How much of the racial/ethnic disparities in cancer survival in California is explained by differences in tumor, sociodemographic, institutional and neighborhood characteristics?

Elizabeth Ellis¹,², Alison J Canchola¹, David Spiegel²,³, Uri Ladabaum²,³, Robert Haile²,³,⁴, Scarlett Lin Gomez PhD¹,²

¹ Cancer Prevention Institute of California, Fremont, California.
² Stanford Cancer Institute, Stanford, California.
³ Stanford University School of Medicine, Stanford, California.
⁴ Cedars-Sinai Medical Center, Los Angeles, California.
Background

- Racial/ethnic disparities in cancer survival in the US are well documented.
- Persistent survival disparity between non-Hispanic (NH) White and Black patients is particularly stark.
- Various factors have been implicated:
  1. Differences in tumor characteristics at diagnosis - tumor stage, tumor size, lymph node involvement, HR status (breast), tumor subsite (colorectal).
  2. Differences in disease management & treatment - access to care, guideline concordant treatment, healthcare institution.
  3. Social determinants and neighborhood characteristics - neighborhood socioeconomic status (SES), health insurance, marital status.
- Influence of factors varies by cancer site and across racial/ethnic groups.
Aims

1. To investigate racial/ethnic disparities in survival for the 4 most common cancers in California (breast, prostate, lung, colorectal)
2. To quantify the relative contribution of various tumor, treatment, sociodemographic, institutional, and neighborhood factors to disparities in survival
Data

• All patients diagnosed in California between 2000 and 2013 with female breast, prostate, lung or colorectal cancer as first, primary malignancy (n=897,833)
• Excluded cases diagnosed at autopsy or DCO (n=7,887), with unknown follow-up time (n=5,276) or unknown cause of death (n=7,008)
• Follow-up = no. days between date of diagnosis and either date of death, date of last known contact, or end date of follow-up (December 31, 2013)
• For cancer-specific survival, follow-up censored at date of death for those who died from causes other than primary cancer
• Included cases = 877,662, cancer-specific deaths = 222,042 (25%).
• Race/ethnicity classified as NH White, NH Black, Hispanic, Asian American & Pacific Islander (AAPI), + 3 largest AAPI subgroups (Chinese, Japanese, Filipino)
A number of co-variables were included as explanatory factors in racial/ethnic disparities in survival:

<table>
<thead>
<tr>
<th>Tumor</th>
<th>Treatment¹</th>
<th>Institutional²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage at diagnosis</td>
<td>Surgery (yes/no)</td>
<td>NCI cancer center</td>
</tr>
<tr>
<td>Tumor size</td>
<td>Radiation (yes/no)</td>
<td>Racial/ethnic composition</td>
</tr>
<tr>
<td>Grade</td>
<td>Chemotherapy (yes/no)</td>
<td>Health insurance composition</td>
</tr>
<tr>
<td>Lymph node positive</td>
<td></td>
<td>SES composition</td>
</tr>
<tr>
<td>Histology (lung)</td>
<td>Sociodemographic</td>
<td>Neighborhood</td>
</tr>
<tr>
<td>Subsite (colorectal)</td>
<td>Health insurance status⁴</td>
<td>Socioeconomic status</td>
</tr>
<tr>
<td>Hormone receptor ³ (breast)</td>
<td>Marital status</td>
<td>Racial/ethnic composition⁵</td>
</tr>
<tr>
<td>Year of diagnosis</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹ Limited to first course of treatment  
² Based on first reporting hospital  
³ Estrogen / progesterone receptor positive  
⁴ Based on primary and secondary payer source  
⁵ Classified as White predominant, Minority predominant, or Mixed
Statistical analysis

Mediation analysis was conducted to estimate the relative contribution of each co-variable to racial/ethnic disparities in survival (for each cancer site and sex), following these steps:

1. Baseline Cox proportional hazards model: \textit{race/ethnicity + age}
2. Test influence of each co-variable: \textit{race/ethnicity + age + co-variable}
3. Rank co-variables in order of significance of influence (i.e. by how much hazard ratio reduced when included in model)
4. Summary measure used to describe influence on co-variables on survival disparities across all racial/ethnic group combined (standard deviation of Cox regression coefficients for the racial/groups from the model)
5. Co-variables added to baseline model in order of their significance of influence
6. Change in hazard ratio assessed as measure of relative change in disparity (i.e. proportion of total disparity contributed by the co-variable, after accounting for previously added co-variables)
7. Change in hazard ratio assessed for each racial/ethnic group, and using summary measure across all racial/ethnic groups
Distribution (%) of key demographic characteristics by race/ethnicity & cancer: California, 2000-2013

