadien des directeurs des services de santé, 402–350, rue Sparks, Ottawa, ON K1R 7S8; tél (800) 363-9056 ou (613) 235-7218, fax (613) 235-5451

Apr. 16–19, 1994: Society of American Gastrointestinal Endoscopic Surgeons 1994 Scientific Session and Postgraduate Course
Nashville, Tenn.
SAGES, 101–11701 Texas Ave., Los Angeles, CA 90025; tel (310) 479-3249, fax (310) 479-9744

Apr. 17, 1994: 6th Annual Symposium on Treatment of Headaches and Facial Pain
New York
Dr. Alexander Mauskop, director, New York Headache Center, 301 E 66 St., New York, NY 10021; tel (212) 794-3550

Apr. 18–21, 1994: T-Cell Receptor Use in Human Autoimmune Diseases (cosponsored by the Arthritis Foundation)
San Diego
Geraldine Busacco, conference director, New York Academy of Sciences, 2 E 63rd St., New York, NY 10021; tel (212) 838-0230, fax (212) 838-5640

Apr. 21–24, 1994: Women's Health: Key Research and Health Care Issues — a National Multidisciplinary Conference
Hamilton, Ont.
Keynote address: Dr. Judith Kazimerski
Child care available during the conference.
I. Ellis, conference coordinator, Faculty of Health Sciences, Room 1M10, McMaster University, 1200 Main St. W, Hamilton, ON L8N 3Z5; tel (416) 525-9140, ext. 2182, fax (416) 521-2100

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