Comparing survival outcomes for patients with colorectal cancer treated in public and private hospitals

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ABSTRACT

Objective: To determine whether treatment in a private versus public hospital was an independent predictor of survival outcomes in patients with colorectal cancer.

Design: Retrospective, population-based study.

Setting: Tertiary care hospitals.

Participants: All patients diagnosed with colorectal cancer in Western Australia between 1993 and 2003.

Interventions: Management in private versus public hospitals.

Main outcome measures: Overall survival and cancer-specific survival rates.

Results: 5809 patients were treated for colorectal cancer. Of these, 1523 (26%) were managed in private hospitals. The 5-year overall survival rates for private and public hospital patients were 59.4% (95% CI, 56.9%–61.9%) and 48.6% (95% CI, 47.0%–50.2%), respectively. Significant independent predictors of overall survival were: treatment in a private hospital ($P = 0.0001$; relative risk [RR], 0.764; 95% CI, 0.696–0.839); younger age ($P = 0.0001$; RR, 1.032; 95% CI, 1.029–1.036); male sex ($P = 0.001$; RR, 1.148; 95% CI, 1.068–1.234); and cancer stage (eg, Stage II: $P = 0.0001$; RR, 1.508; 95% CI, 1.316–1.729).

Conclusions: Treatment in a private hospital was a significant independent predictor of survival outcomes. Further validation of these results would have a significant bearing on how we approach health care delivery for patients with colorectal cancer.

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There has been little attempt in the medical literature to assess the relative performance of different health care systems. An example would be the survival benefit for patients with serious, life-threatening illnesses being managed in one system compared with another. One of the main arguments against such comparisons is the need to stratify the risks to account for the inherent biases they engender.

In Australia, there are two health care systems:

- A clearly defined public hospital system manages the health care needs of the entire population. Access is not dependent on socioeconomic status. This system deals with the majority of patients requiring emergency care and provides education for medical and nursing staff.
- A private hospital system manages patients with private health insurance. This system is predominantly led by medical specialists, with the recent introduction of junior medical staff onto the wards. The proportion of the Australian population with private medical insurance has increased from 33.6% to 43.0% over the past 10 years.[1]

There have been few meaningful comparisons of outcomes for patients managed in these two systems. The aim of our study was to determine whether treatment in private versus public hospitals was an independent predictor of improved survival outcomes in patients with colorectal cancer. Risk was stratified according to the covariates known to influence survival in patients with colorectal cancer.[2]

METHODS

Review of pathology records

A retrospective review was performed of all pathology records from the four hospital pathology departments in Western Australia. From these records, we identified 5809 patients who had undergone treatment for colorectal cancer within the state during the period 1993–2003 inclusive. Only patients who had had a resection or a biopsy were included in the analysis. The pathology services at these hospitals processed surgical specimens from within the hospital and from other minor district and country hospitals. Cross-referencing these data with the Western Australian Cancer Registry identified a further 120 patients with colorectal cancer not found by the initial search protocol. Standardised pathology pro-forma reporting of colorectal specimens was introduced in Western Australia between 1996 and 1998. This included public and private services.

Tumour stage and site

Tumour stage was classified according to the current American Joint Committee on Cancer guidelines.[3] The histopathological report for each patient was reviewed and the information recorded. Anatomical site of the tumour was ascertained from the pathology reports and crosschecked with information from admission and procedure records. Rectal carcinomas were defined as originating within 12 cm of the anal verge. If cancer location could not be clearly defined, then it was coded as colonic.

Treatment

Patient records were crosschecked with the Western Australian Linked Database to determine whether patients had received either chemotherapy or radiotherapy. Patients were considered to have received chemotherapy if they had had one or more courses of treatment, and to have received radiotherapy if they completed either a short course (25 Gy, 5 fractions) or long course (45–50 Gy, 25 fractions) of treatment. Note was made as to whether the initial surgical treatment was conducted in a public or a private hospital.

