

Hospital variation in referral for primary radiotherapy in South Netherlands, 1988–1999

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Abstract

In this study, we have assessed whether referral for primary radiotherapy varied according to hospital size in a region with 1 million inhabitants served by community hospitals. We studied 20 178 patients diagnosed with breast, non-small cell lung, prostate, rectal, or endometrial cancer between 1988 and 1999. We used logistic regression analysis, adjusted for age, stage and period of diagnosis. Medium-sized and small hospitals referred breast cancer patients more often (OR = 2.2, 95%CI: 2.0–2.5, OR = 1.2, 95%CI: 1.1–1.4, respectively), and patients with prostate cancer less often (OR = 0.7 (0.5–0.8) and 0.7 (0.6–0.9), respectively). Referral rates for patients with non-small cell lung and rectal cancer showed minor differences according to hospital size, referral for endometrial cancer was somewhat higher for patients from medium-sized hospitals (OR = 1.5 (1.0–2.1)). Time trends in variation were shown, but differences according to hospital size only decreased over time for rectal cancer. Despite multidisciplinary oncology meetings and treatment guidelines there were large variations in rates of referral for radiotherapy.

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1. Introduction

Of all cancer patients, 50–60% are assumed to receive radiotherapy (RT) [1–3]. These numbers are often used in decision-making, for example to calculate required capacity of RT equipment. According to a population-based study from the Eastern part of the Eindhoven Cancer Registry (ECR) approximately 30% of all cancer patients received primary RT between 1975 and 1998 [4,5]. We found the same percentages for the western part of the ECR (data not shown). Little is known about the inter-hospital variation in referral patterns. Our regional radiotherapy department operates in a region covered by the Comprehensive Cancer Centre South, which promotes adherence to (and sometimes development of)

guidelines. The area includes a population-based cancer registry and is served by community hospitals only. This allows us to study the variation in rates of referral for a regional radiotherapy department in a population-based setting.

2. Patients and methods

The ECR records data on all patients newly diagnosed with cancer in the southern part of the Netherlands; it covers a population of approximately 2.3 million. This population-based registry includes six pathology departments, 15 community hospitals (no university hospital) and two RT departments, one of which is located in the western part (Tilburg) as an independent facility. Data on patient characteristics (age, gender, concomitant diseases), tumour characteristics

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(localisation, morphology, stage at diagnosis) and treatment (planned within 6 months of diagnosis) is recorded by trained registry personnel, usually between 6 and 18 months after diagnosis. Despite the lack of access to death certificates, the infrastructure of and good access to Dutch health care facilities, together with the multiple source notification procedures used, cancer registries in the Netherlands typically cover over 95% of cases [6]. The Dr. B. Verbeeten Institute (BVI) offers RT in the western part of the region. Within the referral area the number of referring hospitals decreased due to mergers from nine to seven between 1988 and 1999, but the original locations (units of patient care) were retained. A subdivision was made into large (more than 500 beds, $n = 2$), medium-sized (350–500 beds, $n = 3$) and small hospitals (less than 350 beds, $n = 4$). Physicians' training facilities were present in both large and some of the medium-sized hospitals. Treatment guidelines for most tumour types were available. In all hospitals cancer patients were presented on multidisciplinary oncology meetings, in the presence of a radiotherapist–oncologist to discuss treatment policy. We included all patients with cancer of the breast, prostate, rectum and endometrium and non-small cell lung cancer diagnosed between 1988 and 1999 ($n = 20\,178$). We studied both the individual hospital and the hospital size. In stage-specific [7] analysis of breast cancer NX and MX were coded N0 and M0, respectively. Differences in distribution were tested with the χ^2 test. Logistic regression analysis was used to estimate the effect of hospital size on the referral for RT, adjusted for age, stage and period of diagnosis.

3. Results

Forty-five percent of patients in the study received primary RT (*i.e.*, within 6 months of diagnosis). The lowest percentage (42%) of cancer patients was referred for RT in the large hospitals (medium: 43%, small: 51%, $P < 0.0001$). Variation in stage existed between the hospitals for most tumour types. Regardless of hospital size, referral for RT was lower for patients aged 70+ compared to those below 70, except for non-small cell lung cancer (Table 1). This was also demonstrated by the multivariate analysis (Table 2). The largest effect was observed for breast cancer patients, the odds for receiving RT were 0.3 for patients aged 70+ compared to those diagnosed before age 70 (95%CI: 0.3–0.4).

