INDIVIDUAL- AND NEIGHBORHOOD-LEVEL PREDICTORS OF MORTALITY IN FLORIDA COLORECTAL CANCER PATIENTS

Stacey L Tannenbaum, PhD
COLORECTAL CANCER (CRC)

- CRC 2nd leading cause of cancer death for both sexes combined in US
- Incident cases = 142,820 (2013)
- Deaths = 50,830 (2013)
STATE OF FLORIDA (2010)

- Age-adjusted incidence = 36.4/100,000 (95% CI=35.6-37.1)
- Age-adjusted mortality rate per 14.1/100,000 (95% CI=13.7-14.6)
SURVIVAL/MORTALITY

- Adherence to screening guidelines leads to long-term improvements in cancer-specific mortality risk
- *Five-year relative survival rate*
  - 90.1% when CRC is detected at the localized stage
  - 69.2% when diagnosed at regional
  - 11.7% when diagnosed at distant
AGE MAKES A DIFFERENCE

- Older CRC patients may demonstrate different mortality experience than younger patients
- Unknown what predictors of mortality risk are important among different age groups
OBJECTIVE

- To examine individual-level and neighborhood-level predictors of mortality from CRC and stratify by age group in order to identify high-risk groups for targeted clinical and social support interventions.
METHODS

- Florida Cancer Data System (FCDS) linkage to Agency for Health Care Administration (AHCA) and the US Census
- FCDS awarded GOLD CERTIFICATION again!
FCDS

- Demographic information
- Clinical characteristics
- Treatment information
- Date of death (NDI)
AHCA

- Administrative discharge data for in and outpatient visits at hospitals and treatment centers
  - Elixhauser Comorbidities
Socioeconomic Status (SES)

- Measures were obtained from the US Census Bureau 2006-2010
- The neighborhood poverty level (SES) was categorized as follows:
  - Lowest ($\geq 20\%$)
  - Middle low ($\geq 10$ and $< 20\%$)
  - Middle high ($\geq 5$ and $< 10\%$)
  - Highest ($< 5\%$)
ELIGIBILITY CRITERIA

- Diagnosed in Florida between 2007-2011
- ≥18 years of age
- Valid 2010 census tract assignment (based on geocoded addresses at the time of diagnosis)

- Sample size = 47,872
DEMOGRAPHIC VARIABLES

- Race/ethnicity (NHW, NHB, Cuban, Puerto Rican, Mexican, NH other)
- Age
  - 18-49
  - 50-64
  - 65+
- Sex (male/female)
- Primary payer at diagnosis (private, not insured, Medicare, Medicaid, VA, insurance NOS)
- Martial Status (married, single, divorced/separated, widowed)
CLINICAL VARIABLES

• Site
  ❌ Proximal
  ❌ Distal
  ❌ Rectum

• Stage
  ❌ in situ, localized, regionalized and distant
CLINICAL VARIABLES

- Treatments
  - Surgery
  - Radiation
  - Chemotherapy
- Comorbidities – 30 Elixhauser comorbidities
ANALYSIS PLAN

- Cox proportional hazard regressions were performed
  - univariate models
  - multivariable (demographic and clinical factors in one model)
  - Stratification by age groups (18-49, 50-64, and 65+).
  - No interactions were found among main predictor variables

• All statistical analyses SAS v 9.3
POPULATION DESCRIPTION - SES

- Highest <5%
- Middle high ≥5 and <10%
- Middle low ≥10 and ≥20%
- Lowest ≥20%

- Highest: 31.2%
- Middle high: 28.5%
- Middle low: 25.3%
- Lowest: 15.1%
RACE AND ETHNICITY

- NH White: 72.9%
- NH Black: 10.6%
- Cuban: 2.9%
- Puerto Rican: 0.5%
- Mexican: 0.2%
- Other Hispanic: 10.6%
- NH Other: 0.7%
- Unknown Ethnicity: 1.8%
**POPULATION DESCRIPTION**