Mortality data

Mortality data were obtained from the state death registry. Reports were reviewed individually and classified as death due to cancer or death from other causes. Postoperative mortality was defined as death within 30 days of a surgical procedure.

Index of socioeconomic advantage/disadvantage

The 2001 Australian Bureau of Statistics report on Socio-Economic Indexes for Areas was used to gain information on indexes of community disadvantage.[4] For each patient, we determined the values for the index of relative socioeconomic advantage/disadvantage, the index of economic resources, and the index of education and occupation. A frequency distribution was then performed,

1 Demographic data for patients managed in public and private hospitals in Western Australia (1993–2003)

	Public hospitals	Private hospitals	*P*
No. (%) patients with colorectal cancer	4286 (74%)	1523 (26%)	
Age (years) — mean ± SD (range)	68 ± 13 (14–99)	66 ± 13 (18–95)	0.001
Male : female ratio	1.18	1.20	0.723
Follow-up period (months) — mean ±SD (range)	61 ± 52 (1–205)	56 ± 39 (1–150)	0.888
Index of:			
relative socioeconomic advantage/disadvantage*	976 (856–1207)	1054 (870–1207)	0.0001
economic resources*	984 (816–1206)	1033 (865–1206)	0.0001
education and occupation*	972 (830–1223)	1046 (830–1223)	0.0001
Postoperative 30-day mortality rate	214 (5.0%)	38 (2.5%)	0.001

* Indexes standardised to have a mean ±SD of 1000 ± 100. ◆

and the patients were divided into quintiles. These quintiles were used as an ordinal scale of social disadvantage.

Ethics approval

Ethics approval for this project was obtained from the human research ethics committees at each hospital, the Confidentiality of Health Information Committee, and the University of Western Australia.

Statistical analysis

The data were imported into SPSS, version 11.0 (Macintosh version) (SPSS Inc, Chicago, Ill, USA) for statistical analysis.

Mean, SD and range were used as descriptive statistics. The χ^2 test was used to compare nominal data between the two groups.

The Kaplan–Meier product limit estimate of survival was used to calculate survival rates. For overall survival, the event variable included death in the postoperative period, death from cancer, or death as a result of other causes. For cancer-specific survival, the event variable included death from colorectal cancer (as defined on the death certificate). All survival times were calculated from the date of histological diagnosis of colorectal cancer until either an event occurred or they remained alive at 1 March 2006. The log-rank test was used to compare survival functions.

A multivariate logistic regression analysis was used to determine the relationship between a number of covariates and treatment in a private hospital. The covariates included: age, sex, site of cancer (colon versus rectum), cancer stage, and the index of relative socioeconomic advantage/disadvantage, or the index of economic resources, or the index of education and occupation.

The Cox proportional hazards model was used to define the relationship between a number of covariates and overall and cancer-specific survival. The covariates included: age, sex, site of cancer (colon versus rectum), cancer stage (ie, I, II, III, and IV),[3] use of chemotherapy, use of radiotherapy, public hospital versus private hospital, the index of relative socioeconomic advantage/disadvantage. All the variables were categorical apart from age (years), which was analysed as a continuous variable. All variables were entered into the analysis using the forced-entry method. Significance was defined as the probability of a type 1 error of less than 5%. The results are presented as relative risk (RR) and 95% confidence intervals. The likelihood statistic was used as an overall test of the Cox regression model.

RESULTS

Between 1993 and 2003, 5809 patients with colorectal cancer were managed in Western Australia. Of these, 1523 patients (26%) were treated in private hospitals. Demographic data for the two groups are given in Box 1. Patients treated in private hospitals were younger, and had a lower 30-day postoperative mortality rate. In addition, they had a higher index of relative socioeconomic advantage/disadvantage, a higher index of economic resources, and a higher index of education and occupation.

