Disclosures

• No conflicts of interest to disclose
Objectives

- To review reported health disparities and inequities in the use radiotherapy for prostate cancer:
  - Diagnostic/Staging Work-up
  - Treatment
    - Omission
    - Delay
    - Type
  - Clinical outcomes
Definitions

- Health disparities:
  - differences in the incidence, prevalence, mortality, and burden of diseases and other adverse health conditions that exist among specific population groups.
  - National Institute on Minority Health and Health Disparities (NIMHD).

- NIH-designated U.S. health disparity populations:
  - Blacks/African Americans
  - Hispanics/Latinos
  - American Indians/Alaska Natives
  - Asian Americans
  - Native Hawaiians and other Pacific Islanders
  - Socioeconomically disadvantaged populations
  - Underserved rural populations
  - Sexual and gender minorities
What Is Health Equity? A Definition

For general purposes, health equity can be defined as follows:

Health equity means that everyone has a fair and just opportunity to be as healthy as possible. This requires removing obstacles to health such as poverty, discrimination, and their consequences, including powerless and lack of access to good jobs with fair pay, quality education and housing, safe environments, and health care.
Definitions

6 Domains of Health Care Quality: (National Academy of Medicine)

1) **Safe**: Avoiding harm to patients from the care that is intended to help them.

2) **Effective**: Providing services based on scientific knowledge to all who could benefit and refraining from providing services to those not likely to benefit (avoiding underuse and misuse, respectively).

3) **Patient-centered**: Providing care that is respectful of and responsive to individual patient preferences, needs, and values and ensuring that patient values guide all clinical decisions.

4) **Timely**: Reducing waits and sometimes harmful delays for both those who receive and those who give care.

5) **Efficient**: Avoiding waste, including waste of equipment, supplies, ideas, and energy.

6) **Equitable**: Providing care that does not vary in quality because of personal characteristics such as gender, ethnicity, geographic location, and socioeconomic status.
Prostate cancer RT disparities literature review

- yielded 79 studies

Katipally R, Deville C. ARS 2018
Background

- Well-documented disparities exist in prostate cancer incidence, morbidity, and mortality in Black vs. White males in the United States

Table 2. Lifetime Probability of Developing or Dying from Invasive Cancers by Race/Ethnicity and Sex, US, 2010-2012*

<table>
<thead>
<tr>
<th>Cancer Type</th>
<th>Developing</th>
<th>Dying</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Black (%)</td>
<td>NH White (%)</td>
</tr>
<tr>
<td>All Sites†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>40.8 (1 in 2)</td>
<td>42.4 (1 in 2)</td>
</tr>
<tr>
<td>Female</td>
<td>34.3 (1 in 3)</td>
<td>39.0 (1 in 3)</td>
</tr>
<tr>
<td>Prostate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>18.2 (1 in 6)</td>
<td>13.3 (1 in 8)</td>
</tr>
<tr>
<td>Female</td>
<td>11.1 (1 in 9)</td>
<td>13.1 (1 in 8)</td>
</tr>
<tr>
<td>Breast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>7.5 (1 in 13)</td>
<td>7.5 (1 in 13)</td>
</tr>
<tr>
<td>Female</td>
<td>5.4 (1 in 19)</td>
<td>6.7 (1 in 15)</td>
</tr>
<tr>
<td>Lung &amp; bronchus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>4.9 (1 in 21)</td>
<td>4.6 (1 in 22)</td>
</tr>
<tr>
<td>Female</td>
<td>4.7 (1 in 21)</td>
<td>4.3 (1 in 23)</td>
</tr>
<tr>
<td>Colon &amp; rectum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Excludes basal cell and squamous cell skin cancers and in situ carcinoma with the exception of urinary bladder.

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Background

- Black men with low grade prostate cancer had increased recurrence after radical prostatectomy
Background

• Black men classified as having very low risk prostate cancer, eligible for active surveillance, were more likely to have:
  – adverse pathologic features at the time of radical prostatectomy
  – larger dominant intraprostatic lesions with high prevalence of anterior foci.


Disparities in staging prostate magnetic resonance imaging utilization for nonmetastatic prostate cancer patients undergoing definitive radiation therapy

Ayobami Ajayi BA 1, Wei-Ting Hwang PhD 2, Neha Vapiwala MD 3, Mark Rosen MD PhD 4, Christina H. Chapman MD 4, Stefan Beth PhD 4, Meera Shah BS 5, Xingmei Wang MS 6, Atu Agwu MD MPH 7, Peter Gabriel MD 8, John Christodoulas MD MPH 9, Zeitig Tochner MD 10, Curtiland Deville MD 11, 14

705 non-metastatic PCa patients

RT from 2005-2013

Uni- and multivariable logistic regression evaluated the relationship of clinical and demographic characteristics with MRI utilization

