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Cancer at the extremes of age: are there any differences in handling youngsters and seniors

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Original article

Effect of hospital volume on quality of care and outcome after rectal cancer surgery

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Background: **Research on the relationship between hospital volume and quality of care in the treatment of rectal cancer is limited.**

Methods: **Process and outcome indicators were assessed in patients with rectal adenocarcinoma who underwent total mesorectal excision, registered on a voluntary basis in the PROCARE clinical database. Volume was derived from an administrative database and analysed as a continuous variable. Sphincter preservation, 30-day mortality and survival rates were cross-checked against population-based data.**

Results: **A total of 1469 patients registered in PROCARE between 2006 and 2011 were included in this study. A volume effect was observed regarding neoadjuvant therapy for stage II–III disease, reporting of the circumferential resection margin, R0 resection rate, sphincter preservation rate, and number of nodes examined after chemoradiotherapy. The global estimate of quality of care was highly variable, but surgery was the single domain in which quality correlated with volume. No volume effect was observed for recurrence and overall survival rates. In the population-based data set (5869 patients), volume was associated with 30-day mortality adjusted for age (odds ratio 0·99, 95 per cent confidence interval (c.i.) 0·98 to 1·00; $P = 0·014$) and adjusted overall survival (HR 0·99 (95 per cent c.i. 0·99 to 1·00) per additional procedure; $P = 0·001$), but not with the sphincter preservation rate. Because of incomplete and biased registration on a voluntary basis, results from a clinical database could not be extrapolated to the population.**

Conclusion: **Some volume effects were observed, but their effect size was limited.**

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Introduction

Systematic reviews and meta-analyses[1–4] of outcomes after rectal cancer surgery found that high-volume hospitals perform more sphincter-preserving operations and have better 5-year survival than low-volume centres. These findings have already influenced health policy in some countries. However, the use of volume as a measure of quality of care has been criticized[5]. In most studies, volumes have been aggregated into categories. Values from six to 14 rectal resections per year have been used to define low-volume hospitals, and from 17 to 35 for high-volume hospitals[4]. In fact, volume should be modelled as a continuous variable, model fit statistics should be reported along with some measure of the volume's relative importance in explaining outcome variance, and hierarchical modelling should be performed to account for clustering[6]. Moreover, merely concentrating on rigid volume criteria is not sufficient to improve quality of care for colorectal cancer[7]. It is more pertinent to benchmark differences in treatment patterns and quality of care at a hospital level, including all disciplines concerned. A beneficial effect of nationwide surgical audits on compliance with guidelines and variation between individual hospitals has been reported[8–10].

Volume–outcome studies usually use data that can be extracted from administrative databases, such as postoperative mortality, length of hospital stay or survival. Reports on the relationship between volume and process indicators in rectal cancer management are scarce as they require specific clinical data[7,11,12]. PROCARE, a Belgian multidisciplinary improvement project on cancer of the rectum, was launched in 2006[13]. Multidisciplinary guidelines and quality of care indicators were established[14,15]. Several workshops were organized for radiologists, radiation

oncologists, oncologists, surgeons and pathologists. All hospitals were invited to participate on a voluntary basis. Multiple data relating to all aspects of rectal cancer management were registered in a specific database[16].

The present study aimed to explore the relationship between hospital volume and compliance with guidelines, performance for process indicators and outcome using the PROCARE clinical database. In view of incomplete and biased registration in PROCARE, the volume effect was cross-checked for outcomes that could be measured in a population-based data set[17].

Methods

Between January 2006 and October 2011, patients with primary invasive adenocarcinoma of the rectum between 0 and 10 cm above the anal verge as determined by rigid or flexible endoscopy, who underwent elective total mesorectal excision (TME), were registered in the PROCARE database.

Hospital volume was derived from the population-based Belgian Cancer Registry (BCR) linked with the Intermutualistic Agency (IMA) database. It was calculated as the average annual number of radical resections for rectal cancer at any level in the interval 2006 to mid-2008.

For assessment of proficiency, several process and outcome indicators were analysed covering all aspects of treatment using PROCARE data. Oncological outcome measures were local recurrence, overall recurrence (local and/or distant) and overall survival. Time to event was calculated from the date of surgery. The survival status of all patients was collected by the BCR at the Crossroads Bank for Social Security on 23 November 2012.

