Prostate cancer: socio-economic, geographical and private-health insurance effects on care and survival

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OBJECTIVE

To examine the effects of demographic, geographical and socio-economic factors, and the influence of private health insurance, on patterns of prostate cancer care and 3-year survival in Western Australia (WA).

PATIENTS AND METHODS

The WA Record Linkage Project was used to extract all hospital morbidity, cancer and death records of men diagnosed with prostate cancer between 1982 and 2001. The likelihood of having a radical prostatectomy (RP) was estimated using logistic regression, and the likelihood of death 3 years after diagnosis was estimated using Cox regression.

RESULTS

The proportion of men undergoing RP increased six-fold, from 3.1% to 20.1%, over the 20 years, whilst non-radical surgery (transurethral, open or closed prostatectomy) simultaneously halved to 29%. Men who had RP were typically younger, married and with less comorbidity. Patients with a first admission to a rural hospital were much less likely to have RP (odds ratio 0.15; 95% confidence interval, CI, 0.11–0.21), whereas residence alone in a rural area had less effect (0.54, 0.29–1.03). A first admission to a private hospital increased the likelihood of having RP (2.40, 2.11–2.72), as did having private health insurance (1.77, 1.56–2.00); being more socio-economically disadvantaged reduced RP (0.63, 0.47–0.83). The 3-year mortality rate was greater with a first admission to a rural hospital (relative risk 1.22; 95% CI 1.09–1.36) and in more socio-economically disadvantaged groups (1.34, 1.10–1.64), whereas those admitted to a private hospital (0.77, 0.71–0.84) or with private health insurance (0.82, 0.76–0.89) fared better. Men who had RP had better survival than those who had non-radical surgery (4.85, 3.52–6.68) or no surgery (6.42, 4.65–8.84), although this may be an artefact of a screening effect.

CONCLUSION

The 3-year survival was poorer and the use of RP less frequent in men from socio-economically and geographically disadvantaged backgrounds, particularly those admitted to rural or public hospitals, and those with no private health insurance.

KEYWORDS

radical prostatectomy, geographical, socio-economic disadvantage, private health insurance, record linkage

INTRODUCTION

In Western Australia (WA), 1993 was a watershed year for prostate cancer; although available since 1989, PSA testing became separately itemized on the Medicare Benefits Schedule in November 1993 [1]. In that year overseas urologists arrived in Perth, with new surgical techniques and more aggressive approaches to prostate-cancer care. Furthermore, 1993 saw the beginning of Prostate Awareness Week in Perth, which provided free PSA testing [2]. Dramatic increases in the apparent incidence of prostate cancer were taking place across Australia, not because the underlying biological rate was changing, but because PSA testing allowed earlier latent cancers to be detected. In addition, more surgical procedures for supposed benign prostatic lesions were detecting more cancers [1,2]. In contrast, mortality from prostate cancer has remained stable [1,2].

The main approaches to the care of localized prostate cancer are radical prostatectomy (RP), radiotherapy or combinations of these [3]. There have been no adequate randomized control trials to evaluate which of these options gives the best outcome for survival and quality of life [3–7]. For men presenting with metastasized tumours, palliation and the relief of symptoms are the mainstay of therapy, using hormone suppression or TURP to relieve outlet symptoms. These men, especially if younger, should be diagnosed at an earlier stage when curative treatment may be considered, and thus patterns of non-radical surgery in younger men reflect a lack of early evaluation and opportunities for cure.

Curative radiotherapy is a newer treatment, and as an outpatient procedure is not recorded in the population databases used for the present study. As the present study was population-based and covered 20 years of prostate cancer care, it focuses on surgical intervention, particularly RP. The first aim therefore was to describe the patterns of surgical care and survival outcome in men diagnosed with prostatic cancer in WA.

Australia has universal publicly funded healthcare, provided in tandem with private-sector services funded through individual payments, with community risk pooling. The private health-insurance industry is subsidized by tax rebates. Patients with private health cover can choose to access private or public hospitals, and those with no cover have 'out-of-pocket' costs if they wish to enter the private system [8]. Commentators

have said that this has led to a two-tier system, for the rich and the poor, with implications for treatment patterns and survival in economically disadvantaged groups [9].