Public hospital patients were more likely to have rectal cancers and Stage IV disease (Box 2). A higher proportion of private hospital patients had unknown staging (7% v 0.3%, Box 2). Most of these patients were diagnosed from a biopsy and did not undergo surgery in either hospital system. They most likely represent patients with advanced disease. Patients in private hospitals were significantly more likely to receive chemotherapy, especially if they had Stage II or III colon cancers. When considering only patients under 75 years of age, there was still a significantly higher use of chemotherapy in private hospitals. There was no difference between public and private hospital patients in the use of radiotherapy in those with rectal cancer.

When patients were divided into quintiles according to their index of relative socioeco-

2 Data on colorectal cancer in patients managed in public and private hospitals in Western Australia (1993–2003)

	Public hospitals	Private hospitals	*P*
Colon cancer	2946 (69%)	1226 (80%)	
Rectal cancer	1340 (31%)	297 (20%)	0.0001
Stage*			
I	670 (16%)	222 (15%)	0.059
II	1559 (36%)	540 (36%)	0.630
III	1538 (36%)	523 (34%)	0.779
IV	510 (12%)	132 (9%)	0.048
Unknown	9 (0.3%)	106 (7%)	0.001
Chemotherapy — colorectal cancer	931 (22%)	482 (32%)	0.0001
Chemotherapy — colon cancer			
Stage II	126/1051 (12%)	72/453 (16%)	0.004
Stage III	367/1056 (35%)	222/429 (52%)	0.0001
Radiotherapy — rectal cancer	165/1340 (12%)	44/297 (15%)	0.243

* American Joint Committee on Cancer guidelines.[3] ◆

3 The 5-year overall survival and cancer-specific survival rates for patients with various stages of colorectal cancer managed in Western Australia (1993–2003) — results for public versus private hospitals

Mode of survival and cancer stage*	Public hospitals 5-year survival (95% CI)	Private hospitals 5-year survival (95% CI)	*P*
Overall survival			
All stages	48.6% (47.0%–50.2%)	59.4% (56.9%–61.9%)	0.0001
Stage I	74.3% (70.9%–77.7%)	85.3% (80.3%–90.3%)	0.002
Stage II	60.8% (58.4%–63.2%)	70.3% (66.3%–74.3%)	0.0001
Stage III	37.5% (35.1%–39.9%)	47.0% (42.6%–51.4%)	0.0001
Stage IV	10.4% (7.7%–13.1%)	16.7% (10.1%–23.3%)	0.002
Cancer-specific survival			
All stages	58.7% (57.1%–60.3%)	67.6% (65.1%–70.1%)	0.0001
Stage I	89.0% (86.5%–91.5%)	92.4% (88.5%–96.3%)	0.060
Stage II	74.5% (72.2%–76.8%)	82.8% (79.3%–86.3%)	0.001
Stage III	44.5% (41.9%–47.1%)	52.5% (47.9%–57.1%)	0.001
Stage IV	12.6% (9.4%–15.8%)	18.7% (11.6%–25.8%)	0.034

* American Joint Committee on Cancer guidelines.[3] ◆

nomic advantage/disadvantage, there was no difference in either their stage of disease at presentation or the 30-day postoperative mortality rate.

Patients treated in private hospitals had significantly better 5-year overall survival and cancer-specific survival rates when compared with patients treated in public hospitals (Box 3 and Box 4). This survival advantage was seen in all stages of disease except for the cancer-specific survival in patients with Stage I disease (Box 3).

A logistic regression was performed to analyse the influence of several covariates on whether a patient received treatment in a private hospital. Significant independent predictors of receiving treatment in a private hospital included: younger age at diagnosis ($P = 0.0001$; odds ratio [OR], 0.986; 95% CI, 0.981–0.991), male sex ($P = 0.026$; OR, 1.155; 95% CI, 1.017–1.310), cancer of the colon ($P = 0.001$; OR, 2.087; 95% CI, 1.787–2.537), and a higher index of relative socioeconomic advantage/disadvantage (highest index, $P = 0.001$; OR, 4.414; 95% CI, 3.604–5.407). This analysis was not influenced by the type of socioeconomic index used in the calculations.