Patients with breast cancer from large hospitals were referred for RT less often (51%, medium-sized 56% and small 68%, $P < 0.0001$) (Table 1). When adjusted for age, stage and period of diagnosis, the chance to receive RT was higher for patients referred by specialists in the medium-sized (OR = 2.2, 95%CI: 2.0–2.5) and the small hospitals (OR = 1.2, 1.1–1.4). Especially patients with stage I and II breast cancer from the small hospitals

Table 1
Total number of cancer patients and referral rates (%) for primary radiotherapy according to hospital size^a and age^b in South Netherlands, 1988–1999

	Breast cancer			NSCLC ^c			Prostate cancer			Rectal cancer			Endometrial cancer			Total		
	No. patients	% irradiated		No. patients	% irradiated		No. patients	% irradiated		No. patients	% irradiated		No. patients	% irradiated		No. patients	% irradiated	
		<70	>70		<70	>70		<70	>70		<70	>70		<70	>70		<70	>70
Large	2211	57	35	2830	45	44	1260	32	21	616	40	25	286	38	33	7203	47	34
Medium-sized	3023	63	35	2456	48	45	1583	28	15	869	44	23	341	43	37	8272	51	30
Small	2336	75	50	549	45	48	902	25	18	658	46	28	258	45	49	4703	60	35

^a Large, >500 beds, $n = 2$, medium sized, 350–500 beds, $n = 3$, small, <350 beds, $n = 4$.

^b <70, younger than 70 years; >70, 70 years and older.

^c NSCLC, non-small cell lung cancer.

Table 2

Chance to receive primary radiotherapy for different tumour types according to hospital size^a adjusted for age^b, stage^c and period of diagnosis in South Netherlands, 1988–1999

	Breast cancer		Non-small cell lung cancer		Prostate cancer		Rectal cancer		Endometrial cancer	
	OR ^d	95% CI ^e	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
<i>Hospital size</i>										
Large ^f	1		1		1		1		1	
Medium-sized	2.2	2.0–2.5	0.9	0.7–1.1	0.7	0.5–0.8	1.2	0.9–1.6	1.5	1.0–2.1
Small	1.2	1.1–1.4	1.2	1.0–1.3	0.7	0.6–0.9	0.9	0.7–1.2	1.1	0.8–1.6
<i>Age</i>										
<70 ^f	1		1		1		1		1	
70+	0.3	0.3–0.4	1.0	0.9–1.2	0.6	0.5–0.7	0.4	0.3–0.5	0.9	0.7–1.2
<i>Stage</i>										
I ^f	1		1		1		1		1	
II	1.0	0.9–1.1	3.0	2.6–3.4	1.3	1.1–1.6	4.4	3.3–5.8	3.2	1.9–5.5
III	1.8	1.5–2.1			1.6	1.2–2.1	8.7	6.5–11.8	4.2	2.4–7.3
IV	0.2	0.1–0.2			0.1	0.0–0.1	1.2	0.8–1.7	0.5	0.2–1.3
Unknown	0.3	0.2–0.4	1.5	1.3–1.8	0.5	0.3–0.7	4.8	3.4–6.9	0.5	0.2–1.5
<i>Period of diagnosis</i>										
1988–1991 ^f	1		1		1		1		1	
1992–1995	1.0	0.9–1.1	1.0	0.9–1.2	1.0	0.8–1.3	1.0	0.7–1.2	0.7	0.5–1.0
1996–1999	0.8	0.7–0.9	0.6	0.5–0.7	1.3	1.0–1.6	0.9	0.7–1.2	0.5	0.4–0.7

^a Large, >500 beds, *n* = 2, medium sized, 350–500 beds, *n* = 3, small, <350 beds, *n* = 4.

^b <70, younger than 70 years; >70, 70 years and older.

^c Non-small cell lung cancer: I, localised, II, non-localised.

^d Odds ratio.

^e Confidence Interval.

^f Reference category.

received RT more often (70–80% compared to 50–60% from the medium-sized and large hospitals, *P* < 0.0001).

Specialists in the large and medium-sized hospitals referred most of the patients with non-small cell lung cancer for RT. The referral of non-small cell lung cancer patients decreased from 50% in 1988 to 36% in 1999 with only small variations according to hospital size or individual hospital.

Specialists in the large hospitals referred 25% of patients with prostate cancer for RT (medium 19% and small 20%, *P* < 0.0001). The chance of RT after adjustment was significantly lower for patients from small and medium-sized hospitals (OR = 0.7, 95%CI: 0.5–0.8, OR = 0.7, 95%CI: 0.6–0.9, respectively).

For rectal cancer the referral rates for RT were approximately 35% regardless of hospital size.