Because of incomplete and biased registration in PROCARE, a cross-check was performed for the volume effect on those measures that could be derived from the population-based BCR and IMA databases: the sphincter preservation rate, 30-day mortality and overall survival[17]. All Belgian patients with an International Classification of Diseases, tenth revision (ICD-10) code C20 for malignant neoplasm of rectum with an incidence date between 2006 and 2010 were extracted from the BCR.

Statistical analysis

The relationship between volume and quality indicators was analysed in patient data using logistic regression models or linear models for binary or continuous indicators respectively. Clustering by hospital was accounted for by use of generalized estimating equations or random intercept respectively. Both linear and quadratic trends of volume were tested. Cox proportional hazard models were used for testing the association between volume and oncological outcomes (local recurrence, overall recurrence, survival). Clustering by hospital was accounted for by the use of a robust sandwich estimate for co-variances. Additional adjustments were made for possible confounders, these being patient or tumour characteristics associated with both volume and oncological outcome. Associations between patient or tumour characteristics and volume were analysed using logistic regression, proportional odds models or linear models for binary, ordered categorical or continuous variables respectively. Hospital clustering was accounted for. Complete-case analysis was applied, using only records with completely observed model variables.

Hospital-level quality scores for the different rectal cancer management domains were based on a preselected set of quality indicators and calculated as the empirical Bayes estimates obtained from hierarchical (logistic) regression models. This approach has been used for surgical hospital quality ranking[18]. A global quality score was obtained by taking the mean over the different domains. The association between quality scores and hospital volume was analysed by means of Pearson correlations.

All statistical tests were two-sided. $P < 0{\cdot}050$ was considered significant. Analyses were carried out using SAS® software version 9.2 for Windows® (SAS Institute, Cary, North Carolina, USA).

Table 1 Patient- and tumour-related characteristics

	No. of patients* ($n = 1469$)
Age (years)†	68·3 (59·5–76·0)
Sex ratio (M : F)	927 : 542
Body mass index (kg/m^2)†	25·5 (23·1–28·3)
ASA grade ≥ III	289 of 1389 (20·8)
Tumour lower limit from anal verge	
Middle third	656 (44·7)
Lower third	813 (55·3)
cTNM stage	
I	192 of 1426 (13·5)
II	249 of 1426 (17·5)
III	985 of 1426 (69·1)
pTNM stage	
T0/Tis N0	195 of 1459 (13·4)
I	498 of 1459 (34·1)
II	342 of 1459 (23·4)
III	424 of 1459 (29·1)

*With percentages in parentheses unless indicated otherwise; †values are median (i.q.r.). ASA, American Society of Anesthesiologists.

Results

Sixty-eight of 110 hospitals registered data from 2296 patients with primary invasive adenocarcinoma of the rectum in the PROCARE database on a voluntary basis.

Table 2 Effect of increasing hospital volume on compliance with guidelines and performance for quality indicators