Previous studies have shown that there are socio-economic gradients in who has a PSA test, with the more socio-economically advantaged more likely to be tested earlier, especially in the younger groups [1]. Although rural and remote areas of WA initially lagged behind in the apparent incidence of prostate cancer, by 1996 similar rates were reported as in the metropolitan area [1]. The question remains as to whether men from more socio-economically deprived groups or those from non-metropolitan areas receive the same treatment for their prostate cancer as the less disadvantaged groups. In addition, the influence of the private health system on prostate cancer care has not been documented in Australia. The issues of socio-economic and geographical inequalities in prostate cancer care therefore warrant investigation, and the second aim of this study was to address these important questions on equality of care.

PATIENTS AND METHODS

The WA Record Linkage Project [10] was used to extract all state cancer registrations, death records and hospital morbidity records of all men resident in WA diagnosed with primary prostate cancer in the WA Cancer Registry (International Classification of Diseases, ICD-9185 and ICD-10-AM C61 [11,12]) from 1 January 1982 to 31 December 2001. The data were extracted on 18 June 2003; this allowed for prostate cancer-related hospital admissions, e.g. for surgery, during 2002 to be captured.

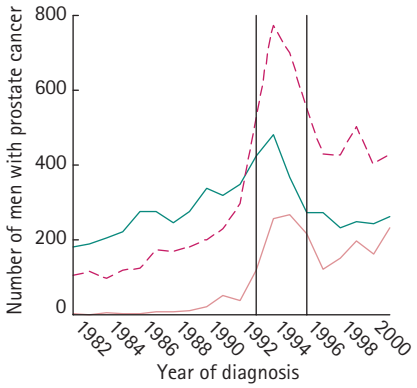
A chain of records was formed for each patient, consisting of rows of hospital admission information to which the cancer and death registry information was appended. The first hospital admission with a mention of a diagnosis of prostate cancer or with a prostate procedure was termed the index admission (11 773). However, in 17% of cases there was no hospital admission with a mention of prostate cancer, and in these cases the first hospital admission after the date of prostate cancer registration was used (2350). In either group, the index record had to be within 1 year before and 10 years after the date of prostate cancer registration. In both groups, almost all index records (90%) were within a year of the prostate cancer registration. The mean (SD) time for cases with an index record for prostate cancer was 0.45 (1.34) years, and for the combined group 0.55 (1.47) years. The index record provided demographic data plus hospital and private health insurance status, and whether the hospital was metropolitan or rural. Regression models using only those with a prostate cancer admission (11 773) and both groups (14 123) were constructed. The odds ratios (OR) and relative risk (RR) were stable, and the significance levels remained the same; therefore results from the combined groups are reported here, as in addition this captures patients treated with a 'watchful waiting' approach.

The Charlson comorbidity index was used to adjust for the effects of comorbidity in the regression analysis [13–15]. This index consisted of 17 groups of ICD codes weighted according to mortality risk (prostatic neoplasms not included); the total weighted index was divided into three intervals. Only comorbidity identified from hospital morbidity records at the time of the prostate cancer registration or in the previous 365 days before the registration contributed to the index.

The year of prostate cancer diagnosis was categorized into three groups. These were determined from several factors, primarily before, during and after the PSA testing years, assigned based on the work by Threlfall *et al.* [2]. These categories were substantiated by also being before, during and after the change in surgeons in Perth. The surgical rates were plotted and three distinct surgical patterns detected (Fig. 1).

To examine the effect of socio-economic disadvantage on treatment patterns and survival we assigned to each record an index of relative socio-economic disadvantage (IRSD) as published from WA collection district census data for 1991 and 1996. Based on household and individual attributes, the IRSD had five categories, dividing the population into quartiles of disadvantage, with the lowest quartile further subdivided into the 15% and 10% most disadvantaged [16]. Likewise, the Accessibility/Remoteness Index of Australia (ARIA) was assigned to each collection district [17]. In cases where the IRSD or ARIA remained unavailable, the postcode was used. Analysis using IRSD or ARIA codes was restricted to admissions after 1 January 1991, when collection districts first became available via address mapping.

