Hospital differences in patient satisfaction with care for breast, colorectal, lung and prostate cancers.

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Abstract

Background: We have investigated cancer patient satisfaction with care and the extent to which it varies between and within hospitals.

Design and methods. A national survey of cancer patients in England with questions in ten different dimensions for four common cancers: breast, colorectal, lung and prostate (55,674 patients). We compared hospitals across tumour types, and against the national average.

Results: Dissatisfaction was greater ($p<0.001$) in younger, female patients. Breast cancer patients expressed least, and prostate cancer greatest dissatisfaction. Breast, colorectal and prostate cancers showed significant ($p<0.001$) pair-wise correlations for standardised satisfaction scores, particularly for in-hospital care. Summed hospital satisfaction scores showed significant associations across different dimensions of care.

Conclusions: Cancer patient satisfaction is measurably different between hospitals, as well as by tumour type. For many aspects of care there is evidence of systemic hospital-level factors that influence satisfaction as well as factors common to the care pathways experienced by individual patients. Factors amenable to clinical or managerial intervention deserve further investigation.

Keywords

Patient satisfaction; surveys; quality of care; cancer; breast, colo-rectum; lung.

Introduction

Quality in health care can be assessed through quantitative measures [1], and patient satisfaction is an important dimension, complementing measures of institutional performance and clinical outcome. Satisfaction is itself multi-dimensional, reflecting the range of experiences that an individual may have during illness. A systematic review of 139 articles reported that correlates of patient satisfaction include personal health status, age and ethnicity, as well as with the provision of information and choice of service [2].

Cancer is the second commonest cause of death in developed countries and a frequent reason for hospital care. However, cancer symptoms, treatment and survival are strongly determined by the pathological origin of the cancer, and clinical studies of cancer patients are usually made within cancer types. Measures of satisfaction with care for cancer patients have been developed for clinical studies [3], and used in hospitals [4], but less for comparison of cancer services. Sandoval and colleagues [5, 6], using data collected from cancer services in Ottawa, Canada, have identified hospital staff and informational dimensions associated with patient's perceptions of quality of care. In cancer palliative care, Fakhoury, Addington-Hall & McCarthy [7] found that informal care-givers' satisfaction was related to frequency of visits of healthcare staff.

Variations in clinical outcomes can be affected by health service organisational characteristics. Hospital factors that may affect survival in cancer care include volume (overview [8], and for breast and prostate cancer surgery [9, 10]); specialisation, (eg colorectal and ovarian cancers[11,12]); treatment standards (eg

colorectaland breast cancers [13, 14]; staffing levels [15] and academic (teaching or specialist) hospital status [16, 17]. But there is less evidence for organisational factors relating to satisfaction.

The UK National Health Service (NHS) has embraced patient surveys for the assessment of hospital-level services. Survey results have been used in performance indicators published by the national regulatory body [18]. The Picker satisfaction questionnaire has been validated in comparison with three others [4], and used in both general hospital surveys and surveys for specific diseases including heart disease, accidents, mental health and cancer [19]. The national cancer survey was made to support the Cancer Plan for England [20], and included patients with six common cancers [21].

We have made secondary analyses of the NHS cancer patient satisfaction survey to investigate whether responses to questions varied by tumour types, and the extent to which the responses for different aspects of the care process were related by hospital. In this way we could identify the extent to which satisfaction is affected by the care teams that work with individual patients as well as the overall cancer care offered by the hospital. Ethics approval was given by the South East Regional Ethics Committee (UK).

Methods

The survey of NHS cancer patients was undertaken by an independent organisation, the National Centre for Surveys and Research (NCSR), using a random sample from a national (England) sampling frame. Patients were identified from hospital admission/discharge registers, and a postal questionnaire sent to the patient's address. The survey was carried out in 2000/01 and received responses from 65,337 patients diagnosed with one of six types of cancer in relation to one episode of in-hospital care in 1999(22). The response rate overall was 74%, ranging from 77% for breast cancer to 62% for lung cancer, and between hospitals from under 60% to over 80%(21). We investigated the four commonest cancers: breast (25,772) colorectal (15,891), lung (4011) and prostate (10,992), a total of 55,674 respondents.