	No. of patients*	Effect of hospital volume‡§	*P*
Staging			
cTNM stage reported	1426 of 1469 (97·1)	1·00 (0·98, 1·03)	0·871
Distance to mesorectal fascia in cTNM stages II–III reported	471 of 1234 (38·2)	1·02 (1·00, 1·04)	0·135
Stage accuracy (cTNM = (y)pTNM stage if no or short-course RT)	199 of 429 (46·4)	1·01 (1·00, 1·01)	0·311
Time to first treatment (days)	31 (20–48)†	−0·003 (−0·417, 0·410)¶	0·987
Neoadjuvant treatment (RT or CRT) for cTNM stage II–III			
Reported, all patients	1234 of 1234 (100)	n.a. (all reported)	
Administered, all patients	1061 of 1234 (86·0)	Quadratic	0·035
Administered, age < 75 years	835 of 909 (91·9)	Quadratic	0·043
Administered, age ≥ 75 years	225 of 324 (69·4)	Quadratic	0·027
Surgery			
TME in mesorectal plane (good quality)	875 of 1381 (63·4)	1·01 (0·99, 1·04)	0·219
Negative resection margins	989 of 1154 (85·7)	1·02 (1·00, 1·03)	0·019
Sphincter-saving operation	1109 of 1469 (75·5)	1·02 (1·01, 1·03)**	0·006
Major postoperative morbidity after sphincter preservation	86 of 1109 (7·8)	1·00 (0·99, 1·01)	0·886
Major postoperative morbidity after APE	18 of 332 (5·4)	1·00 (0·97, 1·02)	0·900
30-day mortality	16 of 1469 (1·1)	1·01 (0·99, 1·03)††	0·501
Pathology			
TME quality reported	1381 of 1469 (94·0)	1·00 (0·97, 1·03)	0·983
(y)pCRM reported	1152 of 1469 (78·4)	Quadratric	0·002
No. of nodes examined if no or short-course RT	13 (9–18)†	−0·032 (−0·126, 0·062)¶	0·503
No. of nodes examined after long-course CRT	10 (7–14)†	Quadratric	0·021
Adjuvant chemotherapy for (y)pTNM stage III			
Reported, age < 75 years	172 of 304 (56·6)	0·99 (0·98, 1·01)	0·527
Administered, age < 75 years	162 of 172 (94·2)	1·00 (0·97, 1·04)	0·818
Follow-up			
Reported data on local recurrence and/or metastasis	1285 of 1469 (87·5)	1·03 (0·98, 1·06)	0·074
5-year local recurrence (%) (adjusted)	4·1 (2·9, 5·8)‡	0·99 (0·97, 1·01)#‡‡	0·462
5-year overall recurrence (%) (adjusted)	22·7 (20·1, 25·5)‡	1·00 (0·99, 1·01)#§§	0·609
5-year overall survival (%) (adjusted)	76·4 (78·7,73·9)‡	1·00 (0·99, 1·01)#§§	0·658

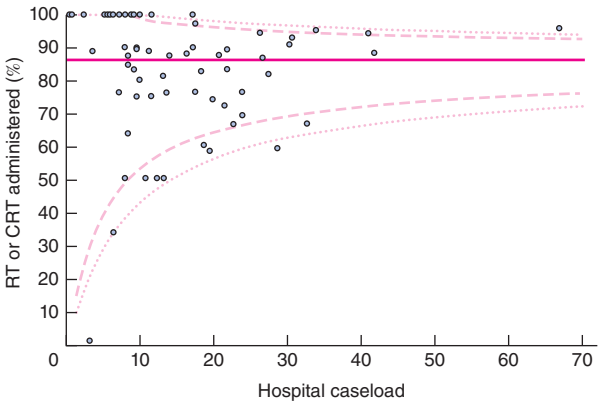
*With percentages in parentheses unless indicated otherwise; †values are median (i.q.r.); ‡values in parentheses are 95 per cent confidence intervals. §Effect sizes are shown as odds ratio (OR) per additional procedure, except ¶slope and #hazard ratio (HR) per additional procedure. OR and HR values greater than 1 indicate that the probability increases with volume, whereas values of less than 1 indicate that the probability decreases with volume. (C)RT, (chemo)radiotherapy; n.a., not applicable; TME, total mesorectal excision; APE, abdominoperineal excision; CRM, circumferential resection margin. Associations between patient or tumour characteristics and volume were analysed using logistic regression, proportional odds models or linear models for binary, ordered categorical or continuous variables respectively. **Adjusted for sex, age, American Society of Anesthesiologists grade III or above, cT4 and preoperative faecal incontinence; ††adjusted for age; ‡‡adjusted for pTNM stage and age; §§adjusted for cN, number of quadrants involved, pTNM stage and age.

Patients with disseminated disease (439 patients), invasion or *en bloc* resection of other organs (322), emergency cases (5) and patients with synchronous cancers (61) were excluded, leaving 1469 patients for analysis in the present study.