FIG. 1. Patterns of surgical care (no surgery, red; radical, light red; non-radical, green) after a diagnosis of prostate cancer in WA, 1982–2001: the two vertical lines at 1993 and 1996 illustrate the three temporal categories.



For the analysis of the patterns of surgical care, prostate cancer treatment was defined as radical surgery, non-radical surgery (e.g. TURP, open or closed prostatectomy or destruction of tissues) or non-surgical intervention. The chi-square analysis was undertaken using the three groups. Crude and adjusted logistic regression analyses of the likelihood of having RP rather than non-radical or no surgery were used to allow a comparison of the RP approach and all other approaches, e.g. conservative 'watchful waiting', curative radiotherapy and any other pattern of care. Cox regression models of the all-cause likelihood of death at 3 years after prostate cancer diagnosis were constructed; these were checked to ensure that the proportional-hazards assumption was met. The 3-year survival models are reported, as 1 year was considered too short to assess prostate cancer outcome, and the patients diagnosed in the most recent calendar period had not yet had 5 years of follow-up. In all regression models for the age variable, the Box-Tidwell term (age × ln age) was used to produce the best-fit model for adjustment purposes [18]. The Human Research Ethics Committee of the authors' institution granted the study ethical approval.

RESULTS

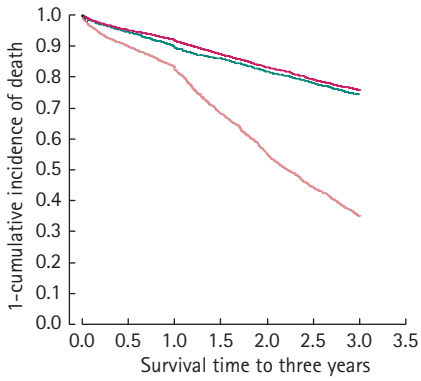
RP was the primary surgical treatment in 1787 (12.7%) men, whilst 5770 (40.8%) had

Category (N total)	n (%) per category	Radical surgery, %	Non-radical surgery, %
Calendar year of diagnosis (14 123)			
1982–92	4 838 (34.3)	3.1‡	59.4‡
1993–96	4 967 (35.2)	17.3	31.2
1997–2001	4 318 (30.5)	20.1	29.2
Age at admission (14 123)			
<65 years	3 199 (22.7)	38.7‡	26.6‡
>65 years	10 924 (77.3)	5.8	44.3
Charlson weighted comorbidity index (14 123)			
0–2	7 665 (54.3)	18.9‡	42.4‡
3–4	3 425 (24.3)	8.7	44.0
5–11	3 033 (21.5)	4.2	30.6
Marital status (14 123)			
Never married	821 (5.8)	10.6‡	44.5‡
Married/de facto	10 500 (74.3)	15.5	39.4
Divorced/separated	663 (4.7)	12.7	36.2
Widowed	1 834 (13.0)	3.2	45.1
Unknown	305 (2.2)	6.9	56.4
Indigenous status (14 123)			
Not indigenous	14 059 (99.5)	13.3‡	40.3‡
Indigenous	64 (0.5)	1.6	34.4
IRSD 1991–2001 (10 364)			
Least disadvantaged, 1	2 912 (28.1)	23.6‡	27.4
2	2 126 (20.5)	19.3	32.8
3	2 986 (28.8)	13.4	36.0
4	1 639 (15.8)	12.8	37.7
Most disadvantaged, 5	701 (6.8)	11.7	35.7
Insurance status (13 865)			
Public	6 895 (49.7)	8.2‡	42.5‡
Private	6 970 (50.3)	18.7	38.2
Hospital type (14 123)			
Public	7 695 (54.5)	6.5‡	42.6‡
Private	6 428 (45.5)	21.4	42.3
ARIA 1991–2001 (10 392)			
Very accessible	8 872 (85.4)	17.9‡	32.9‡
Accessible	743 (7.2)	11.0	35.7
Moderate accessible	504 (4.8)	15.1	35.3
Remote	187 (1.8)	15.0	29.4
Very remote	86 (0.8)	17.4	26.7
Location of hospital where first admitted (14 123)			
Metropolitan	12 462 (88.3)	14.7‡	41.3‡
Rural	1 661 (11.7)	2.30	32.6

TABLE 1 The characteristics of patients with prostate cancer in WA in 1982–2001, showing the proportions who received radical and non-radical prostate surgery

†P < 0.01, ‡<0.001.