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>OR (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>0.92 (0.89, 0.94)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black vs. White</td>
<td>0.51 (0.35, 0.73)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Other vs. White</td>
<td>1.40 (0.61, 3.23)</td>
<td>0.432</td>
</tr>
<tr>
<td>Poverty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes vs. No</td>
<td>0.53 (0.36, 0.77)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Distance (mi)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 45 vs. &lt;45</td>
<td>1.79 (1.11, 2.88)</td>
<td>0.017</td>
</tr>
<tr>
<td>Primary Insurance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-private vs. Private</td>
<td>0.57 (0.39, 0.84)</td>
<td>0.005</td>
</tr>
<tr>
<td>Treatment Year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008-2009 vs. 2005-2007</td>
<td>0.43 (-0.05, 2.63)</td>
<td>0.076</td>
</tr>
<tr>
<td>2010-2013 vs. 2005-2007</td>
<td>1.40 (0.61, 3.23)</td>
<td>0.432</td>
</tr>
<tr>
<td>PSA (ng/mL)</td>
<td>0.99 (0.98, 1.01)</td>
<td>0.354</td>
</tr>
<tr>
<td>Gleason Score</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 vs. 6</td>
<td>0.96 (0.66, 1.41)</td>
<td>0.845</td>
</tr>
<tr>
<td>8 vs. 6</td>
<td>0.87 (0.44, 1.72)</td>
<td>0.683</td>
</tr>
<tr>
<td>9 vs. 6</td>
<td>0.56 (0.27, 1.15)</td>
<td>0.112</td>
</tr>
<tr>
<td>Clinical T stage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T2 vs. T1</td>
<td>0.81 (0.53, 1.24)</td>
<td>0.337</td>
</tr>
<tr>
<td>T3 vs. T1</td>
<td>3.37 (1.42, 7.97)</td>
<td>0.006</td>
</tr>
<tr>
<td>Risk Group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermediate vs. High</td>
<td>1.27 (0.81, 2.00)</td>
<td>0.296</td>
</tr>
<tr>
<td>Low vs. High</td>
<td>1.17 (0.73, 1.86)</td>
<td>0.514</td>
</tr>
<tr>
<td>Percent positive biopsy cores</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.64 (0.25, 1.63)</td>
<td>0.348</td>
<td></td>
</tr>
<tr>
<td>IPSS</td>
<td>0.99 (0.95, 1.03)</td>
<td>0.589</td>
</tr>
</tbody>
</table>
(A) older patients across all risk groups and (B) Black or (C) non-private insurance patients in the low risk group were less likely to undergo MRI.
The IOM has identified **timely delivery of care** as an **indicator for quality** health care.

Treatment delay is a potentially modifiable obstacle that can contribute to the disparities among Black vs White prostate cancer patients in recurrence and mortality.
Treatment Delay

- Using SEER-Medicare linked database
- Compared time from diagnosis to treatment in 2,506 AA and 21,454 Caucasian patients
- Diagnosed with localized prostate cancer from 2004-2007 and treated within 12 mo.
- Linear regression to assess potential differences in time to treatment between AA and Caucasian patients, after adjusting for sociodemographic and clinical covariates.
Results:

- Time from diagnosis to definitive (prostatectomy or radiation) treatment was longer for AA patients in all risk groups
  - and most pronounced in high-risk (96 vs. 105 days, P<.001)
- Racial differences persisted (β = 7.6 for AA) on multivariate analysis.
- Delay was longer in more recent years.

Conclusion:

- AA patients with prostate cancer experienced longer time from diagnosis to treatment than Caucasian patients with prostate cancer.
The NCDB identified 138,019 patients diagnosed with nonmetastatic, high-risk prostate cancer from 2004-2012.

Multivariable logistic analysis was used to identify independent determinants of definitive therapy.

stratified by academic versus community cancer center.
Treatment Delay/ Omission

Results:

• Blacks, Hispanics, and uninsured patients:
  – less likely to receive definitive treatment at:
    • Community center hospitals (by 40%, 31% 75% respectively)
    • Academic hospitals (by 50%, 44%, 69%)
  – are more likely to experience treatment delays regardless of hospital type
    • Community centers: at least 15, 10 and 19 days
    • Academic centers: at least 19, 11 and 18 days
No... Conclusion:

- Academic cancer centers demonstrate similarly high rates of sociodemographic disparities as Community cancer centers.
• NCDB 187,730 nonmetastatic prostate cancer
  EBRT from 2004-2012
• Multivariable logistic regression analysis adjusted for sociodemographic and clinical factors was used to identify independent determinants of proton therapy use.
• Proton therapy use increased significantly 2.3% 2004, 5.2% 2011, and 4.8% 2012 (P<.0001).