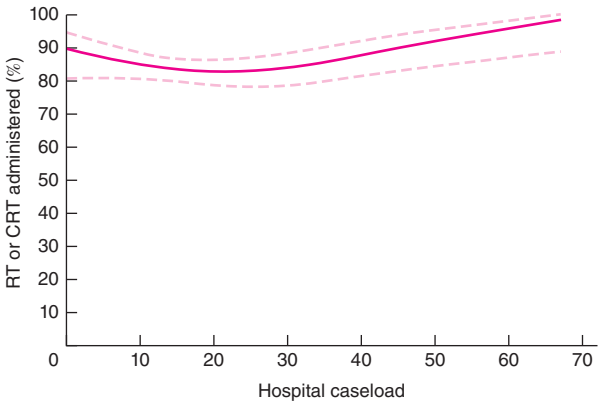
In view of incomplete registration in PROCARE, the caseload of these hospitals was derived from the IMA database. The median number of patients was 11·0 per year, with a wide i.q.r. from 7·6 to 20·8 per hospital. Patient- and tumour-related characteristics are summarized in *Table 1*. Median age was 68·3 years and 63·1 per cent of the patients were men. More tumours were located in the lower third of the rectum (up to 5 cm above the anal verge) and the majority (69·1 per cent) were cTNM stage III. Neoadjuvant (chemo)radiotherapy was administered in 76·5 per cent. Downstaging was noted with an impressive shift towards lower pathological stages.

Clinical stages, based on CT of the abdomen and pelvis, pelvic MRI and/or endorectal ultrasonography, were reported in 97·1 per cent (1426 of 1469), with a mediocre accuracy of 46·4 per cent (199 of 429) among patients who had short-course radiotherapy with a short interval to surgery or no neoadjuvant treatment. The distance to the mesorectal fascia for transmurally invading tumours was reported in only 38·2 per cent (471 of 1234). No effect of hospital volume on these criteria was found (*Table 2*).

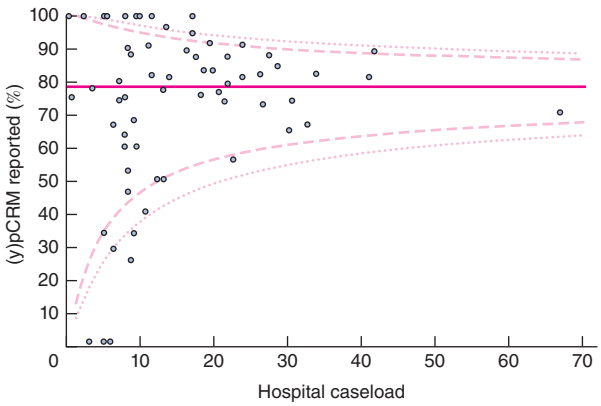
The median time from diagnosis to first treatment was 31 (i.q.r. 20–48) days, and was not influenced by volume. Neoadjuvant therapy was administered to 86·0 per cent of patients with cTMN stage II–III rectal cancer, more so to



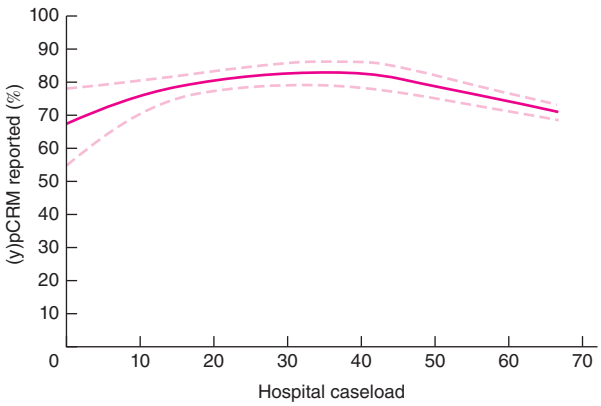
a Neoadjuvant therapy–funnel plot



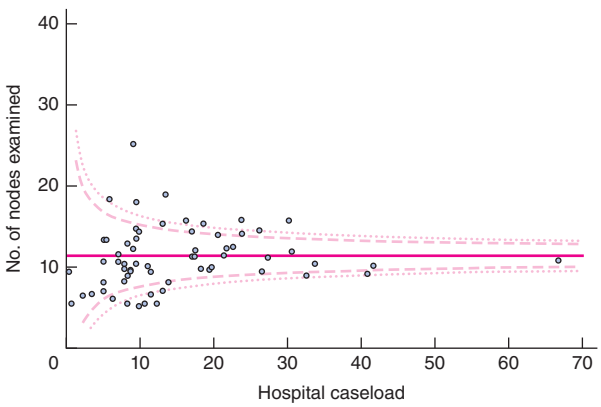
b Neoadjuvant therapy–logistic regression line