FIG. 2. Survival after a diagnosis of prostate cancer in WA in different periods (1982–92, light red; 1993–96, red; 1997–2001, green).



non-radical surgery, leaving 6566 (46.5%) men with no surgical intervention. Of those who had non-radical surgery, 86 (1.5%) had a follow-up RP. A death was recorded for 6873 (48.7%) of the cases, and of these, 2402 (34.9%) had prostate cancer recorded as the underlying cause of death.

The proportion of men having RP increased seven-fold over the study period and was accompanied by a halving in the proportion having non-radical surgery (Fig. 1 and Table 1). Men were considerably more likely to have RP in the period after PSA testing was introduced, especially if younger, married and with less comorbidity (Tables 1 and 2). Men who were more socio-economically advantaged or had private health insurance were more likely to have RP, but when the other variables of disadvantage were entered into the model, the effect of private health insurance was lost.

A first admission to a metropolitan hospital, especially to a private hospital, increased the likelihood of having RP (Tables 1 and 2). In general, men resident in rural areas were less likely to have RP, but after adjusting for socio-economic and other disadvantage factors, men from the accessible and moderately accessible areas became more likely to have RP (Table 2). Further examination, using logistic regression, indicated that the OR for the IRSD was most affected by the hospital status and having private health insurance at the time of first hospital admission, whereas the IRSD was primarily responsible for the change in ORs of the ARIA between the demographically and fully adjusted models.

The 3-year cumulative incidence of survival was much better after a diagnosis in 1993–96 and 1997–2001 (Fig. 2). Cox regression models of the all-cause likelihood of death at 3 years (Table 3) showed that men were much less likely to die after a diagnosis of prostate cancer if they were diagnosed in the more recent periods, were younger, had less comorbidity and were described as either being presently married/de facto or divorced/separated, rather than never married or widowed. Men who had a RP were significantly less likely to die than those who did not have a surgical procedure or who had non-radical surgery, although this may have been a result of non-surgical factors. Men who had their first admission to a rural hospital, a public hospital or had no private health insurance, and men from socio-economically disadvantaged groups or living in rural areas, were also much more likely to die; however, men in remote areas did not fare worse. Some of these risk factors were

modified in the fully adjusted model and these were explored further. In the case of hospital location, each of the other factors of disadvantage individually reduced the RR from 1.22 to ≈1.00. Moreover, re-running the survival analysis without adjusting for surgical status gave a similar RR of 1.08 (95% CI 0.91–1.28). The RR for insurance status was modified by the hospital location, the IRSD and the ARIA, but not by the hospital status.

TABLE 2 Logistic regression analysis of the likelihood of having RP rather than non-radical or no surgery for primary prostate cancer according to demographic, social and geographical disadvantage, and having private health insurance