- Mean follow-up time: 2-person yrs. (731 days)
- Mean age: 69.1 years (SD 13.5)
  - range 18-104 years
- **Sex:**
  - 52.1% Male
  - 47.9% Female
- 28.5% no comorbidity
PREDICTORS OF MORTALITY
<table>
<thead>
<tr>
<th>Sex</th>
<th>18-49 years</th>
<th>50-64 years</th>
<th>65+ years</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>N=4,077</td>
<td>N=12,560</td>
<td>N=31,235</td>
</tr>
<tr>
<td>Male</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Female</td>
<td>0.85 (0.82-0.88)**</td>
<td>0.81 (0.70-0.93)**</td>
<td>0.87 (0.80-0.94)**</td>
</tr>
</tbody>
</table>

*P<0.05; **P<0.01; ***P<0.0001
<table>
<thead>
<tr>
<th>Age</th>
<th>HR</th>
<th>18-49 years N=4,077</th>
<th>50-64 years N=12,560</th>
<th>65+ years N=31,235</th>
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<tbody>
<tr>
<td>Age at diagnosis</td>
<td>1.03 (1.04-1.04)***</td>
<td>1.01 (0.99-1.02)</td>
<td>1.01 (1.00-1.02)*</td>
<td>1.05 (1.05-1.05)***</td>
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<thead>
<tr>
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<th>18-49 years N=4,077</th>
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<td>1.00</td>
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<tr>
<td>Not Insured</td>
<td>1.22 (1.11-1.35)***</td>
<td>1.17 (0.93-1.48)</td>
<td>1.35 (1.20-1.53)***</td>
<td>0.76 (0.60-0.97)*</td>
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<tr>
<td>Medicare</td>
<td>1.03 (0.98-1.08)</td>
<td>1.30 (0.95-1.78)</td>
<td>1.44 (1.28-1.63)***</td>
<td>1.00 (0.93-1.07)</td>
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<tr>
<td>Medicaid</td>
<td>1.42 (1.30-1.54)***</td>
<td>1.52 (1.25-1.85)***</td>
<td>1.53 (1.36-1.72)***</td>
<td>1.11 (0.95-1.29)</td>
</tr>
<tr>
<td>Veterans/Military</td>
<td>1.19 (1.03-1.39)***</td>
<td>1.53 (0.92-2.53)</td>
<td>1.26 (1.01-1.57)*</td>
<td>1.10 (0.88-1.38)</td>
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# MARTIAL STATUS

<table>
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<th>Marital Status</th>
<th>HR</th>
<th>18-49 years N=4,077</th>
<th>50-64 years N=12,560</th>
<th>65+ years N=31,235</th>
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<tbody>
<tr>
<td>Married</td>
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<td>1.00</td>
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<tr>
<td>Divorced/separated</td>
<td>1.22 (1.15-1.30)***</td>
<td>1.11 (0.88-1.40)</td>
<td>1.18 (1.06-1.32)**</td>
<td>1.28 (1.19-1.38)***</td>
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<tr>
<td>Single</td>
<td>1.29 (1.22-1.35)***</td>
<td>1.11 (0.94-1.31)</td>
<td>1.23 (1.11-1.35)***</td>
<td>1.26 (1.18-1.34)***</td>
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<tr>
<td>Widowed</td>
<td>1.19 (1.14-1.25)***</td>
<td>0.91 (0.94-1.31)</td>
<td>1.14 (0.94-1.37)</td>
<td>1.13 (1.08-1.19)***</td>
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<tr>
<th>SES</th>
<th>HR</th>
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<tr>
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<td>N=4,077</td>
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<td>N=31,235</td>
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<tr>
<td>Highest</td>
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<td>1.00</td>
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<tr>
<td>Middle-high</td>
<td>1.04 (1.00-1.09)</td>
<td>1.03 (0.84-1.27)</td>
<td>1.05 (0.94-1.18)</td>
<td>1.04 (0.99-1.09)</td>
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<tr>
<td>Middle-low</td>
<td><strong>1.13 (1.08-1.19)</strong>***</td>
<td>1.08 (0.88-1.32)</td>
<td><strong>1.17 (1.05-1.30)</strong>**</td>
<td><strong>1.12 (1.06-1.18)</strong>***</td>
</tr>
<tr>
<td>Lowest</td>
<td><strong>1.19 (1.13-1.26)</strong>***</td>
<td>1.11 (0.89-1.39)</td>
<td><strong>1.23 (1.09-1.39)</strong>**</td>
<td><strong>1.17 (1.10-1.25)</strong>***</td>
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## Cancer Site