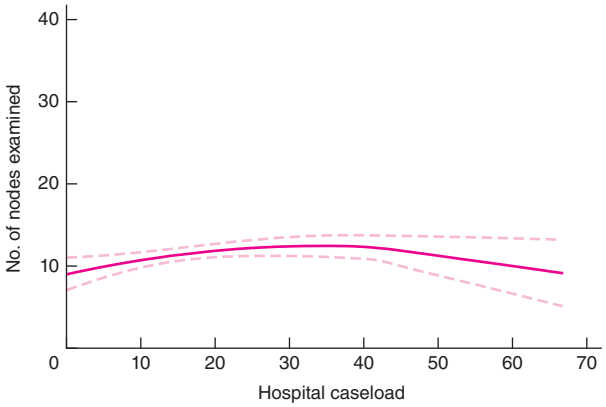
c CRM status–funnel plot



d CRM status–logistic regression line



e No. of lymph nodes–funnel plot



f No. of lymph nodes–logistic regression line

Fig. 1 **a**,**c**,**e** Funnel plots and **b**,**d**,**f** regression lines for quadratic associations between volume and **a**,**b** neoadjuvant therapy administered for cTNM stages II–III, **c**,**d** reporting the pathological circumferential resection margin (CRM) status and **e**,**f** number of lymph nodes examined after chemoradiotherapy. Symbols represent individual centres. Dashed and dotted lines represent 95 and 99 per cent control or confidence limits respectively. (C)RT, (chemo)radiotherapy

patients aged less than 75 years than to older patients (91·9 and 69·4 per cent respectively; $P < 0·001$). A significant quadratic association with hospital volume was observed (*Fig. 1*).

TME quality was reported for 1381 specimens (94·0 per cent). TME planes were mesorectal in 63·3 per cent, intramesorectal in 27·4 per cent and muscularis propria in 9·3 per cent. Reporting of TME quality and good TME quality were not associated with hospital volume (*Table 2*). Resection margins were reported in 1154 specimens (78·6 per cent) and were negative (R0 resection) in 85·7 per cent of these. A margin of 1 mm or less was considered positive. The pathological circumferential resection margin (pCRM) status was reported more frequently in hospitals with caseload located between the extremes on the volume scale (*Fig. 1*), but the association between R0 resection and hospital volume was linear (*Table 2*). The estimated relative risk (RR) for R0 resection was limited at 1·02 (95 per cent confidence interval (c.i.) 1·00 to 1·03) per ten added cases. A sphincter-preserving operation was performed in 75·5 per cent of patients (1109 of 1469). After adjustment for sex, age, American Society of Anesthesiologists (ASA) grade III or above, cT4 and preoperative faecal incontinence, the odds ratio (OR) for sphincter preservation was 1·02 (95 per cent c.i. 1·01 to 1·03) per additional procedure ($P = 0·006$). The estimated RR for sphincter preservation was 1·03 (1·01 to 1·06) per ten added procedures. In practical terms, this means a 3 per cent increased chance of avoiding a definitive stoma if the annual volume increases by ten patients.

Major postoperative morbidity occurred in 7·8 per cent (86 of 1109) after a sphincter-preserving procedure and in 5·4 per cent (18 of 332) after abdominoperineal excision. The 30-day mortality rate was 1·1 per cent (16 of 1469). Morbidity and mortality were not associated with volume. A median of 13 (i.q.r. 9–18) lymph nodes were examined if no or short-course neoadjuvant radiotherapy had been administered; there was no association with hospital volume. After chemoradiotherapy a median of 10 (i.q.r. 7–14) nodes were examined, and a quadratic association with volume was found (*Fig. 1*). The use or non-use of adjuvant chemotherapy was registered in 56·6 per cent of patients with (y)pTNM stage III rectal cancer and administered in 94·2 per cent of them, with no observed volume effect (*Table 2*). Data on recurrent disease during follow-up were available for 1285 patients (87·5 per cent), without a volume effect.

To assess the quality of rectal cancer management per domain, eight quality indicators were selected (*Table 3*). A significant correlation between the surgical domain score and hospital volume was observed, as well as a trend for the global score. A funnel plot of the global score per centre illustrates wide variation with high and low outliers over the whole volume scale (*Fig. 2*). All low outlying centres but one had an annual volume of 30 or fewer.