Questions were developed by the NCSR, and patient responses were dichotomised according to whether they reflected a perceived problem with that aspect of care. Drawing from 60 questions, the NCSR undertook a factor analysis to construct ten dimensions with adequate inter-item correlations, and a single lead question within each dimension [22]. We used these single item questions to assess inter-relationships of the ten dimensions between hospitals and tumour types.

The ten dimensions are shown in Table 1. Single lead questions were used for nine of them, while a tenth dimension (outpatient clinics: medical care) was constructed when no single lead question could be identified by the NCSR analysis [22]. For this dimension five questions (which related to the waiting time to see the doctor, the actual time spent by doctors with the patient, the perceived time spent by the doctors

with the patient, confidence and trust in the outpatient doctor and whether the patient was treated with respect and dignity as an outpatient) were amalgamated into one single question, and defined as a patient having a problem with any of the five aspects. Using the dichotomy of question responses, "problem" or "no problem" used by NCSR, we made a logistic regression analysis of the relationship between response and age, gender and tumour type, whilst correcting for variations between hospitals.

To address the likelihood of response set bias, we also analysed the data using internal standardisation. The first step was to calculate the expected proportions of patients expressing a problem with each aspect of care given the tumour type and age-sex composition of the hospital. After stratifying with respect to age and sex, these expected outcomes were estimated from the observed national rates. To compare actual performance against the expected we calculated a z-score by subtracting the expected number of recorded problems from the observed number and dividing by the standard deviation [23]. The standard deviation was obtained by assuming that the observed values within each stratum were binomially distributed about the national mean. To compensate for over-dispersion each z-score was then adjusted by inflating the variance appropriately [24]. These adjusted z-scores reflect the performance of each hospital with respect to each questionnaire dimension and, being standardised, with a mean of zero and variance equal to one, are mutually comparable and reduce any response bias. Further details are given in the Appendix. To measure whether satisfaction varied across tumour types within hospitals we correlated z-scores for each tumour type pair-wise by calculating Pearson correlation coefficients.

We also analysed the combination of z-scores for each particular hospital in order to judge the extent with which outcomes for individual hospitals are similar across all ten care dimensions. Our null hypothesis was that, at the hospital level, there was no similarity with regard to quality across the different aspects of care, so that any correlations between the different dimensions occur at the individual patient level. For each tumour type we summed each hospital's set of z-scores and divided the total by the standard deviation, calculated assuming the null hypothesis, i.e. we adjusted for correlations at the individual patient level . This gave us an overall score for each hospital that reflected levels of patient satisfaction across the ten care dimensions. Under the null hypothesis, the variances of these scores would be equal to one. Again, further details are described in the appendix. After testing for normality using a Kolmogorov-Smirnov one sample Test [25], we compared the observed variance with the null hypothesis of unit variance using a chi-squared test.

Results

The overall number of respondents to each question and the proportion indicating a problem with the corresponding aspect of care are shown by tumour type in Table 2. The highest proportion of patients reported problems in relation to experience of pain and discomfort (dimension 5) whilst only a small proportion of patients indicated problems with privacy at outpatients clinics (dimension 10).

Within some dimensions there appear to be large differences between tumour types, in particular with access to care (dimension 1); for other dimensions the results across tumour types are more uniform, e.g. respect and communication at first treatment (dimension 4) and aftercare (dimension 8). The proportion of patients reporting problems was generally lower for breast cancer compared with the other three tumour types, except for outpatient aftercare (dimension 9).