Factor	1982–2001 Crude OR (95% CI)	1982–2001 Adj OR (95% CI)*	1991–2001 Adj OR (95% CI)†
Calendar period (by year of diagnosis)			
1982–92	1.00	1.00	1.00
1993–96	6.63 (5.54–7.93)	5.27 (4.35–6.38)	1.99 (1.53–2.58)
1997–2001	7.95 (6.64–9.52)	6.00 (4.94–7.29)	2.35 (1.81–3.06)
Age at diagnosis			
Per year	0.84 (0.84–0.85)	0.85 (0.85–0.86)	0.85 (0.84–0.86)
Charlson (weighted comorbidity index)			
0	1.00	1.00	1.00
1–2	0.41 (0.36–0.47)	0.42 (0.53–0.72)	0.63 (0.53–0.74)
3–15	0.19 (0.16–0.23)	0.35 (0.29–0.44)	0.37 (0.30–0.46)
Indigenous status	0.11 (0.02–0.75)	0.11 (0.02–0.85)	0.19 (0.02–1.48)
Marital status			
Never married	1.00	1.00	1.00
Married/defacto	1.54 (1.23–1.94)	1.85 (1.42–2.41)	1.57 (1.19–2.09)
Divorced/separated	1.22 (0.89–1.68)	1.01 (0.70–1.46)	0.98 (0.67–1.45)
Widowed	0.28 (0.20–0.39)	1.18 (0.80–1.75)	1.37 (0.90–2.09)
Unknown	0.62 (0.38–1.02)	1.00 (0.57–1.76)	1.39 (0.76–2.53)
IRSD 1991–2001			
Least, 1	1.00	1.00	1.00
2	0.78 (0.68–0.89)	0.79 (0.67–0.94)	0.89 (0.75–1.05)
3	0.50 (0.44–0.57)	0.57 (0.48–0.67)	0.71 (0.59–0.84)
4	0.47 (0.40–0.56)	0.68 (0.56–0.83)	0.88 (0.72–1.09)
Most, 5	0.43 (0.34–0.55)	0.63 (0.47–0.83)	0.90 (0.66–1.21)
Insurance status			
Private	2.59 (2.33–2.87)	1.77 (1.56–2.00)	0.72 (0.58–0.89)
Hospital status			
Private	3.92 (3.52–4.37)	2.40 (2.11–2.72)	2.64 (2.11–3.29)
ARIA 1991–2001			
Very accessible	1.00	1.00	1.00
Accessible	0.57 (0.45–0.72)	0.63 (0.48–0.83)	1.03 (0.76–1.38)
Moderate accessible	0.81 (0.62–1.05)	0.74 (0.55–0.98)	1.21 (0.87–1.69)
Remote	0.81 (0.54–1.21)	0.49 (0.31–0.78)	0.71 (0.43–1.15)
Very remote	0.97 (0.55–1.70)	0.54 (0.29–1.03)	0.80 (0.40–1.59)
Location of hospital			
Rural	0.14 (0.10–0.19)	0.15 (0.11–0.21)	0.19 (0.13–0.28)

**for the adjusted OR 1982–2000, each factor was adjusted for age, Box-Tidwell transformation of age, calendar period, Charlson index, indigenous status and marital status, except where it was the factor of interest; †for the adjusted OR 1991–2000, each factor was adjusted as for * plus ARIA, IRSD, location and status of hospital, and insurance status, except where it was the factor of interest.*

DISCUSSION

Prostate cancer is a significant public-health issue in Australia, with continuing debate about testing, treatment and survival [1,4,19,20]. There was a considerable change in treatment patterns over the 20 years of the study, with a shift from non-radical surgery to RP, probably driven by an earlier identification of the cancer, coupled with increasing clinical knowledge and skills over this period. However, the change was not equally distributed among all men, with those in disadvantaged groups continuing to be less likely to have radical surgery.

In WA, the proportion of men diagnosed with prostate cancer treated by RP increased seven-fold, from 3% in the 1980s to 20% in 1997–2000. During the later years, 1993–2000, a third (36%) of men aged ≤65 years had RP, compared to 5% of men aged >65 years. During the late 1980s and before 1993, proportions of 38% [5] to 50% [21] were reported from the USA. The use of population-based data has many advantages [22,23] but the cancer registries in Australia do not routinely compile staging information, therefore prostate cancer staging was unavailable. It is plausible that earlier cancer stage could explain the higher RP fraction in the USA, as testing may have been more common earlier than in Australia [24], albeit that Australian rates continue to be lower than those reported from the USA [5,20]. The lower rate of RP in geographically and socio-economically disadvantaged groups also raises the possibility that a de facto screening process may have operated in metropolitan and higher socio-economic areas, leading to earlier diagnosis and the opportunity for more successful treatment regimens in these groups, and possibly better survival [2]. This may be because screening for prostate cancer is not being supported by published reports and therefore not incorporated into clinical best-practice guidelines [19,20,24,25].