In the PROCARE database, 5-year local and overall recurrence rates were 4·1 (95 per cent c.i. 2·9 to 5·8) and 22·7 (20·1 to 25·5) per cent respectively. They were not associated with hospital volume, either before or after adjustment for patient or tumour characteristics found

Table 3 Pearson correlations between quality scores per domain or global score and hospital volume

	Pearson correlation coefficient	*P*	No. of hospitals*
Staging	0·123	0·319	68
Distance to mesorectal fascia reported in cTNM stage II–III			
Accuracy of staging			
Neoadjuvant treatment	0·119	0·339	67
(C)RT in cTNM stage II–III			
Surgery	0·265	0·029	68
TME in mesorectal plane			
Negative resection margins			
Adjusted sphincter preservation rate			
Pathology	0·139	0·268	65
No. of nodes examined after CRT			
Adjuvant chemotherapy	0·005	0·975	43
For (y)pTNM stage III if age < 75 years			
Global score	0·237	0·052	68

*Some domain scores could not be obtained for all hospitals. (C)RT, (chemo)radiotherapy.

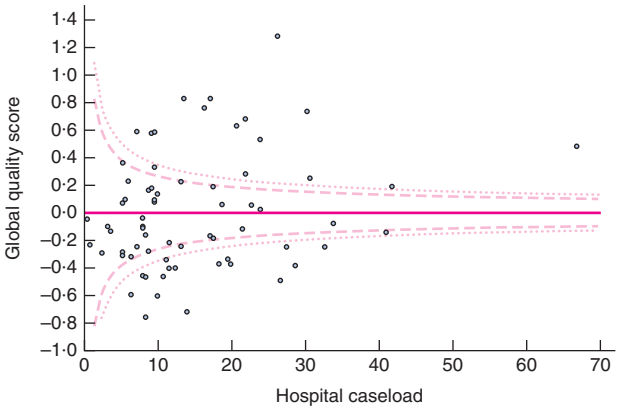


Fig. 2 Funnel plot of global quality score and hospital volume. Symbols represent individual centres. The horizontal line indicates the overall mean score; dashed and dotted lines represent 95 and 99 per cent control limits respectively

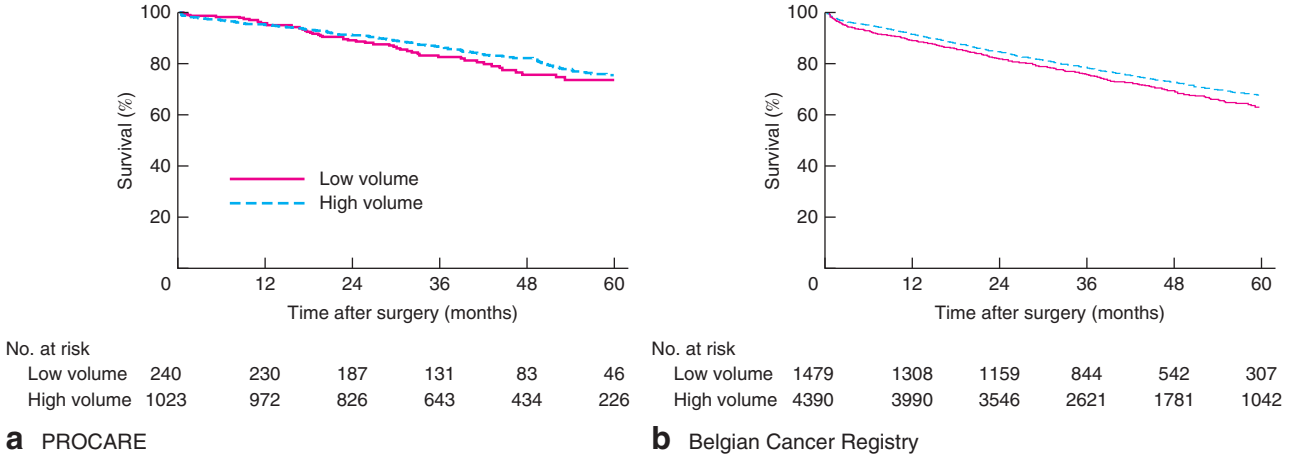


Fig. 3 Kaplan–Meier curves showing overall survival for patients with pTNM stage I–III rectal cancer treated in hospitals with volume below *versus* equal to or above the median: **a** PROCARE data set and **b** population-based data from the Belgian Cancer Registry. **a** $P = 0{\cdot}271$, **b** $P = 0{\cdot}047$ (log rank test)

to be associated with both volume and these oncological outcomes (*Table 2*). The unadjusted hazard ratio (HR) for overall survival was 0·99 (95 per cent c.i. 0·98 to 1·00) per additional procedure ($P = 0{\cdot}032$). After adjustment for age, pathological stage, clinical stage and the number of rectal quadrants involved, related to both overall survival and volume, the HR became non-significant (*Table 2*).

