Overall Prostate Cancer Survival in Florida: A Multilevel Analysis

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Outline

- Background
- Objective
- Methods
- Results
- Discussion
- Limitation
- Conclusion
- Disclosure & Acknowledgement
Background (Cont.)

- It has been estimated that there will be 233,000 new cases and 29,480 deaths from prostate cancer (PCa) in the United States in 2014.¹

In 2014, the State of Florida ranks

- Second behind California for incidence (16,590 estimated new cases).¹
- Second behind California for mortality (2,170 estimated deaths) from PCa.¹
Background

- Differences in PCa survival are apparent across a variety of individual-level and contextual factors, and their assessment offers a unique opportunity to search for clues as to their underlying association with PCa survival.
PCa survival is associated with

- Age $^{2-4}$
- Race $^{4,5}$
- Socioeconomics status $^5$
- Tumor characteristics $^{4-7}$
- Treatment and tolerance to treatment $^4$
- Comorbidity $^{8,9}$
Objective

To identify individual-level and contextual factors contributing to overall survival among prostate cancer patients in Florida.
Methods
Study Population

- A random sample of 6,453 cases diagnosed with PCa between 10/1/2001 and 12/31/2007 in the Florida Cancer Data System
- Men aged 40 and older
- African American and Caucasian
Data Sources and Extraction

- Florida Cancer Data System (FCDS)
  - Demographic Information
    - Age
    - Race/ Ethnicity
    - Marital status
    - Type of health insurance
    - Smoking status
  - Clinical Information
    - Year of diagnosis
    - Tumor stage and grade
    - First course of treatment
    - Vital status
Data Sources and Extraction (Cont.)

- Census 2000 Summary File-3
  - Median household income
  - Farm land indicator
- Florida Agency for Health Care Administration
  - Comorbidity was computed following Elixhauser Index method based on diagnosis information (ICD-9 codes)
Statistical Methods

- Descriptive statistics
- Kaplan-Meier estimator to estimate survival probability curve
- Wei, Lin and Weissfeld (WLW) survival model was adopted for the multivariate analysis
- SAS/STAT® software Version 9.3 was used for data analyses
Statistical Methods (Cont.)