A Cox proportional hazards regression analysis was then performed to evaluate the influence of a number of covariates on overall and cancer-specific survival rates (Box 5). Independent predictors of improved overall survival included: treatment in a private hospital, diagnosis at a younger age, female sex, and cancer stage. Independent predictors of cancer-specific survival included: treatment in a private hospital, diagnosis at a younger age, and cancer stage.

DISCUSSION

The results of our study indicate that patients with colorectal cancer treated in a private hospital have improved survival outcomes when compared with patients treated in a public hospital. This relationship holds, even when corrected for potential confounding variables such as stage of disease, patient age and sex, use of adjuvant therapies, and disease location. The improvements in survival outcomes were noted for all stages of cancer. The significance of this association deserves further consideration.

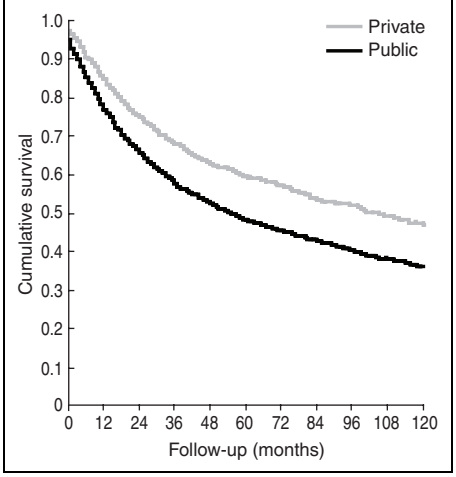
Clearly, not all of the potential factors that impact on survival could be adjusted for. This analysis was unable to clearly determine prognostic factors such as mode of presentation (ie, emergency v elective treatment), general health of the patient (eg, smoking status and American Society of Anesthesiologists [ASA] score — a subjective categorisation of patients into five subgroups by preoperative physical fitness), and quality of surgery.[2]

An analysis of the socioeconomic indexes for the study population showed a marked difference between those treated in public versus private hospitals. Patients treated in a public hospital had significantly lower scores for the index of relative socioeconomic advantage/disadvantage, the index of economic resources, and the index of education and occupation. However, none of the socioeconomic indexes were significant predictors (in univariate and multivariate analysis) of either overall or cancer-specific survival outcomes. There was also no difference in either stage of disease at presentation or postoperative mortality rate between these groups.

Why were there improved survival outcomes for patients treated in a private hospital? This finding may reflect improved standards of surgery; in general, surgeons performing high volumes of procedures have improved patient survival outcomes.[5] There was also increased access to chemotherapy in private hospitals. This was especially noted in patients with Stage II and III disease and appeared to be independent of patient age. There is now acceptance of the use of chemotherapy as standard treatment for Stage III disease,[2] yet in public hospitals only 45% of patients with Stage III disease who were less than 75 years of age received chemotherapy. This compares with 67% of similar patients in private hospitals. This low rate of compliance with accepted clinical standards is a point of significant concern.

The survival differences between the two groups could also be explained by the fact that patients treated in a public hospital may be less fit and possibly more likely to present as emergencies. Precise data for these two areas were not available for our

4 Comparison of overall survival rates of patients treated for colorectal cancer in public versus private hospitals in Western Australia (1993–2003)



5 Cox proportional hazards regression model of the influence of a number of independent predictors on overall survival in patients with colorectal cancer treated in Western Australia (1993–2003)

Covariates	*P*	Relative risk	95% CI
Hospital			
Public	0.0001	1.000	
Private		0.764	0.696–0.839
Age at diagnosis	0.0001	1.032	1.029–1.036
Sex			
Females	0.0001	1.000	
Males		1.148	1.068–1.234
Stage*			
I	0.0001	1.000	
II		1.508	1.316–1.729
III		3.227	2.820–3.692
IV		8.610	7.403–10.013