There were substantial improvements in case survival after the introduction of PSA testing in 1993, and the move towards more aggressive surgical intervention. Health Department data from 1982 to 2002 indicated that the age-standardized mortality rate for prostate cancer in WA increased during the 1990s, but has since declined to levels of the 1980s (Fig. 3). These results were congruent with the assessment of Threlfall *et al.* [2], who found minor increases in the mortality rate in men aged >60 years up to 1996, but no real difference in the long-term trend. This increase to 1994 followed by a decline was reported elsewhere for Australia as a whole [3,20,26], the UK and the USA [27]. In contrast, the all-cause age-standardized mortality rates for WA men declined over this 20-year

TABLE 3 Cox regression analysis of the likelihood of death from any cause during the 3 years after a diagnosis of prostate cancer, according to demographic, social and geographical disadvantage, and having private health insurance

Factor	1982–2001 Crude RR (95% CI)	1982–2001 Adj RR (95% CI)*	1991–2001 Adj RR (95% CI)†
Calendar period (by year of diagnosis)			
1982–92	1.00	1.00	1.00
1993–96	0.30 (0.28–0.32)	0.37 (0.34–0.40)	0.59 (0.51–0.67)
1997–2001	0.32 (0.29–0.35)	0.35 (0.30–0.39)	0.54 (0.46–0.63)
Age at diagnosis			
Per year	1.09 (1.08–1.09)	1.06 (1.05–1.06)	1.07 (1.06–1.07)
Charlson (weighted comorbidity index)			
0	1.00	1.00	1.00
1–2	1.76 (1.60–1.94)	1.44 (1.30–1.59)	1.57 (1.37–1.81)
3–14	4.33 (3.97–4.71)	3.00 (2.74–3.28)	3.56 (3.13–4.05)
Indigenous status			
Indigenous	1.48 (0.91–2.42)	0.84 (0.51–1.40)	1.00 (0.46–2.15)
Marital status			
Never married	1.00	1.00	1.00
Married/defacto	0.66 (0.58–0.76)	0.72 (0.62–0.83)	0.71 (0.58–0.87)
Divorced/separated	0.71 (0.57–0.87)	0.78 (0.62–0.98)	0.73 (0.54–0.99)
Widowed	1.56 (1.35–1.80)	0.93 (0.79–1.10)	0.90 (0.71–1.13)
Unknown	0.88 (0.69–1.14)	0.87 (0.65–1.16)	1.04 (0.74–1.47)
Surgery			
Radical	1.00	1.00	1.00
Non-radical	14.65 (10.78–19.92)	4.85 (3.52–6.68)	4.71 (3.23–6.85)
No surgery	16.94 (12.48–23.00)	6.42 (4.65–8.84)	6.40 (4.41–9.29)
IRSD 1991–2001			
Least,	1	1.00	1.00
2	1.24 (1.08–1.43)	1.29 (1.11–1.51)	1.24 (1.07-1.45)
3	1.44 (1.27–1.63)	1.22 (1.06–1.40)	1.14 (0.98-1.32)
4	1.44 (1.25–1.67)	1.29 (1.10–1.51)	1.23 (1.05-1.45)
Most, 5	1.83 (1.53–2.20)	1.34 (1.10–1.64)	1.22 (0.99-1.50)
Insurance status			
Private	0.51 (0.48–0.55)	0.82 (0.76–0.89)	0.89 (0.77–1.03)
Hospital status			
Private	0.39 (0.36–0.42)	0.77 (0.71–0.84)	0.88 (0.76–0.99)
ARIA 1991–2001			
Very accessible	1.00	1.00	1.00
Accessible	1.40 (1.19–1.65)	1.18 (0.99–1.41)	1.12 (0.92–1.35)
Moderate accessible	1.42 (1.17–1.74)	1.40 (1.13–1.74)	1.32 (1.04–1.66)
Remote	0.99 (0.69–1.42)	1.07 (0.72–1.57)	1.00 (0.68–1.47)
Very remote	0.56 (0.29–1.08)	0.71 (0.36–1.07)	0.68 (0.34–1.35)
Location of hospital			
Rural	1.44 (1.31–1.59)	1.22 (1.09–1.36)	1.00 (0.84–1.18)

*†for the adjusted RR 1982–2000, each factor was adjusted for age, Box-Tidwell transformation of age, calendar period, Charlson index, indigenous status, marital status and surgical status, except where it was the factor of interest; ‡for the adjusted RR 1991–2000, each factor was adjusted as for *, plus ARIA, IRSD, location and status of hospital, and insurance status, except where it was the factor of interest.*

period, from 11.8 to 7.5 per 1000 man-years (Information supplied by Epidemiology & Analytical Services, WA Department of Health). Enormous caution is required when interpreting trends in case survival over time, which correlate with the introduction of new treatments, the introduction of a de facto screening process or changes in the background mortality rate. It is argued that PSA testing may mean that many latent 'innocent' prostate cancers would have been included in the clinical population of patients, leading to what might appear to be improved treatment and survival, when in reality the apparent benefits are an artefact because less-aggressive cancers are being detected and treated [24].

Australia has a pluralist health system, with a large private hospital sector supported by private health insurance. In this study, men admitted to private hospitals had much higher rates of RP and better survival. Typically men with access to private healthcare are more socio-economically advantaged, with higher levels of education, which may lead to more demand for screening [19] and active rather than conservative treatment. In addition, radiotherapy facilities are often more comprehensive in public hospitals and therefore there may be less curative radiotherapy used in the private sector; this may explain the pattern of surgical intervention, but not the additional survival seen in private hospital patients, even after adjusting for other factors such as comorbidity.

In California [5], Virginia [7] and the UK [6] there is a positive relationship between higher socio-economic status and higher rates of RP. In California [5], socio-economically or educationally advantaged groups were less likely to be treated in compliance with guidelines, suggesting that patients who demand more or can afford more are increasingly likely to be treated, even when according to the guidelines they are considered unsuitable; an example is men aged >70 years [3,24]. In concurrence, our study also found a strong socio-economic effect, and although it was reduced in the fully adjusted models, this was mainly a result of the additional effect of private health insurance. Tarman *et al.* [28] found that in an equal-access health system, patients from lower socio-economic groups presented with more advanced prostatic cancer. In WA, before PSA testing the incidence of prostate cancer was similar between socio-economic groups, but afterwards the incidence in the higher socio-economic groups increased [2]. While some of the variation in the odds of RP amongst socio-economic groups may be attributable to the stage of disease at presentation, it is likely that contributing

factors may also include less demand for surgery, surgeon preference and psychosocial reasons, e.g. fear of incontinence or impotence [29]. Men in higher socio-economic groups also tend to have a higher quality of life [30], which may affect treatment practices and survival [31].

Men first admitted to rural hospitals were much less likely to have RP and tended to have higher mortality. The mortality risk was confounded by each of the other factors of disadvantage, which may be indicative of more poverty in non-metropolitan areas and the lack of availability of private healthcare [31]. The rural and remote incidence of prostate cancer lagged behind that in metropolitan areas until 1996, reflecting lower PSA testing rates [2,31], and conceivably accounting for the lower treatment and survival rates. After adjusting for socio-demographic disadvantage, in the present study the case fatality in men with a first admission to a rural hospital was no different to that of men first admitted to metropolitan hospitals, who had a much higher use of RP. In this regard, 'first admitted to a rural hospital' is acting like an instrumental variable [32] and the result is consistent with no real effect of RP vs other treatment approaches on patient survival.

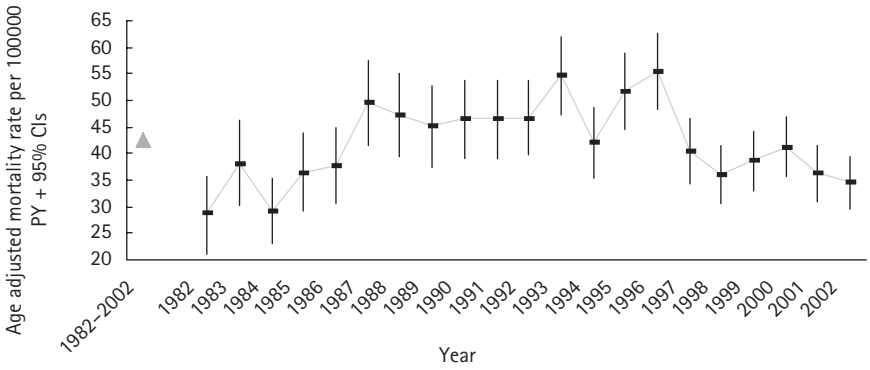
Related to hospital location was the residential location of the patient, men from remote areas tending to be admitted to metropolitan hospitals, whereas those from rural areas went to rural hospitals, thus explaining some of the fluctuation seen in the use of radical surgery and survival in the ARIA. Possibly rural patients are diagnosed at a later stage, are not given the choice of surgery, not recommended to undergo surgery, or rural surgeons choose not to use RP [6]. Radiotherapy options are also more limited in rural hospitals, making it unlikely that rural men are choosing radiotherapy rather than surgery, with the heavy commitment to travel to metropolitan centres for ongoing treatment [33]. Travelling distances to receive radiotherapy, even as little as 60 km, have been shown to affect treatment choices [34–36]. With 1.2 million people living in and around Perth, and the remaining WA population of 0.7 million people spread over 2.6 million km^2, travelling distance is a major barrier in accessing health services.

This study benefited from using population-based hospital morbidity records to examine surgical treatment patterns for prostate cancer in WA [10,22,23]. However, a limitation was that the data were not primarily collected for this purpose; in particular, outpatient radiotherapy treatment information was not collected. Furthermore, it was impossible to differentiate accurately if the inpatient radiotherapy was curative or palliative. In this study, patients who had radiotherapy with no surgery would have been categorized as having non-radical surgery, leading to an underestimate of active treatment patterns. It is plausible that the lower rates of RP found in WA were caused by men having radiotherapy rather than surgery, but the reduced survival rate in the groups not treated by RP does not concur with this scenario.

The lack of conclusive randomized control trials comparing approaches such as RP, radiotherapy and 'watchful waiting' limits the range of policy interventions that can realistically be considered. In WA, with vast distances and a widely spread population, sophisticated radiotherapy services are unlikely to be an option in non-metropolitan areas, whereas other options may be more applicable. With any of these options, identifying the disease at a stage amenable to curative treatment is still an issue. This suggests that while screening with PSA testing may not be accepted as per the guidelines [25], educating rural men and their GPs to recognize the symptoms earlier and test appropriately (e.g. not men aged ≥70 years) may be more important. The variability in treatment method and survival between metropolitan and rural patients suggests that policies to counteract this problem are required. This may either involve taking the surgeons and multidisciplinary team members to the rural areas, providing resources to surgeons already in rural areas, or bringing the rural patients to metropolitan areas. Men from remote areas will almost certainly continue to travel long distances, as there are too few to make visiting specialist services an economically viable proposition. Ensuring continuity of care with ongoing observation will be important in any scenario. Further research is required to determine whether lower rates of RP are a result of patient choice, are related to tumour stage or the result of medical attitudes; these factors could also affect any other active intervention.

Of considerable concern is the reduced rate of surgery and increased mortality in patients with no private health insurance or access to a private hospital, and in those in more socio-economically disadvantaged groups. As with rural men, the influence of PSA testing on the stage of the prostate cancer at diagnosis is a consideration, and patient and GP education in testing symptomatic men at an appropriate time may be required. While the present Australian government has adopted policies to support private health insurance [9], men in the lower socio-economic groups are unlikely to be able to purchase private health insurance [37]. Even if men in the public system are undergoing radiotherapy rather than RP the mortality rates in publicly treated men continue to be higher, which again may be indicative of stage at diagnosis or treatment pattern. The stage at presentation, ease of compliance with treatment options, especially radiotherapy, and costs to the patient and health system should be assessed and policies initiated to lower barriers.

FIG. 3. Age-standardized prostate cancer mortality rate per 100 000 person years in males aged ≥15 years, WA 1982–2002: information supplied by Epidemiology and Analytical Services, WA Department of Health.



In an uncertain climate, with no evidence for clinical practice guidelines and screening options, the way forward remains unclear, albeit that reducing inequalities in the Australian health system is fundamental to a health system which prides itself on universal coverage.

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CONFLICT OF INTEREST

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Abbreviations: **RP**, radical prostatectomy; **WA**, Western Australia; **OR**, odds ratio; **RR**, relative risk; **ICD**, International Classification of Diseases (code); **IRSD**, index of relative socio-economic disadvantage; **ARIA**, Accessibility/Remoteness Index of Australia.