❖ Times from PCa diagnosis to overall mortality were evaluated for patients who died during study period.
❖ The observation times were censored at June 30, 2012 for patients who were still alive at end of study.
❖ Hazard ratios, confidence intervals, and p-values were calculated.
❖ A higher hazard ratio implies an increase of overall death rate (lower survival probability).
Results
Table 1. Study Population Characteristics (N=6,453)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Percent</th>
<th>Variable</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>66.55 years</td>
<td></td>
<td>Insurance</td>
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<td>Privately Insured</td>
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<td>Publicly Insured</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Uninsured</td>
<td>1.77</td>
</tr>
<tr>
<td>Race</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>87.60</td>
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<tr>
<td>African-American</td>
<td>12.40</td>
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</tr>
<tr>
<td>Married</td>
<td></td>
<td></td>
<td>Year of Diagnosis</td>
<td></td>
</tr>
<tr>
<td>Unmarried</td>
<td>20.52</td>
<td></td>
<td>2001</td>
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<tr>
<td>Married</td>
<td>79.48</td>
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<td>19.15</td>
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<td>Smoking</td>
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<td>2003</td>
<td>14.04</td>
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<td>Non–Current Smokers</td>
<td>84.24</td>
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<td>2004</td>
<td>14.30</td>
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<tr>
<td>Current Smokers</td>
<td>15.76</td>
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<td>2005</td>
<td>14.23</td>
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<tr>
<td>Vital Status</td>
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<td>16.10</td>
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<tr>
<td>Alive</td>
<td>82.95</td>
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<td>2007</td>
<td>16.92</td>
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<tr>
<td>Dead</td>
<td>17.05</td>
<td></td>
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<tr>
<td>Tumor Grade</td>
<td></td>
<td></td>
<td>Treatment</td>
<td></td>
</tr>
<tr>
<td>Well and moderately</td>
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<td></td>
<td>No definitive treatment</td>
<td>9.53</td>
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<tr>
<td>differentiated</td>
<td>62.20</td>
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<td>Surgery + radiation + no hormone</td>
<td>1.29</td>
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<tr>
<td>Poorly differentiated</td>
<td>31.64</td>
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<td>Surgery + radiation + hormone</td>
<td>0.91</td>
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<td>Surgery + hormone</td>
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<td>Stage</td>
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<td>Localized</td>
<td>87.84</td>
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<td>Hormone only</td>
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<td>Advanced</td>
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<td>Radiation + hormone</td>
<td>13.02</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Surgery only</td>
<td>45.20</td>
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Figure 1. Survival Probability over Time
Figure 2. Survival estimate by race
<table>
<thead>
<tr>
<th>Variables</th>
<th>Est</th>
<th>Hazard Ratio</th>
<th>HR 95% CI Lower</th>
<th>HR 95% CI Upper</th>
<th>P–Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient demographics</strong></td>
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<tr>
<td>Age 40</td>
<td>0.076</td>
<td>1.079</td>
<td>1.068</td>
<td>1.091</td>
<td>&lt;.0001*</td>
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<tr>
<td>Married Vs. unmarried</td>
<td>-0.411</td>
<td>0.663</td>
<td>0.572</td>
<td>0.769</td>
<td>&lt;.0001*</td>
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<tr>
<td>Current smoker Vs. non–current smoker</td>
<td>0.485</td>
<td>1.624</td>
<td>1.389</td>
<td>1.899</td>
<td>&lt;.0001*</td>
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<tr>
<td>No insurance Vs. private insurance</td>
<td>0.511</td>
<td>1.667</td>
<td>1.036</td>
<td>2.683</td>
<td>0.0351*</td>
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<tr>
<td><strong>Types of treatment and tumor characteristics</strong></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>No definitive treatment Vs. surgery</td>
<td>0.618</td>
<td>1.855</td>
<td>1.486</td>
<td>2.316</td>
<td>&lt;.0001*</td>
</tr>
<tr>
<td>Radiation Vs. surgery</td>
<td>0.332</td>
<td>1.394</td>
<td>1.163</td>
<td>1.670</td>
<td>0.0003*</td>
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<td>Hormone Vs. surgery</td>
<td>0.742</td>
<td>2.101</td>
<td>1.651</td>
<td>2.674</td>
<td>&lt;.0001*</td>
</tr>
<tr>
<td>Radiation + hormone Vs. surgery</td>
<td>0.228</td>
<td>1.257</td>
<td>1.022</td>
<td>1.545</td>
<td>0.0302*</td>
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<tr>
<td>Undiff/unknown Vs. well–moderately diff</td>
<td>0.311</td>
<td>1.364</td>
<td>1.057</td>
<td>1.761</td>
<td>0.0172*</td>
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<tr>
<td>Poorly diff Vs. well–moderately diff</td>
<td>0.494</td>
<td>1.639</td>
<td>1.310</td>
<td>2.051</td>
<td>&lt;.0001*†</td>
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<tr>
<td>Poorly diff Vs. well–moderately diff x time</td>
<td>-1.755E-4</td>
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<td></td>
<td>0.0205*</td>
</tr>
<tr>
<td>Advanced stage Vs. localized stage</td>
<td>0.637</td>
<td>1.891</td>
<td>1.575</td>
<td>2.272</td>
<td>&lt;.0001*</td>
</tr>
<tr>
<td><strong>Year of Diagnosis</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007 Vs. 2001</td>
<td>-1.210</td>
<td>0.298</td>
<td>0.216</td>
<td>0.412</td>
<td>&lt;.0001*</td>
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<tr>
<td>2006 Vs. 2001</td>
<td>-0.637</td>
<td>0.529</td>
<td>0.401</td>
<td>0.698</td>
<td>&lt;.0001*</td>
</tr>
<tr>
<td>2005 Vs. 2001</td>
<td>-0.563</td>
<td>0.570</td>
<td>0.435</td>
<td>0.745</td>
<td>&lt;.0001*</td>
</tr>
<tr>
<td>2004 Vs. 2001</td>
<td>-0.370</td>
<td>0.691</td>
<td>0.537</td>
<td>0.889</td>
<td>0.0040*</td>
</tr>
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<td>2003 Vs. 2001</td>
<td>-0.566</td>
<td>0.568</td>
<td>0.436</td>
<td>0.740</td>
<td>&lt;.0001*</td>
</tr>
</tbody>
</table>