* American Joint Committee on Cancer guidelines.[3]

study. Having access to a score of wellness (eg, ASA) would have strengthened this analysis. Similarly, patients who present as emergencies with colorectal cancers appear to have reduced survival outcomes. However, clearly defining an emergency presentation can be difficult, especially with a retrospective analysis. A review of a database one of us (CP) has of patients with colorectal cancer (1996–2006) revealed that, if an emergency is defined as the requirement for surgery within 24 hours of admission without recourse to the usual preparation, then, in one public hospital, the emergency presentation rate was 11.6% (76/656). This compares with 3.8% (3/79) for emergency presentations to private hospitals. However, a review of the cancer stage at presentation for patients admitted as emergencies shows that they usually have advanced disease (Stage I, 3%; Stage II, 25%; Stage III, 18%; Stage IV, 53%). Yet, in our study, the improvements in survival rates were seen in patients through all stages of disease.

There have been previous attempts at defining the relationship between socioeconomic status, private health insurance, and outcomes for cancer. Within Western Australia, a population-based study by Hall et al[6] of patients with colorectal cancer diagnosed between 1982 and 2001 ($n = 14\,587$) attempted to address these issues. This study found that socioeconomic and location status, as well as private health insurance, did not influence overall survival. In Hall et al's study, patients' data were accessed directly from the Western Australian Linked Database, and no attempt was made to individually validate the pathology records and check on cancer staging. Patients with carcinoid tumours, adenosquamous and squamous carcinomas of the colon and rectum were included. The study also covered a time period when there was little use of adjuvant therapy. In contrast, our study included only patients with adenocarcinoma of the colon and rectum who had undergone a procedure or a biopsy; selection was from the pathology services; the results were all checked; and staging information was gained. This information was then crosschecked with the Cancer Registry and the Western Australian Linked Database. All diagnoses and treatments were validated.

The influence of socioeconomic status on cancer survival has been studied in other population centres in Australia and overseas. A regional study of patients with lung cancer in New South Wales ($n = 526$) found similar patterns of care and survival outcomes despite variation in the socioeconomic indexes.[7] A population-based study in Norway on cancer outcomes ($n = 98\,992$) found that survival improved with increasing average education level, and that this appeared to be due to earlier diagnosis.[8] In contrast, in our study, indexes of socioeconomic advantage/disadvantage, economic resources, and education and occupation were not significant determinants of survival in patients with colorectal cancer. Moorin and Holman[9] also used the Western Australian Linked Database to study the effects of socioeconomic status on accessibility to services for patients who had died of cancer between 1997 and 2000. They concluded that there was inequality between patients who were privately insured compared with those with no insurance who were relying on the public hospital system. Private patients had greater access to hospital resources.[9]

Within the United Kingdom there have been a number of population- and regional-based studies evaluating the association between social disadvantage and survival outcomes for patients with colorectal cancer. In contrast to Australia, fewer patients in the UK have private health insurance (11% in 2006 v 43% in Australia).[10] Several large UK studies have shown that deprivation predicts a worse survival outcome for patients with colorectal cancer.[11-14] These findings are usually significant on univariate analysis; however, when other independent predictors of survival outcomes are included (ie, cancer stage, ASA score, urgency of surgery), then deprivation seems less important. In general, deprived patients presented with more advanced disease and were less fit. Not all UK studies have shown an association between disadvantage and poorer outcomes for patients with colorectal cancer. One review of 603 consecutive patients with colorectal cancer within one district found no relationship between patient socioeconomic status and survival outcome.[15]

In conclusion, treatment in a private hospital was a significant independent predictor of survival for patients with all stages of colorectal cancer. In contrast, social disadvantage was not a predictor of survival in patients with colorectal cancer treated within Western Australia. The reasons for these improved survival outcomes in private hospitals need to be further elucidated. If these observed improvements are a result of superior treatment, and not just patient selection, then they raise serious concerns regarding equity and access to treatment.

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COMPETING INTERESTS

None identified.

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