The results of analysing the relationship between response and age, gender and tumour type by logistic regression are shown in Table 3. Correcting for the other factors, patients indicating problems tend to be younger or female. However, breast and lung cancer patients are inclined to indicate fewer problems than patients with colorectal cancer, while prostate cancer patients tend to specify more problems.

Pair-wise correlations of hospital-wide adjusted satisfaction scores between each tumour type by care dimension are shown in Table 4. Satisfaction scores were correlated ($p<0.001$) for colorectal and breast cancer in eight out of ten dimensions of care, between colorectal and prostate, and breast and prostate, in five dimensions, and for lung with the other cancers in three and two dimensions. Table 4 also shows more

correlation of satisfaction scores for dimensions relating to the hospital period of the episode (dimensions 4 - 6), and more variation between tumour types for pre- and post-hospital care (dimensions 1 - 3, and 7 - 10).

To assess the presence of an independent hospital effect, the individual z-scores for each hospital were summed over all ten aspects of care and divided by the standard deviation to generate an overall satisfaction score. The distribution of the resulting satisfaction scores for colorectal cancer is shown in Figure 1 together with the fitted normal distribution and the standard normal curve for comparison. Testing these scores (Table 5) indicated that, for each tumour type, it was reasonable to assume a normal distribution. We could therefore compare the observed variances of the scores with a null hypothesis of unit variance using chi-squared tests, and these showed significant differences for each tumour type (Table 5). This indicates that the cancer patient satisfaction scores were correlated not only for individuals, but also independently at hospital level.

Discussion

We investigated whether hospitals may have an independent effect on cancer patient satisfaction with their care. We were able to compare patient answers across hospitals, tumour types and dimensions of care by using z-score standardisation for each dimension of care. To an extent this also reduces response bias by normalising the responses to each question. We found that hospital satisfaction varies by cancer type (for breast, colorectal, lung and prostate cancer patients), and with more effect on in-hospital than out-of-hospital care. We also found that the cancer patient satisfaction scores were correlated not only for individuals, but also independently at hospital level.

Limitations of the study

There were moderate associations of satisfaction by patients treated at the same hospital for three different cancer diagnoses, but less similarity in responses across the different cancers for the pre- and post-hospital dimensions, which may reflect real differences in patterns of care specific to the cancer types. Our findings took account of greater dissatisfaction reported among younger and female patients, and for colorectal and prostate cancers. Differences in patient socio-economic characteristics, and in stage and co-morbidity case-mix, are important for cancer survival [26]. We had no data available to adjust for these, and they could be confounding factors.

A larger body of work (indicated earlier) has related hospital characteristics to cancer patient survival. The satisfaction survey did not give details of hospital

characteristics. Apart from volume, physician specialisation, standards, staffing and academic (teaching) status, other potential hospital-related factors affecting cancer patient satisfaction might include hospital specialisation [27] and variation in geographical access [28]. Moreover, information and communication [29] are of particular concern to cancer patients, and these might also be structured systematically by hospital as well as individual clinician.

Satisfaction of lung cancer patients was less strongly correlated than for other cancers. This finding may be partly an artefact, relating to the considerably shorter survival of lung cancer compared with breast, colorectal and prostate cancers, and therefore greater selection of patients: there could have been a greater proportion of sicker patients, with less satisfaction in outcome, in the survivors interviewed. Differences in treatment experienced (eg proportion given surgery, radiotherapy or chemotherapy) could also affect satisfaction responses.

Strengths of the study

A strength of this study is that we have been able to overcome some of the potential problems in analysing survey data. In particular, we have attempted to quantify the extent to which consistent responses across different aspects of care are due to hospital-level factors beyond the response-set of an individual patient. To reduce the effects of bias when assessing consistency, we have standardised outcomes in relation to each care dimension. We have also been able to allow for the movement of patients between hospitals. However, the fact that such movements occur would affect the independence of the overall satisfaction scores, but this only appears to affect a few,

perhaps specialised, hospitals, to which many patients from nearby hospitals are referred for treatment.