Table 2. Multivariate Analysis (N=6,453)
<table>
<thead>
<tr>
<th>Variables</th>
<th>Est</th>
<th>Hazard Ratio</th>
<th>HR 95% CI</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comorbidity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>0.550</td>
<td>1.733</td>
<td>1.276</td>
<td>2.352</td>
</tr>
<tr>
<td>Pulmonary circulation disease</td>
<td>0.610</td>
<td>1.840</td>
<td>1.013</td>
<td>3.342</td>
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<tr>
<td>Chronic pulmonary disease</td>
<td>0.518</td>
<td>1.678</td>
<td>1.398</td>
<td>2.016</td>
</tr>
<tr>
<td>Diabetes</td>
<td>0.352</td>
<td>1.422</td>
<td>1.182</td>
<td>1.710</td>
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<tr>
<td>Liver disease</td>
<td>0.678</td>
<td>1.970</td>
<td>1.023</td>
<td>3.792</td>
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<tr>
<td>Metastatic cancer</td>
<td>0.824</td>
<td>2.279</td>
<td>1.804</td>
<td>2.878</td>
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<tr>
<td>Solid tumor w/out metastasis</td>
<td>0.606</td>
<td>1.833</td>
<td>1.478</td>
<td>2.272</td>
</tr>
<tr>
<td>Fluid and electrolyte disorders</td>
<td>0.301</td>
<td>1.351</td>
<td>1.050</td>
<td>1.738</td>
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<tr>
<td>Deficiency Anemias</td>
<td>0.276</td>
<td>1.318</td>
<td>1.019</td>
<td>1.703</td>
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<tr>
<td>Genitourinary system disease</td>
<td>0.293</td>
<td>1.340</td>
<td>1.157</td>
<td>1.552</td>
</tr>
<tr>
<td>Respiratory disorders</td>
<td>0.447</td>
<td>1.564</td>
<td>1.228</td>
<td>1.991</td>
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<tr>
<td>Other mental disorders</td>
<td>1.016</td>
<td>2.762</td>
<td>1.896</td>
<td>4.024</td>
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<tr>
<td>Other anemias</td>
<td>0.452</td>
<td>1.571</td>
<td>1.013</td>
<td>2.438</td>
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<tr>
<td>Brain and other Neurological disorders</td>
<td>0.941</td>
<td>2.563</td>
<td>1.474</td>
<td>4.456</td>
</tr>
</tbody>
</table>

*significant at level 5%
†effect at diagnosis time
Non-significant Factors

Comorbidities
- Valvular disease
- Peripheral vascular disease
- Paralysis
- Other neurological disorders
- Diabetes w/ chronic complications
- Hypothyroidism
- Renal failure
- Peptic ulcer Disease x bleeding
- Acquired immune deficiency syndrome
- Lymphoma
- Rheumatoid arthritis/collagen vas
- Coagulopathy
- Obesity
- Weight loss
- Chronic blood loss anemia
- Alcohol abuse
- Drug abuse
- Psychoses
- Depression
- Endocrine disorders, nutritional and metabolic, immunity

- Ischemic heart disease
- Digestive system disease
- Infection
- Injury and poisoning
- Other circulatory disease
- Benign neoplasm and in-situ cancer
- Other nervous system and sense organs disorders
- Skin and subcutaneous tissue disease
- Musculoskeletal and connective tissue disease
- Congenital anomalies
- Hypertension

Other factors
- African American Vs. Caucasian
- Public insurance VS. private insurance
- Surgery + radiation + no hormone Vs. surgery
- Surgery + radiation + hormone Vs. surgery
- Surgery + hormone Vs. surgery
- 2002 Vs. 2001
- For-profit Vs. not-for-profit
- Ambulatory Vs. hospital
- Median household income ($1,000)
- Farmhouse presence
Discussion

- The older the patient at diagnosis, the worse the overall survival.\textsuperscript{2}
- Underuse of potentially curative local therapy among these men may partly explain the observed differences in PCa survival across age strata.\textsuperscript{2,3}
- Men who are married are more likely to undergo early screening, comply with treatment, and have a social support, \textsuperscript{10} thus have better survival.
Discussion (Cont.)

- Smoking is associated with aggressive PCa, and thus decreases survival in PCa patients.\textsuperscript{11}
- Having no health insurance is a barrier to receipt of timely and high-quality medical care, including preventive services.\textsuperscript{12}
- Surgical treatment is reserved for patients with localized PCa and who are projected to have a long life expectancy.\textsuperscript{13,14}
Discussion (Cont.)

- Men with poorly differentiated, undifferentiated, or unknown tumor grades tend to have a more advanced stage of disease at the time of prostate cancer diagnosis.\textsuperscript{6,7}

- Advanced diagnostic techniques and the emergence of new therapies may explain the increased survival among men diagnosed with PCa in recent years.\textsuperscript{15}
Discussion (Cont.)

- Long-term survival depends, in part, on risks posed by existing comorbidity because patients with significant comorbidities are not likely to derive expected benefits from treatment.\(^8,9\)
Limitations

- Only cases diagnosed from 2001 through 2007 were analyzed, this analysis may not necessarily reflect the most current trends.
- Disease-specific survival not available
- Severity data for comorbidities is not available.
- Follow-up information are limited to vital status.
  - No detailed information on side effects of treatment or treatment compliance.
- Validity issues with secondary data analyses
Conclusion

- Age at diagnosis, marital status, smoking status, insurance type, treatment type, tumor characteristics, year of diagnosis, and comorbidity are associated with overall survival among patients diagnosed with PCa.
- Effective control of comorbidity in PCa patients should help improve life expectancy and lead to prolonged survival.
- Further research is needed to understand mechanisms in which individual and contextual factors impact PCa survival.
Disclosure

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- Funding Period: January 2010 – December 2013
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- Askal Ali, MA; Florida A&M University
- Georges Adunlin, MA; Florida A&M University
Thank you !!

Questions??
References