<table>
<thead>
<tr>
<th></th>
<th>Breast (n=264,681)</th>
<th>Prostate (n=270,101)</th>
<th>Lung (n=181,060)</th>
<th>CRC (n=161,820)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NHW</td>
<td>Black</td>
<td>Hispanic</td>
<td>AAPI</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;55</td>
<td>30.9</td>
<td>42.4</td>
<td>50.6</td>
<td>47.9</td>
</tr>
<tr>
<td>55-74</td>
<td>47.8</td>
<td>43.2</td>
<td>39.0</td>
<td>41.9</td>
</tr>
<tr>
<td>75+</td>
<td>21.3</td>
<td>14.4</td>
<td>10.4</td>
<td>10.2</td>
</tr>
<tr>
<td><strong>Stage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local</td>
<td>63.7</td>
<td>53.9</td>
<td>54.8</td>
<td>62.4</td>
</tr>
<tr>
<td>Regional</td>
<td>30.3</td>
<td>36.4</td>
<td>38.2</td>
<td>32.2</td>
</tr>
<tr>
<td>Distant</td>
<td>4.5</td>
<td>7.8</td>
<td>5.4</td>
<td>4.1</td>
</tr>
<tr>
<td>Unknown</td>
<td>1.5</td>
<td>1.9</td>
<td>1.6</td>
<td>1.3</td>
</tr>
<tr>
<td><strong>nSES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 (high)</td>
<td>31.4</td>
<td>9.5</td>
<td>10.4</td>
<td>30.5</td>
</tr>
<tr>
<td>4</td>
<td>25.8</td>
<td>17.2</td>
<td>15.6</td>
<td>26.1</td>
</tr>
<tr>
<td>3</td>
<td>20.8</td>
<td>21.4</td>
<td>20.1</td>
<td>19.9</td>
</tr>
<tr>
<td>2</td>
<td>14.8</td>
<td>25.1</td>
<td>24.6</td>
<td>15.3</td>
</tr>
<tr>
<td>1 (low)</td>
<td>7.2</td>
<td>26.8</td>
<td>29.3</td>
<td>8.2</td>
</tr>
</tbody>
</table>
Results - breast cancer

Breast cancer

Adjusted for all co-variables explained 54% of overall racial/ethnic survival disparities
Results - prostate cancer

Prostate cancer

Adjusted for all co-variables explained 48% of overall racial/ethnic survival disparities.
Results - lung cancer

Adjusted for all co-variables explained **40%** of overall racial/ethnic survival disparities

Adjusted for all co-variables explained **15%** of overall racial/ethnic survival disparities
Results - colorectal cancer

Adjusted for all co-variables explained 52% of overall racial/ethnic survival disparities

Adjusted for all co-variables explained 55% of overall racial/ethnic survival disparities

- Men
- Women
Summary

Stage at diagnosis, neighborhood SES, and marital status were found to be the most influential factors in racial/ethnic survival disparities.

Stage
- Differences in both stage distribution & stage-specific survival across racial/ethnic groups
- Potential modifiable risk factor
- Access to treatment, especially for late stage tumors, may play a role

Neighborhood SES
- Important explanatory factor in all cancers sites
- Effect limited to Black & Hispanic patients
- Does not explain AAPI survival advantage
Summary cont.

Marital status
- Most notable in men
- Attributable to increased social support & higher psychological well-being

Cancer-specific factors
- HR status was 2nd largest contributor to racial/ethnic survival disparities in breast cancer
- Tumor histology was important contributing factor in lung cancer, especially in women
Conclusions

- Stage at diagnosis had largest impact, but earlier detection alone will not entirely eliminate racial/ethnic survival disparities
- Little impact of differences in care after diagnosis
  - But registry treatment data limited
- Considerable influence of neighborhood SES & marital status
  - Social determinants, support mechanisms, & access to health care cannot be overlooked
  - More equitable access to care for underserved groups could substantially reduce racial/ethnic disparities in cancer survival
Acknowledgements

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