Implications

The national survey of cancer patients' satisfaction was a unique national survey of cancer care in England. The high response rate to the survey, with 74% overall with 65,337 replies, reflects accuracy of recent discharge addresses, and the interest of most patients in providing feed-back about their care. Presentation of hospital differences in cancer care in a public sphere, as for example in Ontario [30] and UK [31], may encourage managers and patients to become more aware of quality measures. From our analysis, improvements of care within hospitals are more likely to impact on all cancer types, while care before and after hospitalisation would need action that is more cancer-type specific. Further investigation of explanatory characteristics of variations in cancer patients' satisfaction with care is warranted.

Appendix

For a particular tumour type, let π_{qi} denote the national proportion of patients in age-sex stratum i who specify a problem with question q. Also, within hospital t, let n_{tqi} denote the number of respondents to question q in stratum i and m_{tqi} the number who specify a problem. Then the z-score for hospital t in relation to question q is given by:

$$z_{tq} = -\frac{\sum_i (m_{tqi} - n_{tqi}\pi_{qi})}{\sqrt{\sum_i n_{tqi}\pi_{qi}(1-\pi_{qi})}}$$

If the outcomes are binomially distributed about the national mean, then these z-scores will have expected value equal to zero and a variance of one.

To adjust for over-dispersion in these z-scores we calculate the quantity:

$$s_q = \sqrt{\frac{\sum_t z_{tq}^2}{T}}$$

then use this in adjusting the z-scores:

$$z_{tq}^* = \frac{z_{tq}}{s_q}$$

We now put $Y_t = \sum_q z_{tq}^*$, the sum of each hospital's z-scores over the ten questions.

The expected value of Y_t will be zero, and the variance can be approximated by:

$$Var\,(Y_t) = 10 + \sum_q \sum_{r \neq q} Cov\,(z_{tq}^*, z_{tr}^*)$$

i.e. the sum of the variances of the individual z-scores and the covariances between each pair of questions. (Note that if a hospital has only scores for, say, nine questions then the first term of the above variance will be equal to nine instead of ten.)

Under the null hypothesis of that, at the hospital level, there was no similarity with regard to quality across the different aspects of care, any correlations between the different dimensions are at the individual patient level. These covariances can then be calculated from the individual responses: if x_{tqik} denotes the response to question q for patient k in stratum i and hospital t, then

$$Cov\,(z_{tq}^*, z_{tr}^*) = \frac{Cov\,(z_{tq}, z_{tr})}{s_q s_r} = \frac{\sum_i \sum_k Cov\,(x_{tqik}, x_{trik})}{s_q s_r}$$

If a patient refers to different hospitals in his or her responses to questions q and r, then the covariance in the summation will be zero.

The satisfaction score for each hospital is calculated as:

$$Z_t = \frac{Y_t}{\sqrt{Var\ (Y_t)}}$$

Under the null hypothesis this will have a variance equal to one.

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Conflict of interest statement

The Authors declare they have no conflict of interest

References

1. Mainz J. Defining and classifying clinical indicators for quality improvement. Int J Qual Hlth Care. 2003;**15**:523-530.

2. Crow R, Gage H, Hampson S, et al. The measurement of satisfaction with health care: implications for practice from a systematic review of the literature. Health Tech Assess. 2002;**6**:1-244.

3. Brédart A, Razavi D, Delvaux N, et al. A comprehensive assessment of satisfaction with care for cancer patients. Suppor Care Cancer 1998;**6**:487-541.

4. Perneger TV, Kossovsky MP, Cathieni F, di Florio V, Burnand B. A randomized trial of four patient satisfaction questionnaires. Med Care. 2003;**41**:1343-1352.

5. Fakhoury W, Addington-Hall J, McCarthy M. Determinants of informal caregivers' satisfaction with services for dying cancer patients. Soc Sci Med. 1996; **42**:721-731.