Comparison of PROCARE and Belgian Cancer Registry data

A volume effect on the sphincter preservation rate, 30-day postoperative mortality and overall survival could be cross-checked in a population-based data set of 5869 patients who underwent resection for rectal cancer between 2006 and 2010 in 108 hospitals. Two of the 110 Belgian hospitals were excluded because hospital volume was unknown. Patients with metastatic disease or unknown pTNM stage (3968 patients), a history of cancer (845) or synchronous cancer (154) were excluded, as well as those who did not undergo a radical resection (489 patients). The 5869 patients left for analysis were assigned to the centre where surgery was performed.

PROCARE data had to be reanalysed and restricted to patients with pTNM stage I–III rectal cancer because pT0 N0 tumours were classified as stage unknown or X in the BCR. The unadjusted sphincter preservation rate was 72·9 per cent in the BCR, compared with 74·1 per cent in the PROCARE database ($P = 0{\cdot}283$). The unadjusted OR for sphincter preservation was 1·01 (95 per cent c.i. 1·00 to 1·02) per added procedure ($P = 0{\cdot}193$) in the BCR data set, contrasting with a significant unadjusted OR of 1·02 (1·01 to 1·03) per additional procedure in the PROCARE data set ($P = 0{\cdot}001$). The 30-day mortality rate was significantly higher in the BCR than among comparable patients from PROCARE (2·4 *versus* 1·3 per cent; $P = 0{\cdot}001$). In contrast to results from the PROCARE database, a significant association was found between hospital volume and postoperative 30-day mortality adjusted for age in the BCR (OR 0·99, 95 per cent c.i. 0·98 to 1·00; $P = 0{\cdot}014$).

The HR for overall survival, adjusted for age, sex and pTNM stage, in the population-based database was 0·99 (95 per cent c.i. 0·99 to 1·00) per added procedure ($P = 0{\cdot}001$), indicating improved survival with increasing hospital volume. Reanalysis of patients with pTNM stage I–III disease from PROCARE did not yield a significant result, although the HR was in the same range (1·00 (95 per cent c.i. 0·99 to 1·01) per added procedure; $P = 0{\cdot}371$). To illustrate the effect size of volume, the overall survival of patients treated in centres with volumes below, and equal to or above the median volume was compared. In PROCARE, the 5-year overall survival rate was 73·3 per cent in centres with a lower caseload and 75·1 per cent in higher-volume centres ($P = 0{\cdot}271$). Respective rates in the BCR were 61·7 and 66·5 per cent ($P = 0{\cdot}003$) (*Fig. 3*). After adjustment for age, sex and pTNM stage the difference in overall survival after treatment in centres with volumes below, and equal to or above the median remained significant in the BCR data set (HR 0·90, 95 per cent c.i. 0·81 to 1·00; $P = 0{\cdot}047$), but not in PROCARE (HR 0·91, 0·67 to 1·23; $P = 0{\cdot}538$). Hospitals with a caseload below the median treated 19·0 per cent of patients in PROCARE and 25·2 per cent in the Belgian population (*Fig. 3*).

Discussion

This study evaluated the volume effect on general outcome measures as well as on compliance with guidelines and quality of care indicators in all domains of rectal cancer management. In contrast to other studies, the volume effect was assessed as a continuous variable. Two databases were used. The clinical PROCARE database was essential to study the association between hospital volume and process indicators and outcome. Because of incomplete and biased registration in PROCARE, a population-based patient data set was used to cross-check the volume effect on outcome measures for which data were available[17].