<table>
<thead>
<tr>
<th>Cancer Site</th>
<th>HR</th>
<th>18-49 years</th>
<th>50-64 years</th>
<th>65+ years</th>
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<tbody>
<tr>
<td></td>
<td>N=4,077</td>
<td>N=12,560</td>
<td>N=31,235</td>
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<tr>
<td>Distal Colon</td>
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<tr>
<td>Proximal Colon</td>
<td>1.03 (0.99-1.07)</td>
<td>1.23 (1.03-1.47)*</td>
<td>1.28 (1.16-1.40)***</td>
<td>0.96 (0.92-1.01)</td>
</tr>
<tr>
<td>Rectum</td>
<td>0.98 (0.93-1.03)</td>
<td>0.89 (0.73-1.08)</td>
<td>0.99 (0.89-1.10)</td>
<td>0.99 (0.94-1.05)</td>
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</table>

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<tr>
<th>Stage</th>
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<th>50-65 years (N=12,560)</th>
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<tbody>
<tr>
<td>Localized</td>
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<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>In Situ</td>
<td>1.09 (0.98-1.21)</td>
<td>0.78 (0.36-1.71)</td>
<td>0.82 (0.59-1.13)</td>
<td>1.19 (1.06-1.32)</td>
</tr>
<tr>
<td>Regional</td>
<td>1.83 (1.75-1.92)***</td>
<td>2.72 (2.02-3.67)***</td>
<td>2.61 (2.27-3.00)***</td>
<td>1.72 (1.63-1.81)***</td>
</tr>
<tr>
<td>Distant</td>
<td>6.07 (5.77-6.39)***</td>
<td>11.94 (8.92-15.98)***</td>
<td>10.86 (9.47-12.46)***</td>
<td>5.84 (4.85-5.45)***</td>
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</table>

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<table>
<thead>
<tr>
<th>Comorbidity (count)</th>
<th>HR</th>
<th>18-49 years</th>
<th>50-65 year</th>
<th>65+ year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comorbidity (count)</td>
<td>1.15 (1.15-1.16)***</td>
<td>1.21 (1.17-1.24)***</td>
<td>1.19 (1.17-1.21)***</td>
<td>1.14 (1.13-1.15)***</td>
</tr>
</tbody>
</table>

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LIMITATIONS

- Only have neighborhood level SES
- Administrative data – may be some misclassification of comorbidity
- Loss to follow up – transient inhabitants of Floridians
- No information on CRC screening histories
- Limited to the state of Florida
  - may not be generalizable to the rest of US population
CONCLUSION

- High risk groups for CRC survival:
  - Older with more comorbidity, living in lower SES neighborhoods, without insurance, who are unmarried and diagnosed at later disease stage
  - Higher risk among younger patients was cancer site, being on Medicaid, and distant stage disease
    - However, age, lower SES, and being unmarried were not risk factors in this age group.
CONCLUSION

- Targeted interventions are needed to intervene to improve survivorship
- Age group must be taken into account
- All of these factors warrant further study
COLLABORATORS

- Monique Hernandez PhD
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- David J. Lee PhD
- Olveen Carrasquillo MD MPH
- Jammie Klim – MPH student