6. Sandoval GA, Levinton C, Blackstien-Hirsch P, Brown AD. Selecting predictors of cancer patients' overall perceptions of the quality of care received. Ann Oncol. 2006;**17**:151-156.

7. Sandoval1 GA, Brown AD, Sullivan T, Green E. Factors that influence cancer patients' overall perceptions of the quality of care. Int J Qual Health Care. 2006;**18**(4):266-274.

8. Halm EA, Lee C, Chassin MR. Is volume related to outcome in health care? A systematic review and methodological critique of the literature. Ann Intern Med. 2002;**137**:511-520.

9. Mikeljevic JS, Haward RA, Johnston C, Sainsbury R, Forman D. Surgeon workload and survival from breast cancer. Br J Cancer. 2003;**89**:487−491.

10. Thorpe AC, Cleary R, Coles J, Vernon S, Reynolds J, Neal DE. Deaths and complications following prostatectomy in 1400 men in the Northern Region of England. Br J Urol 1994;**74**:559-565.

11. Smith TJ, Hillner BE. Ensuring quality cancer care by the use of clinical practice guidelines and critical pathways. J Clin Oncol. 2001;**19**(11):2886-2897.

12. Woodman C, Baghdady A, Collins S, Clyma J-A. What changes in the organisation of cancer services will improve the outcome for women with ovarian cancer? Br J Obstet Gynaecol 1997;**104**:135-139.

13. Smith JA, King PS, Lane RH, Thompson MR. Evidence of the effect of 'specialization' on the management, surgical outcome and survival from colorectal cancer in Wessex. Br J Surg. 2003;**90**(5):583-592.

14. de Roos MAJ, de Bock GH, Baas PC, de Munck L, Wiggers T, de Vries J. Compliance with guidelines is related to better local recurrence-free survival in ductal carcinoma in situ. Br J Cancer. 2005; **93**(10):1122-1127.

15. Tourangeau AE, Cranley LA, Jeffs L. Impact of nursing on hospital patient mortality: a focused review and related policy implications. Qual Saf Health Care, 2006;**15**:4-8.

16. Richards MA, Wolfe C, Tilling K, Barton J, Bourne HM, Gregory WM. Variations in the management and survival of women under 50 years with breast cancer in the South East Thames region. Br J Cancer 1996;**73**(6):751-757.

17. Chaudhry R, Goel V, Sawka C. Breast cancer survival by teaching status of the initial treating hospital. CMAJ 2001;**164**(2):183-188.

18. Healthcare Commission. *NHS Performance Ratings 2004/5*. London: Commission for Healthcare Audit and Inspection, 2005.

19. Picker Institute Europe. *Is the NHS getting better or worse?* Oxford: Picker Institute Europe, 2005.

20. Department of Health. *The NHS Cancer Plan: a Plan for Investment, a Plan for Reform*. London: Department of Health, 2002.

21. Department of Health. *National Survey of NHS Patients: Cancer Survey*. London: Department of Health, 2002.

22. Department of Health. *National Survey of NHS Patients. Cancer: Analysis of Themes*. London: Department of Health, 2004.

23. Altman, D.G. *Practical Statistics for Medical Research*. London: Chapman & Hall, 1990.

24. Spiegelhalter DJ. Handling over-dispersion of performance indicators. Qual Saf Health Care 2005;**14**:347-351.

25. Siegel S, Castellan NJ. *Nonparametric Statistics for the Behavioral Sciences*. New York: McGraw Hill, 1988.

26. Read WL, Tierney RM, Page NC, et al. Differential prognostic impact of comorbidity. J Clin Oncol. 2004;**22**(15):3099-3103.

27. Urbach DR, Baxter NN. Does it matter what a hospital is "high volume" for? Specificity of hospital volume-outcome associations for surgical procedures: analysis of administrative data. Brit Med J 2004;**328**:737-740.