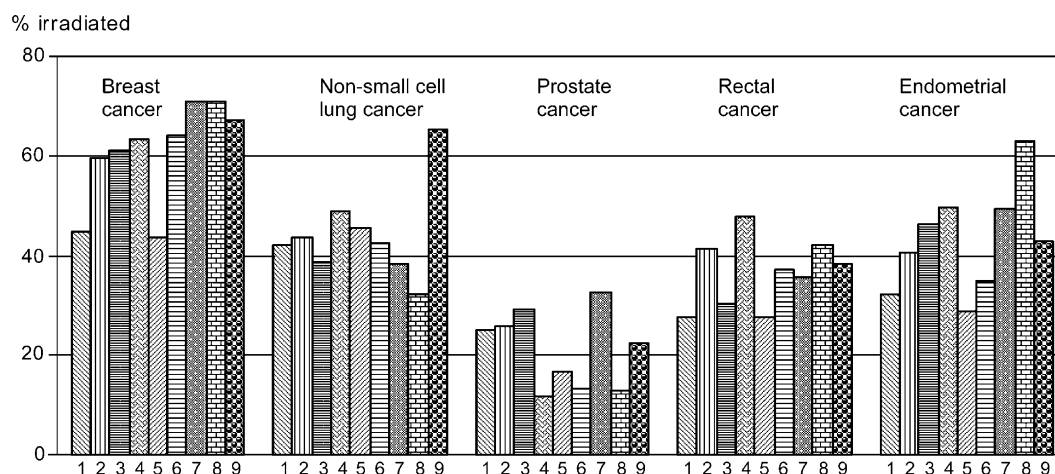


Fig. 1. Referral for primary radiotherapy (%) according to tumour type and hospital in South Netherlands, 1988–1999. 1,2: large hospitals; 3–5: medium-sized hospitals; 6–9: small hospitals.

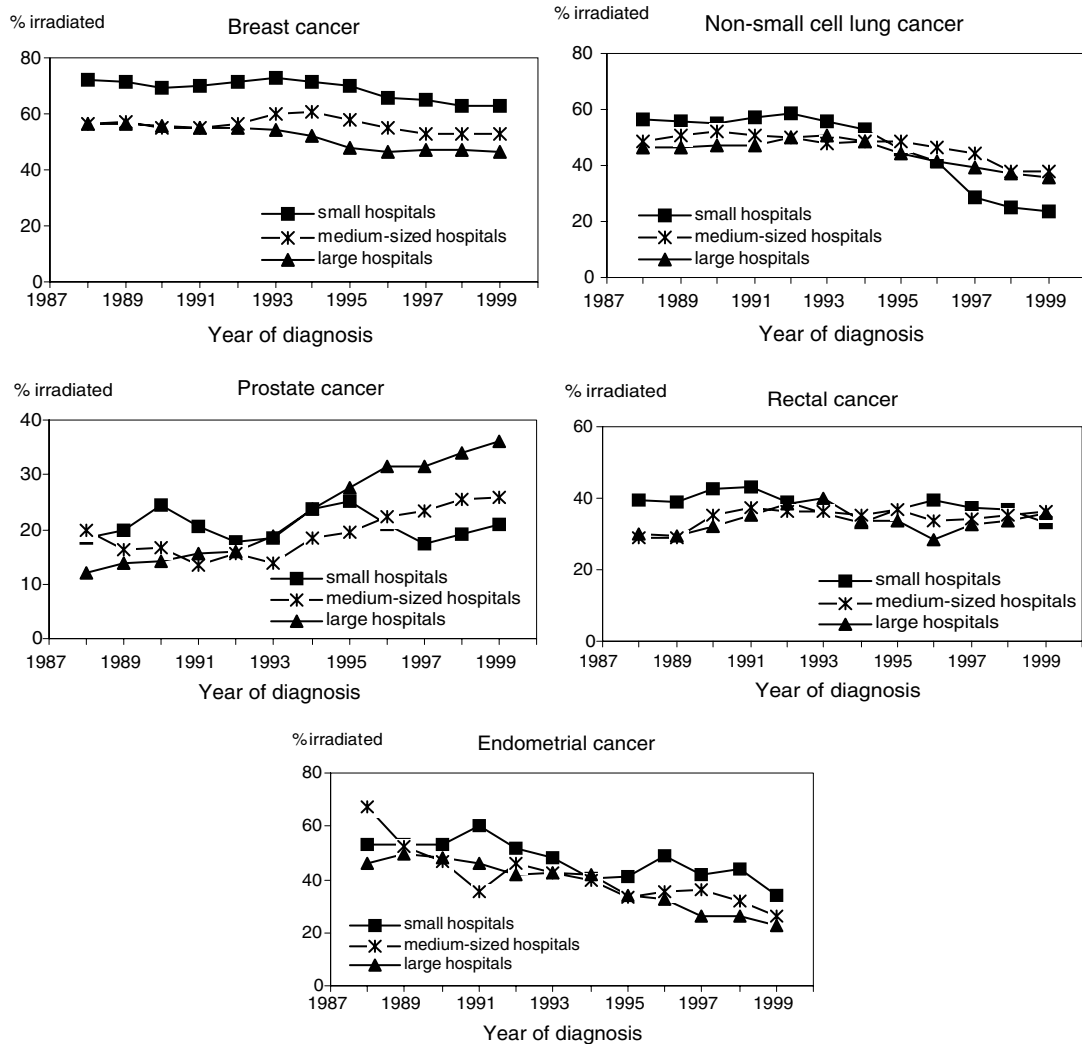


Fig. 2. Time trends for variation in referral for primary radiotherapy (%) according to tumour type and hospital size in South Netherlands, 1988–1999.