At a patient level, an association was found between hospital volume and neodjuvant treatment for cTNM stage II–III, R0 resection rate, sphincter preservation rate, pCRM reporting and number of lymph nodes examined in the TME specimen after chemoradiotherapy. The nature of these associations was sometimes enigmatic. Indeed, the models indicated that hospitals at the extremes of the volume scale performed better than those situated in between for some indicators, but worse for others. Moreover, the volume effect size was rather limited. The chance to avoid a definitive stoma was estimated to increase by 3 per cent if the hospital volume increased by ten patients. For an individual patient this represents virtually no improved chance. In the population-based patient data set no association between hospital volume and the unadjusted sphincter preservation rate was observed. This can be explained by the fact that upper rectal cancers could not be excluded from the BCR. The 30-day mortality rate was about 1·1 per cent higher and related to hospital volume in the population-based data set, possibly because emergency cases could not be excluded from the BCR, higher participation of better centres and incomplete, biased registration in PROCARE[17].

Local and overall recurrence rates were not related to hospital volume in PROCARE, as reported by others[1–4]. These findings could not be confirmed confidently on a population basis because registration of recurrent disease in the BCR is incomplete. A statistically significant volume effect on overall survival in patients with pTNM stage I–III disease was observed in the BCR database but not in the PROCARE. This can be explained at least partially by the larger number of patients in the BCR. However, smaller centres participated less in PROCARE than larger centres[17]. Better centres might have participated more than others. Indeed, the RR of death in patients treated in centres that did not participate in the project was significantly higher than that among patients treated in participating centres[17]. A comparison of adjusted overall survival in hospitals below *versus* at least the median volume showed an absolute difference in 5-year survival of 4·8 per cent in the population-based data set. Knowing that only one-quarter of patients in Belgium are treated in centres with a caseload below the median, it is evident that the effect size of centralization in larger-volume hospitals would be limited on the national level.

Some limitations related to the characteristics of the databases used have been mentioned above. This study deliberately chose to analyse the effect of hospital volume because rectal cancer management requires a multidisciplinary approach and because the variation at hospital level is most pertinent in a quality improvement context. It is obvious that experience per centre does not reflect experience of individual specialist physicians. The fact that several specialists could be involved in a given domain in some hospitals could not be taken into account, nor their respective degree of specialization in colorectal cancer.

There are mixed views on concentrating rectal cancer treatment in high-volume centres[19]. A statistically significant volume effect on several aspects of rectal cancer management has been confirmed. However, this study also illustrates that underperforming centres can be found throughout the volume scale. Volume effects on postoperative mortality and survival after resection of oesophageal or pancreatic cancer in Belgium[20] are much more relevant than those observed here. It is therefore concluded that clinical audit is more important than centralization based on volume alone.

Collaborators

The PROCARE Steering Group consists of delegates from all Belgian scientific organizations involved in the treatment of rectal cancer: Belgian Section of Colorectal Surgery, a section of the Royal Belgian Society of Surgery (C. Bertrand, D. De Coninck, M. Duinslaeger, A. Kartheuser, F. Penninckx, J. Van de Stadt, W. Vaneerdeweg), the Belgian Society of Surgical Oncology (D. Claeys), the Belgian Group for Endoscopic Surgery (D. Burnon), the Belgian Society of Radiotherapy – Oncology (K. Haustermans, P. Scalliet, P. Spaas), the Belgian Society of Pathology and the Digestive Pathology Club (P. Demetter, A. Jouret-Mourin, C. Sempoux), the Belgian Society of Medical Oncology (W. Demey, Y. Humblet, E. Van Cutsem), the Belgian Group for Digestive Oncology (S. Laurent, E. Van Cutsem, J. L. Van Laethem), the Royal Belgian Society of Radiology (B. Op de Beeck, P. Smeets), the Société Royale Belge de Gastro-Entérologie (M. Melange, J. Rahier), the Vlaamse Vereniging voor Gastro-enterologie (M. Cabooter, P. Pattyn, M. Peeters) and the Belgian Society of Gastrointestinal Endoscopy

(M. Buset). Also represented are: the Belgian Professional Surgical Association (B. Mansvelt, K. Vindevoghel), the Foundation Belgian Cancer Registry (E. Van Eycken) and the Belgian National Institute for Health and Disability Insurance (INAMI-RIZIV) (M. Daubie, A. Thijs). F. Penninckx chairs the PROCARE Steering Group.

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