28. Jack RH, Gulliford MC, Ferguson J, Møller H. Geographical inequalities in lung cancer management and survival in South East England: evidence of variation in access to oncology services? Brit J Can 2003;**88**:1025-1031.

39. Davidson R, Mills ME. Cancer patients' satisfaction with communication, information and quality of care in a UK region. Eur J Cancer Care 2005; 14: 83-90.

30. Cancer Care Ontario. http://www.cancercare.on.ca/qualityindex2007/outcomes/satisfaction/index.html

31. McCarthy M, Gonzalez-Izquierdo A, Sherlaw-Johnson C, Khachatryan A, Coleman MP, Rachet B. Comparative indicators for cancer network management in England: availability, characteristics and presentation. BioMedCentral Health Services Research 2008; 8**:**45. Doi:10.1186/1472-6963-8-45

Table 1: The ten care dimensions within the survey.

Dimension	Heading	Single questions used to represent each dimension
1	Access to care: waiting times	Time waiting for first appointment with doctor
2	Explanation at first visit	Time spent on explaining condition at first visit
3	Understanding of diagnosis and treatment	Whether doctor discussed the purpose of treatment with patient
4	First treatment: respect communication and involvement	Whether treated with respect and dignity by doctor/nurse
5	First treatment: pain and discomfort	Whether in pain or discomfort during first visit
6	First treatment: hospital management	Whether there were sufficient nurses on duty
7	Discharge co-ordination	Whether patient given printed information on care after discharge
8	Aftercare	Whether doctors spent enough time informing patient on aftercare
9	Recent outpatient visit: medical care	*Five questions amalgamated into single composite*
10	Recent outpatient visit: privacy	Privacy when discussing condition/treatment

Table 2: The number of respondents to each question and the proportion indicating a problem with each aspect of care.

Dimension of care	Colorectal		Breast		Lung		Prostate	
	Respondents	% problems	Respondents	% problems	Respondents	% problems	Respondents	% problems
1 (access)	12,061	37.2%	16,025	13.5%	2,865	25.4%	7,216	45.8%
2 (explanation)	13,549	22.4%	22,525	16.6%	3,508	18.3%	8,519	28.6%
3 (understanding)	14,421	18.0%	22,808	14.8%	3,572	19.9%	8,969	22.7%
4 (respect)	14,508	21.8%	22,920	21.4%	3,629	19.3%	9,106	19.1%
5 (pain)	14,417	70.8%	22,828	64.0%	3,593	58.6%	9,016	60.0%
6 (nurses)	15,676	26.3%	25,308	26.7%	3,937	19.9%	10,753	19.2%
7 (coordination)	14,249	32.5%	22,650	17.7%	3,535	30.2%	8,875	31.8%
8 (aftercare)	14,210	19.1%	22,579	18.1%	3,527	21.0%	8,847	21.2%
9 (medical)	12,621	49.6%	21,869	63.0%	3,251	48.3%	8,226	51.9%
10 (privacy)	13,028	0.7%	22,454	0.7%	3,309	0.5%	8,424	0.6%
Total respondents	15,891		25,772		4,011		10,992	

Table 3: The influence of different cofactors on the chances of a patient expressing a problem with each aspect of care. Outcomes of a multivariate logistic regression analysis.