Patients with endometrial cancer were referred more often by specialists in the medium-sized or small hospitals (41% and 47%, respectively), compared to the large hospitals (36%, $P = 0.06$). According to multivariate analysis the chance that patients from medium-sized hospitals would receive RT was significantly higher ($OR = 1.5$, 95%CI: 1.0–2.1) (Table 2).

The variation in referral between individual hospitals was large for patients with breast cancer (mean 58%, range 44–71%), prostate cancer (mean 22%, range 12–33%), rectal cancer (mean 36%, range 28–48%) and endometrial cancer (mean 42%, range 29–63%). For non-small cell lung cancer the referral rate ranged from 32% to 49% (mean 46%), with an outlier (65%) for 1 small hospital with only a few patients (Fig. 1). The time trend in variation according to hospital size is shown in Fig. 2. The referral rates converged for rectal cancer. The differences remained stable for patients with breast, non-small cell lung and endometrial cancer, and the variations became larger for prostate cancer.

4. Discussion

The rate of referral for primary RT in the study region (the western part of the ECR) was 30% between 1988 and 1999 for all cancer patients (data not shown), and 45% for the five tumour types studied, which is very similar to that found for the eastern part of the ECR [4,5]. We found variations in referral rates for RT between the different hospitals. Variations in referral rates might be explained by the preference of specialists with regard to treatment chosen, sometimes despite treatment guidelines. Some variation can be explained by the choice of the patient. Although a variation in stage was seen for most tumour types between the hospitals, this can not explain the variation in referral rates for RT because we corrected for this in the multivariate analysis (Table 2).

The slight increase in rates of referral for RT for breast cancer in 1992–1994 can be explained by the introduction of mass screening in 1992. For most small

breast cancers, conservative surgery with RT was established as the standard treatment as it gave the same results in terms of disease-free survival and overall survival as mastectomy [8–10]. Nevertheless, we found a large difference in the referral rates for RT (which is an important indicator of the percentage of patients undergoing conservative surgery [11]), between hospitals. The small hospitals, with the lowest caseload, had the highest percentage referrals. In these hospitals a larger proportion of patients was presented at the multidisciplinary oncology meetings. Probably because of the fact that less expertise on cancer treatment was available, these meetings had more influence on the treatment policy in these hospitals. Other authors found the opposite: according to Moritz and colleagues surgeons with a higher caseload had a lower mastectomy rate [12], and Nattinger and colleagues [13] noted that larger hospitals were more likely to perform breast-conserving surgery compared to smaller hospitals. In our region the choice between conservative treatment and mastectomy in the larger hospitals was influenced markedly by the personal experience and practice of the individual surgeon, and to a lesser extent by multidisciplinary recommendations.

The decreasing rate of referral for RT for patients with non-small cell lung cancer was seen in all hospitals, probably as a result of increased use of chemotherapy [14].

Since 1994 the PSA-test has been used for detection of prostate cancer. More patients with a localised tumour were referred for RT from that time [15]. The large variation in referral rates may be related to the preference of the urologist for different treatment modalities. This variation in the management of localised prostate cancer (prostatectomy, RT or watchful waiting) exists world-wide [16–19].

From 1996 most patients with rectal cancer were treated with preoperative instead of postoperative RT within the framework of the TME trial (total mesorectal resection with or without preoperative RT) [20]. Before 1994 referral rates converged, then they diverged to lower referral rates for the large and higher referral rates for the small hospitals. Since 1996 the referral rates have converged again.

Variation in referral of patients with endometrial cancer stage I, similar variations were also found in the Southeastern part of the Netherlands [21], can be explained by the lack of conclusive evidence for postoperative RT, which was therefore applied depending on the individual gynaecologists and the individual oncology meetings. When the results of the Portec trial [22] became available in 1997, the decreasing trend was interrupted for patients aged 70+, but differences according to hospital sizes remained.

For each of the investigated tumours we found variations in the rates of referral for RT according to hospital size. However, we did not find that the highest referral rates were always from one particular hospital

size. For one tumour, the small hospitals referred most patients, for another tumour large hospitals referred the most. After a change in treatment policy the same trend in referral for RT was found for all three hospital sizes, but for most tumour types the variations in referral rates remained.

In conclusion, we found that despite the existence of guidelines and multidisciplinary oncology meetings during which the treatment policy for cancer patients is discussed, large variations, with a slight convergence in later years, were found for the referral rates for RT.

Conflict of interest statement

None.

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