Cancer
Volume 122, Issue 10, pages 1505-1512, 11 MAR 2016 DOI: 10.1002/cncr.29960
Treatment Type

- significantly less likely to receive proton therapy even after robust multivariable adjustments:
  - Blacks: OR 0.20 (0.18-0.22, P<.0001)
  - Hispanics: OR 0.57 (0.48-0.66, P<.0001)
  - SES
  - Clinical parameters: lower PSA, low-grade or low-stage disease
Treatment Type

Scientific Article

Sociodemographic disparities in the utilization of proton therapy for prostate cancer at an urban academic center

Kristina D. Woodhouse MD a, Wei-Ting Hwang PhD b, Neha Vapiwala MD a, Akansha Jain a, Xingmei Wang MS b, Stefan Both PhD c, Meera Shah BS d, Marquise Frazier RT(T), MBA e, Peter Gabriel MD a, John P. Christodoulou MD, MPH a, Zelig Tochner MD a, Curtiland Deville MD f,*

• All low and intermediate-risk prostate cancer patients (n=633) treated from 2010-2015
Variables associated with proton therapy:

- Treatment years: 2011 (OR 4.87, 2.23-10.6), 2012 (OR 8.27, 3.43-19.9), and 2014 (OR 4.44, 1.94-10.2) relative to 2010
- Distance (OR 1.14, 1.06-1.24)
- Race:
  - Black (OR 0.29, 95% CI 0.15-0.57)
  - Other race (OR 0.42, 0.20-0.90)
- One physician (OR 0.38, 0.18-0.81) relative to the reference physician
- Not associated: clinical factors, such as PSA, prostate volume, IIEF, and ADT.
Treatment Type: Proton vs IMRT

- **Race**
  - Black vs. White: OR (95% CI) 0.30 (0.20–0.47), 0.29 (0.15–0.57)
  - Other vs. White: OR (95% CI) 0.52 (0.27–1.00), 0.41 (0.19–0.89)

- **Age**
  - OR (95% CI) 0.80 (0.69–0.92), 0.85 (0.71–1.01)

- **Distance**
  - OR (95% CI) 1.18 (1.09–1.28), 1.14 (1.06–1.24)

- **Poverty line**
  - Univariate: OR (95% CI) 0.88 (0.82–0.95), Multivariate: 1.03 (0.92–1.15)
Clinical Outcomes: SEER-Medicare

- SEER-Medicare study compared survival rates among African-American and Caucasian patients across different types
- Data on treatment modality, age, race, cancer stage, tumor grade, census tract socioeconomic status, and date of death

Clinical Outcomes: SEER-Medicare

- Median survival in black patients relative to white patients was:
  - Surgery: 1.8 years less (95%CI = 1.5-2.0 yrs)
  - RT: 0.7 years less (95%CI = 0.5 to 1.0 yrs)
  - “nonaggressive” tx: 1.0 years less (95%CI = 0.7-1.1 yrs)
Clinical Outcomes: clinical trials

- Methods:
  - Transcriptome-wide expression profiles of tumor samples from 5,831 localized PCa patients were used with tissue from a prospective cohort (n=5,239) and 2 retrospective cohorts with long-term outcomes (n=592).
Clinical Outcomes: clinical trials

**Results:**

- AfA tumors had decreased double strand break repair pathway expression \((p<0.001)\) and increased predicted RT sensitivity \((p<0.001)\).

  - **suggests AfA may have improved outcomes with RT.**

- 4 large RTOG trials were used to clinically test whether AfA tumors are more radiosensitive

  - On both unadjusted and propensity weighted cohorts (adjusting for age, performance status, PSA, Gleason grade, T-stage, N-stage, and use/duration of hormone therapy):

  - **AfA had significantly improved outcomes compared to Whites:**

    - BCR: HR 0.82; 95% CI 0.74-0.92; \(p = 0.0005\)
    - DM: HR 0.70; (95% CI 0.57-0.86; \(p = 0.0008\)).
assessed the impact of race on survival
2,048 men treated with EBRT+/- ADT
localized prostate cancer
RTOG phase III randomized trials from 1975-1992
• On univariate analysis Blacks had lower overall (p=0.04, RR=1.24) and disease specific survival (p=0.016, RR=1.41).

• After adjusting for risk group and treatment type race was no longer associated with outcome (p>0.05).
Blacks were younger and had worse performance status, higher testosterone and PSA, and lower Hgb than white men. Despite these differences, median OS:
- Black: 21.0 mo (95%CI 19.4-22.5 mo) vs White: 21.2 mo (95%CI 20.8-21.7 mo)

Pooled multivariable HR 0.81 (95%CI 0.72-0.91) \(\rightarrow\) Blacks decreased risk of death compared to Whites (P<.001).

When adjusted for known prognostic factors, significantly increased Overall Survival in black vs white men with mCRPC in these trials.
Solutions and Interventions

- Applying the 4\textsuperscript{th} generation model for addressing health disparities requires
  (1) a foundation of descriptive studies to characterize the problem
  (2) explanatory data
  (3) interventional solutions and approaches
  (4) public health praxis, infrastructure, and policy


Annu. Rev. Public Health. 32:399–416
Conclusions

• Health disparities and inequities exist in PCa RT:
  – Diagnostic/Staging work-up
  – Treatment Delay, Omission, and Type
  – Clinical outcomes
    • EXCEPT prospective Clinical Trials where equivalent and sometime better outcomes have been noted for certain demographic groups

• Community/Patient engagement and Quality metrics (e.g. monitoring time to treatment and technology utilization across demographics) may help mitigate disparities to achieve health equity in prostate RT
Thank You

• Comments and Questions?

cdeville@jhmi.edu
Treatment Omission

- 9771 patients with clinical N1M0 prostate cancer diagnosed from 1998 to 2012 using the National Cancer Database.
  - