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Socioeconomic disadvantage but not remoteness affects short-term survival in prostate cancer: A population-based study using competing risks

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Abstract

Aim
With most studies focusing on long-term survival of prostate cancer patients, there remains a need to explore short- to medium-term survival. Using competing risks models, we examined how socio-demographic, clinical, and area-level factors are related to prostate cancer mortality versus mortality from other causes, a crucial distinction for this disease that disproportionately affects men older than 60 years.

Methods
Using administrative data from the Queensland Cancer Registry in Australia and competing risks survival models, we estimated sub-hazard ratios and 95% confidence intervals for men diagnosed with prostate cancer (International Classification of Diseases C619). Diagnosis was between January 2005 and July 2007, with follow-up to December 2011. Models were run for all cases as well as stratified by Gleason score.

Results
7,393 men were diagnosed with prostate cancer between January 2005 and July 2007. Cases had a median follow-up of 5 years 3 months. In the multivariate models for all cases, remoteness and area-level disadvantage were not significantly associated with prostate cancer mortality. However, area-level disadvantage had a significant negative relationship with hazard of death from a cause other than prostate cancer within 7 years; compared with those living in the most advantaged areas, the likelihood of mortality was higher for those in the most disadvantaged (sub-hazard ratio [SHR] 1.39 [95% confidence interval {CI} 1.01, 1.90], $p = 0.041$), disadvantaged (SHR 1.51 [95% CI 1.14, 2.00], $p = 0.004$), middle (SHR 1.34 [95% CI 1.02, 1.75], $p = 0.034$), and advantaged areas (SHR 1.44 [95% CI 1.09, 1.89] , $p = 0.009$). Those with Gleason score of 7 and higher had a lower hazard of prostate cancer mortality if they were living with a partner (Gleason score of 7 SHR 0.58 [95% CI 0.40, 0.85], $p = 0.007$; Gleason score 8 to 10 SHR 0.73 [95% CI 0.59, 0.91], $p = 0.004$). In contrast, those with lower Gleason scores had a lower hazard of other-cause mortality if they were living with a partner (Gleason score 2 to 6 SHR 0.56 [95% CI 0.41, 0.75], $p < 0.001$; Gleason score of 7 SHR 0.68 [95% CI 0.53, 0.87], $p = 0.003$).

Conclusions
Recognition of the living arrangements of men diagnosed with prostate cancer should be a priority for clinicians and cancer support personnel to ensure that the men without a partner have appropriate support networks. Understanding why men living in more disadvantaged areas have higher risk of non-prostate cancer causes of death should be a priority.

Key words
Cause of Death
Follow-Up Studies
Prostate Cancer
Socioeconomic Factors
Survival Analysis

Introduction

In this era of prostate-specific antigen screening, most men diagnosed with prostate cancer and treated with normal standards of care have no excess mortality compared to the general population.[1] However, 5- and 10-year relative survival estimates for men diagnosed with distant stage prostate cancer of 31% and 20%,[1] respectively, suggest that there remains a subset of men who do face early mortality due to the disease. In addition, with the incidence of prostate cancer increasing with age, men diagnosed with prostate cancer also face the risk of dying prematurely from other causes.[2]

While most prostate cancer mortality studies have considered death over the longer term, there remains a need for men diagnosed with this condition to appreciate their overall mortality risks in the short to medium term. This may also be helpful in providing appropriate reassurance or warning to the patient.

Previous studies have shown that mortality among men diagnosed with prostate cancer varies according to marital status,[3,4] clinical factors,[5,6] and where they live.[7–14] However, there is little information about how these factors differ according to competing causes of death. Also, by including both long- and short-term mortality in their outcome, these previous studies were not able to directly inform the short-term mortality risks faced by men diagnosed with prostate cancer. Based on related literature, we hypothesize that living remote from a major city and living in a socioeconomically disadvantaged area will be associated with higher risks of both types of mortality. Understanding how remoteness or area-level disadvantage are related to competing risks of mortality could shed light onto opportunities for clinicians and policy makers to better serve these communities.

Most previous studies that have considered prostate cancer mortality are either based on cancer registry information, and so are limited in the scope of variables they can consider, or

else are based on clinical cohorts, in which the representativeness of the cohort can be limited. By utilizing population-based data from the Queensland Cancer Registry, supplemented with information extracted from pathology and clinical records, we have a unique opportunity to investigate how a variety of individual-, clinical- and area-level factors interact to impact on the short-term mortality outcomes of men diagnosed with prostate cancer, and how these associations vary for competing causes of death.

Patients and Methods

Study population

Records of all prostate cancer cases (International Classification of Diseases code C619) from January 2005 through July 2007 were abstracted from the Queensland Cancer Registry, yielding 7 764 cases. Individuals who were not residents of Queensland at the time of diagnosis (n = 293) were excluded, as were those who had previously declined to participate in research (n = 16). Ethical approval was given by the Queensland University of Technology Human Research Ethics Committee and the ethics committees of ten public hospitals in Queensland. Access to data from the Queensland Cancer Registry for the purposes of this study was approved by Queensland Health.

Explanatory variables

Australian Bureau of Statistics (ABS) area-level disadvantage and remoteness indices were linked to each Statistical Local Area. Area-level disadvantage is a summary measure representing the average economic and social conditions of people and households within a particular geographic region.[15] The ABS Index of Relative Socio-Economic Advantage and Disadvantage is cut into quintiles at the population level (categories shown in Table 1). The

ABS measure of remoteness (see Table 1) also has five levels, although the categories Remote and Very remote were combined for this analysis due to small numbers of cases. Prostate cancer cases were placed in categories based on their residential address at diagnosis.

Demographic and clinical information were obtained from the Queensland Cancer Registry. Additional information on Gleason score was extracted manually from pathology forms held within the Registry. Gleason score was determined from, in order of priority, radical prostatectomy results, transrectal ultrasound biopsy or transurethral resection of the prostate. Consistent with previous studies [5,16], Gleason score was categorized as 2 to 6, 7, or 8 to 10 for the purposes of analysis. Age at diagnosis categorized as younger than 65 years, 65 to 74 years, and 75 years and older. Those divorced, never married, separated, or widowed at diagnosis, as recorded on the notifications received by the Queensland Cancer Registry, were categorized as "living without a partner;" those married or in a de facto relationship at diagnosis were combined into the category "living with a partner."

Vital status as of 31 December 2011 was obtained through routine matching with the Australian National Death Index. Cases were categorized as "prostate cancer death" if the medical records held by the Queensland Cancer Registry indicated the person had died of prostate cancer (ICD code C619); all other deaths were categorized as "other cause."

Analysis

We tabulated the cases by variables of interest for all cases and by Gleason score categories. Using Chi-square tests, we compared the Gleason score subgroups for statistically significant differences by the variables of interest.

We estimated the Kaplan-Meier (KM) five-year survival function by each variable of interest using the cohort method. In this analysis, deaths from causes other than prostate cancer were censored. We used log-rank test to compare five-year survivor functions for values within each variable.

Using Fine and Gray's method,[17] we conducted cause-specific survival analysis with competing risks, with censoring at 31 December 2011. Two types of models were estimated: (1) prostate cancer mortality with other cause mortality as a competing risk, and (2) other cause mortality with prostate cancer mortality as a competing risk. Models were run for all cases and separately within categories based on tumor score. Cases with missing values for any of the variables were excluded from the analysis. Since the presence of a poorly-differentiated tumor is a prime determinant of prostate cancer mortality,[5] we controlled for Gleason score. To enable the use of likelihood ratio tests to assess the significance of variables, we used data expansion via the *stcrprep* command in Stata and then used the *stcox* command to fit the multivariate models. Sensitivity analyses (not shown) demonstrated negligible differences in point estimates and standard errors compared to the *stcrreg* command with robust standard errors.

Accounting for competing risks, we estimated the crude cumulative probability function for probability of death from prostate cancer, and probability of death from a cause other than prostate cancer. All analysis was conducted using Stata 12.1.[18]

Results

There were 7 393 men diagnosed with prostate cancer in Queensland from January 2005 through July 2007. These cases were followed to the end of 2011. The median follow-up period was 5 years 3 months post-diagnosis, ranging from 4 years 5 months to 7 years.

Table 1 summarizes the individual and area-level socio-demographic variables and clinical variables for all cases and for categories based on Gleason score. The mean age at prostate cancer diagnosis was 67 years. The majority of the men were living with a partner. More than half lived in major cities and over one-third lived in areas categorized as disadvantaged or most disadvantaged.

There were significant differences in individual and area-level characteristics by Gleason score. Those with Gleason score 8 to 10 were, on average, older ($\chi2 = 356.05$, df = 2, $p < 0.001$), more likely to be without a partner ($\chi2 = 29.78$, df = 1, $p < 0.001$), and less likely to have had a radical prostatectomy ($\chi2 = 639.89$, df = 1, $p < 0.001$).

Mortality and crude cumulative probability functions

Of the 7 393 men, 1 359 (18.4%) died on or before 31 December 2011. 15% of the cohort had failed after 4.5 years. The age-standardized (Australian 2001) non-prostate cancer mortality rate among the cancer cohort during the study period was 1 822 cases per 100 000 person years. This was very similar to the average age-standardized non-prostate cancer mortality rate among all males aged 45 years and over in the Queensland population between 2006 and 2012 (1 770 cases per 100 000 population).

The crude Kaplan-Meier 5-year survivor functions (Table 1) show that in terms of area-level variables, prostate cancer survival was significantly lower for men who lived in more disadvantaged areas (log-rank test, $\chi2 = 13.41$, df = 4, p=0.009), however was not significantly associated with remoteness ($p = 0.264$). Socio-demographic factors of younger age ($\chi2 = 388.25$, df = 2, $p < 0.001$) and living with a partner ($\chi2 = 82.70$, df = 1, $p < 0.001$) were significantly associated with higher prostate cancer survival, as were the clinical factors of Gleason score 2 to 6 ($\chi2 = 1010.10$, df = 2, $p < 0.001$), and having had a radical prostatectomy ($\chi2 = 245.40$, df = 1, $p < 0.001$).

Figure 1 shows the crude cumulative probability functions of prostate cancer and other cause mortality. Into the second year post-diagnosis, the probability of prostate cancer mortality was similar to competing cause mortality, and then men with prostate cancer had a higher probability of mortality from a competing cause.

Figure 2 illustrates the crude cumulative probability functions of cause-specific mortality by Gleason score. Those with Gleason score 7 or greater had significantly higher risk of death from prostate cancer than for those with Gleason score 2 to 6.

Short-term prostate cancer mortality

Due to missing data, 6 728 are included in the multivariate analysis. Table 2 displays the adjusted sub-hazard ratios (SHR) and 95% confidence intervals (CI) for prostate cancer mortality, estimated using competing risks. Area-level variables – remoteness and disadvantage - were not significantly associated with prostate cancer mortality in the overall model or the model stratified by Gleason score category.

For all cases combined, living with a partner was significantly associated with lower prostate cancer mortality (SHR 0.69 [95% CI 0.58, 0.84], $p < 0.001$) in the multivariate model compared to living without a partner. Age was also significantly related to prostate cancer mortality, with patients aged 75 years or older having a significantly increased hazard of prostate cancer mortality (SHR 1.82 [95% CI 1.43, 2.32], $p < 0.001$) compared to patients diagnosed when younger than 65. Patients aged 65 to 74 did not have an increased risk of prostate cancer mortality ($p = 0.406$) compared to those younger than 65.

When stratified by Gleason score (Table 2), the association of living with a partner was significant for those with Gleason score 7 (SHR 0.58 [95% CI 0.40, 0.85], $p = 0.007$) and

Gleason score 8 to 10 (SHR 0.73 [95% CI 0.59, 0.91], $p = 0.004$) but not for those with Gleason score less than 7. The increased prostate cancer mortality for those older than 75 years was much greater for those with a Gleason score 2 to 6 (SHR 12.97 [95% CI 2.33, 72.27], $p = 0.003$) than for those with a score of 7 or greater (SHR 2.46 [95% CI 1.45, 4.18], $p = 0.003$).

Short-term mortality from other causes

Table 3 presents the SHRs and 95% CIs for other-cause mortality with prostate cancer death as the competing risk. For all cases combined, area-level disadvantage emerged as an important predictor of mortality. The association between area disadvantage and other cause mortality was significant. Compared to those living in the most affluent areas, men living in areas categorized as “Most disadvantaged” (SHR 1.39 [95% CI 1.01, 1.90], $p = 0.041$), “Disadvantaged” (SHR 1.51 [95% CI 1.14, 2.00], $p = 0.004$), “Middle SES” (SHR 1.34 [95% CI 1.02, 1.75], $p = 0.034$), and “Advantaged” (SHR 1.44 [95% CI 1.09, 1.89], $p = 0.009$) had a significantly higher risk of dying from other causes of death. Remoteness was not significantly associated with mortality from other causes.

Living with a partner was associated with lower mortality from other causes (SHR 0.70 [95% CI 0.60, 0.82], $p < 0.001$). Compared to patients younger than 65 years old, those 65 to 74 years old (SHR 2.21 [95% CI 1.73, 2.84], $p < 0.001$) and 75 or older (SHR 6.81 [95% CI 5.29, 8.76], $p < 0.001$) had a higher hazard of death from other causes.

Table 3 also shows the results of the models for other-cause mortality stratified by Gleason score. Area-level disadvantage was not a significant prognostic factor for other-cause mortality in the stratified models. Men living with a partner at diagnosis had a lower hazard of death for those with Gleason score 2 to 6 (SHR 0.56 [95% CI 0.41, 0.75], $p < 0.001$) and Gleason score 7 (SHR 0.68 [95% CI 0.53, 0.87], $p = 0.003$). The hazard associated with

being 75 or older at diagnosis was greatest for those with Gleason score 2 to 6 (SHR 9.16 [95% CI 5.90, 14.23], $p < 0.001$) and less pronounced, although still significant, for other Gleason score groups. The decreased hazard of death related to having had a radical prostatectomy was evident for those with Gleason score 7 (SHR 0.46 [95% CI 0.31, 0.68], $p < 0.001$) and Gleason score 8 to 10 (SHR 0.45 (95% CI 0.20, 1.00), $p = 0.027$).

Discussion

Area-level factors

The effect of area-level disadvantage on the short-term mortality of prostate cancer patients is well documented worldwide.[7–10] What is not as well established is how that effect varies depending on the type of mortality. Our use of competing risk models provides unique insights in the role of location on short-term mortality faced by men diagnosed with prostate cancer.

We found that men who lived in more affluent areas had lower other-cause mortality than men in more disadvantaged areas, but there was no difference in prostate cancer mortality. The higher other cause mortality among men living in disadvantaged areas is consistent with the higher mortality risk due to cardiovascular disease among those living in similar areas.[19,20] Combined with the knowledge that men living in disadvantaged areas are less likely to have had PSA tests, [21–23] our finding is consistent with men living in disadvantaged areas having lower awareness and concern about their general health. Our finding that area-level disadvantage is not related to prostate cancer mortality was unexpected.

In the present study, remoteness was not significantly associated with prostate cancer patient mortality, regardless of cause. This was surprising, since the existing literature in Australia points to increased prostate cancer mortality by remoteness.[11,13,14] However, our

study cohort was diagnosed between 2005 and 2007, more recent than the cohorts included for the other studies. Future research is needed to better understand whether changes in the management of prostate cancer have occurred that may have influenced mortality trends. However, our data are not sufficient to provide more than suggestive support to this hypothesis.

Individual factors

Our finding that men living with a partner at diagnosis had a reduced risk of short-term prostate cancer and other cause mortality is consistent with a growing body of work that demonstrates a strong, positive relationship between marriage and survival from prostate cancer.[3,4,24] The explanations for these associations remain unclear. Being married might have a positive influence on nutritional status or other lifestyle choices that affect the progression of disease and the ability to tolerate treatment; may have a positive impact on the treatment type, quality, and adherence; or could provide the cancer patients with an advocate and a support who may have a positive impact on their outcome.[25] Based on a recent study in the Unites States, this effect is likely to continue and perhaps increase in magnitude as time from diagnosis increases.

Using competing risks models and stratifying the cases by Gleason score provided additional insight into the protective effect of living with a partner. Those with Gleason score of 7 and higher (higher likelihood of proliferation) had a lower hazard of prostate cancer mortality if they were living with a partner. Therefore, men with more serious prostate cancer disease benefitted from living with a partner, perhaps for the reasons previously mentioned. In contrast, those with tumors less likely to proliferate (lower Gleason scores) had a lower hazard of other-cause mortality if they were living with a partner. This suggests that living with a partner “protects” men from the more probable cause of death: prostate cancer for those with serious diagnoses, and other causes for those with less serious prostate cancer.

In this analysis, older age increased the hazard of mortality from any cause. Recent work has shown that advanced age may result in non-receipt of curative treatment, highlighting an age bias in clinical practice.[26] While we were able to adjust for receipt of radical prostatectomy, we did not have information on other curative treatments, such as external beam radiotherapy or brachytherapy. Compared to those younger than 65 years old, there was no difference in short-term prostate cancer mortality for those 65 to 74 years old; however, this group had a greater probability of mortality from a cause other than prostate cancer. These short term patterns are consistent with that reported for long-term mortality among men diagnosed with prostate cancer in the United States.

Strengths and limitations

Survival analyses of prostate cancer can be biased because of a higher rate of prostate-specific antigen screening in men of high socioeconomic status[21,22] and those in urban areas.[23] A strength of this study is that we have presented survival analysis stratified by Gleason score categories, enabling a more unbiased investigation into personal and area-level factors on prostate cancer patients' survival. Given that we only had information on the socioeconomic characteristics of areas in which men lived at diagnosis, we were unable to investigate the impact of an individual's socioeconomic status on survival outcomes.

We were also unable to investigate treatment effects. Men with prostate cancer may be treated with androgen deprivation therapy, which stabilizes prostate-specific antigen, but is associated with metabolic syndrome.[27–29] Thus, the use of androgen deprivation therapy may increase the probability of prostate cancer specific-mortality shifting to other-cause mortality. Subsequent studies could take into account the effect of androgen deprivation therapy on cause-specific mortality.

The Gleason scoring system was modified by the International Society of Urological Pathology at a consensus conference in 2005.[30] Given the time period in which these cases were diagnosed (2005 – 2007), inconsistencies in Gleason scoring may affect survival estimates[31] particularly those stratified by Gleason score.

It is acknowledged that cause of death information sourced from death certificate information can be inaccurate.[32,33] While acknowledging this limitation, the Queensland Cancer Registry independently assigns cause of death information using a wide range of information including death certificates, autopsy reports and pathology reports, giving increased confidence in the registered cause of death.

Conclusion

Our findings highlight the varying mortality risk faced by men diagnosed with prostate cancer depending on their specific characteristics, and that men diagnosed with less advanced prostate cancer are susceptible to mortality from causes other than prostate cancer. The diagnosis of prostate cancer has the potential to be a teachable moment in which men can be motivated and encouraged to make lifestyle changes to improve health outcomes.[34,35] The inequalities in non-prostate cancer causes of death in this cohort suggest that specific targeting of these groups, especially those living in lower socioeconomic areas should be a priority.

Further, the findings highlight a consistent disparity in mortality outcomes for men who are living without a partner, even after controlling for clinical factors. Recognition of the living arrangements of men diagnosed with prostate cancer should be a priority for clinicians and cancer support personnel to ensure that the men without a partner have appropriate support networks. Further research is also needed to better understand the factors underlying this

association.

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Conflict of Interest

Authors have nothing to disclose.

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Table 1: Number (percent) of cases by demographic, clinical, and area-level variables for all cases and by Gleason score, and Kaplan-Meier survivor function for prostate cancer mortality by variables of interest

	All cases	Gleason score			*p*-value for comparison by Gleason score	Survivor function at 5 years follow up, unadjusted	*p*-value for comparison by survivor function
		2 to 6	7	8 to 10			
	N = 7 393	n = 1 921	n = 3 717	n = 1 755			
Age at diagnosis					<0.001		<0.001
Younger than 65	3 101 (42.0)	43.7%	48.4%	26.5%		0.97	
65 to 74	2 685 (36.3)	36.2%	36.7%	37.8%		0.93	
75 and older	1 607 (21.7)	20.1%	16.0%	35.7%		0.81	
Marital status[a]					<0.001		<0.001
Living with a partner	5 352 (79.4)	79.5%	81.5%	74.9%		0.94	
Not living with a partner	1 386 (20.6)	20.5%	18.5%	25.1%		0.86	
Gleason score							<0.001
2 to 6	1 921 (26.0)					0.99	
7	3 717 (50.3)					0.97	
8 to 10	1 755 (23.7)					0.76	
Radical prostatectomy					<0.001		<0.001
No	5 155 (69.7)	77.8%	56.8%	88.3%		0.89	
Yes	2 238 (30.3)	22.2%	43.2%	11.7%		1.00	
Area-level disadvantage					0.001		0.009
Most disadvantaged	989 (13.4)	11.3%	13.9%	14.6%		0.91	
Disadvantaged	1 701 (23.0)	24.3%	21.4%	25.0%		0.92	
Middle SES	1 960 (26.5)	28.1%	26.4%	25.1%		0.92	
Advantaged	1 604 (21.7)	22.1%	22.3%	19.9%		0.93	
Most advantaged	1 139 (15.4)	14.3%	16.0%	15.3%		0.95	
Remoteness					<0.001		0.264
Major city	4 070 (55.1)	54.2%	55.6%	54.8%		0.93	
Inner regional	1 893 (25.6)	23.2%	25.4%	28.7%		0.92	
Outer regional	1 168 (15.8)	18.8%	15.2%	13.8%		0.92	
Remote	262 (3.5)	3.8%	3.8%	2.8%		0.92	

[a] Missing cases = 665 (8.9%)

Table 2: Sub-hazard ratio (95% confidence interval) for prostate cancer mortality models with competing risks

	All cases		Gleason score					
			2 to 6 (well-differentiated)		7		8 to 10 (poorly-differentiated)	
	SHR (95% CI)	*p*-value	SHR (95% CI)	*p*-value	SHR (95% CI)	*p*-value	SHR (95% CI)	*p*-value
Age at diagnosis		<0.001		<0.001		0.001		<0.001
Younger than 65	1.00		1.00		1.00		1.00	
65 to 74	1.11 (0.87, 1.42)		2.21 (0.35, 13.90)		1.48 (0.88, 2.51)		0.97 (0.73, 1.29)	
75 or older	1.82 (1.43, 2.32)		12.97 (2.33, 72.27)		2.46 (1.45, 4.18)		1.52 (1.16, 1.99)	
Marital status		<0.001		0.154		0.007		0.004
Living with a partner	0.69 (0.58, 0.84)		0.52 (0.21, 1.24)		0.58 (0.40, 0.85)		0.73 (0.59, 0.91)	
Not living with a partner	1.00		1.00		1.00		1.00	
Gleason score		<0.001						
2 to 6	1.00							
7	4.09 (2.57, 6.51)							
8 to 10	20.82 (13.38, 32.38)							
Radical prostatectomy		<0.001		0.543		<0.001		<0.001
No	1.00		1.00		1.00		1.00	
Yes	0.08 (0.04, 0.15)		0.52 (0.05, 6.21)		0.01 (0.00, 0.11)		0.15 (0.08, 0.32)	
Area-level disadvantage		0.216		0.449		0.169		0.605
Most disadvantaged	1.35 (0.95, 1.92)		1.55 (0.20, 11.77)		1.44 (0.66, 3.16)		1.32 (0.88, 1.98)	
Disadvantaged	1.14 (0.83, 1.57)		0.46 (0.06, 3.51)		1.24 (0.59, 2.63)		1.17 (0.82, 1.67)	
Middle SES	1.34 (1.00, 1.81)		1.18 (0.18, 7.57)		2.04 (1.03, 4.03)		1.22 (0.87, 1.71)	
Advantaged	1.30 (0.96, 1.75)		0.67 (0.11, 4.13)		1.49 (0.73, 3.07)		1.29 (0.91, 1.81)	
Most advantaged	1.00		1.00		1.00		1.00	
Remoteness		0.378		0.414		0.322		0.831
Major city	1.00		1.00		1.00		1.00	
Inner regional	1.08 (0.88, 1.34)		1.49 (0.37, 5.98)		0.93 (0.58, 1.48)		1.09 (0.86, 1.39)	
Outer regional	1.26 (0.96, 1.64)		1.62 (0.48, 5.45)		1.51 (0.91, 2.50)		1.14 (0.82, 1.58)	
Remote	1.21 (0.72, 2.05)		4.20 (0.65, 27.09)		0.93 (0.33, 2.64)		1.09 (0.56, 2.11)	

Table 3: Sub-hazard ratio (95% confidence interval) for other cause mortality models with competing risks

	All cases		Gleason score					
			2 to 6 (well-differentiated)		7		8 to 10 (poorly-differentiated)	
	SHR (95% CI)	*p*-value	SHR (95% CI)	*p*-value	SHR (95% CI)	*p*-value	SHR (95% CI)	*p*-value
Age at diagnosis		<0.001		<0.001		<0.001		<0.001
Younger than 65	1.00		1.00		1.00		1.00	
65 to 74	2.21 (1.73, 2.84)		2.54 (1.61, 3.99)		2.18 (1.50, 3.17)		1.81 (1.11, 2.95)	
75 or older	6.81 (5.29, 8.76)		9.16 (5.90, 14.23)		6.81 (4.61, 10.06)		4.88 (3.06, 7.78)	
Marital status		<0.001		<0.001		0.003		0.337
Living with a partner	0.70 (0.60, 0.82)		0.56 (0.41, 0.75)		0.68 (0.53, 0.87)		0.87 (0.66, 1.15)	
Not living with a partner	1.00		1.00		1.00		1.00	
Gleason score		0.435						
2 to 6	1.00							
7	0.91 (0.76, 1.09)							
8 to 10	0.89 (0.73, 1.08)							
Radical prostatectomy		<0.001		0.623		<0.001		0.027
No	1.00		1.00		1.00		1.00	
Yes	0.54 (0.41, 0.72)		0.89 (0.54, 1.46)		0.46 (0.31, 0.68)		0.45 (0.20, 1.00)	
Area-level disadvantage		0.043		0.537		0.413		0.064
Most disadvantaged	1.39 (1.01, 1.90)		1.02 (0.54, 1.91)		1.38 (0.85, 2.25)		1.79 (1.02, 3.14)	
Disadvantaged	1.51 (1.14, 2.00)		1.26 (0.75, 2.14)		1.41 (0.91, 2.18)		1.90 (1.13, 3.20)	
Middle SES	1.34 (1.02, 1.75)		0.90 (0.54, 1.51)		1.50 (0.99, 2.27)		1.65 (1.01, 2.71)	
Advantaged	1.44 (1.09, 1.89)		1.02 (0.62, 1.69)		1.38 (0.91, 2.11)		2.01 (1.21, 3.35)	
Most advantaged	1.00		1.00		1.00		1.00	
Remoteness		0.769		0.492		0.239		0.317
Major city	1.00		1.00		1.00		1.00	
Inner regional	1.06 (0.88, 1.27)		1.19 (0.83, 1.71)		1.01 (0.76, 1.34)		1.03 (0.75, 1.42)	
Outer regional	1.06 (0.85, 1.33)		0.93 (0.62, 1.40)		0.94 (0.66, 1.35)		1.45 (0.98, 2.14)	
Remote	1.21 (0.82, 1.78)		0.72 (0.31, 1.70)		1.72 (1.02, 2.90)		0.99 (0.44, 2.23)	