	Every five years of age		Female sex		Tumour type compared to colorectal					
					Breast		Prostate		Lung	
Dimension of care	Odds ratio	p-value	Odds ratio	p-value	Odds ratio	p-value	Odds ratio	p-value	Odds ratio	p-value
1 (access)	0.90	<0.001	1.16	<0.001	0.19	<0.001	1.67	<0.001	0.54	<0.001
2 (explanation)	0.98	<0.001	0.89	0.002	0.72	<0.001	1.37	<0.001	0.79	<0.001
3 (understanding)	1.00	0.68	1.16	<0.001	0.74	<0.001	1.43	<0.001	1.16	0.002
4 (respect)	0.90	<0.001	1.31	<0.001	0.71	<0.001	1.06	0.11	0.89	0.02
5 (pain)	0.92	<0.001	1.07	0.03	0.60	<0.001	0.70	<0.001	0.57	<0.001
6 (nurses)	0.90	<0.001	1.28	<0.001	0.77	<0.001	0.83	<0.001	0.73	<0.001
7 (coordination)	1.05	<0.001	1.51	<0.001	0.38	<0.001	1.11	0.002	1.02	0.69
8 (aftercare)	1.01	0.37	1.55	<0.001	0.76	<0.001	1.41	<0.001	1.19	<0.001
9 (medical)	0.91	<0.001	1.04	0.22	1.45	<0.001	1.22	<0.001	0.91	0.02
10 (privacy)	0.83	<0.001	0.93	0.70	0.81	0.26	1.08	0.69	0.70	0.18

Table 4: Pairwise correlations of hospital satisfaction scores (adjusted) for each aspect of care between different tumour types. Pearson correlation coefficients (two-tailed p-values in parentheses). Correlations significant at the 1% level are indicated in **bold**.

Dimension of care	Colorectal v. breast	Colorectal v. lung	Colorectal v. prostate	Breast v. lung	Breast v. prostate	Lung v. prostate
1 (access)	**0.23 (0.002)**	-0.30 (0.70)	**0.25 (0.001)**	-0.02 (0.77)	0.01 (0.94)	-0.04 (0.59)
2 (explanation)	0.08 (0.30)	0.06 (0.47)	0.12 (0.14)	-0.03 (0.69)	0.06 (0.41)	-0.04 (0.63)
3 (understanding)	**0.23 (0.002)**	0.04 (0.63)	0.04 (0.60)	-0.14 (0.07)	0.06 (0.41)	-0.12 (0.12)
4 (respect)	**0.35 (<0.001)**	0.11 (0.15)	**0.19 (0.01)**	-0.01 (0.88)	**0.33 (<0.001)**	-0.02 (0.75)
5 (pain)	**0.48 (<0.001)**	**0.31 (<0.001)**	**0.40 (<0.001)**	**0.30 (<0.001)**	**0.34 (<0.001)**	**0.22 (0.003)**
6 (nurses)	**0.55 (<0.001)**	0.14 (0.08)	**0.40 (<0.001)**	**0.22 (0.004)**	**0.45 (<0.001)**	0.14 (0.08)
7 (coordination)	**0.38 (<0.001)**	**0.40 (<0.001)**	**0.35 (<0.001)**	**0.23 (0.003)**	**0.31 (<0.001)**	**0.25 (0.001)**
8 (aftercare)	**0.26 (0.001)**	**0.19 (0.01)**	0.16 (0.04)	0.10 (0.21)	0.16 (0.04)	-0.04 (0.59)
9 (medical)	**0.31 (<0.001)**	0.15 (0.05)	0.15 (0.04)	0.19 (0.02)	**0.19 (0.01)**	0.08 (0.31)
10 (privacy)	-0.06 (0.47)	0.03 (0.69)	0.12 (0.11)	-0.15 (0.045)	0.09 (0.23)	-0.03 (0.71)

Table 5: Analysis of combined satisfaction scores – tests for normality and comparison of observed variances with unit variance.

Tumour type	Test for normality (Kolmogorov-Smirnov D statistic	p-value for D statistic	Observed variance	95% confidence interval for variance	p-value
Colorectal	0.57	0.91	2.06	(1.68, 2.57)	< 0.001
Breast	0.44	0.99	2.00	(1.64, 2.51)	< 0.001
Lung	0.79	0.56	1.27	(1.04, 1.59)	0.01
Prostate	0.72	0.67	1.61	(1.31, 2.01)	< 0.001

Figure 1. Comparison of totalled hospital satisfaction z-scores divided by standard deviation, for colorectal cancer, compared with normal distribution, and fitted comparison curve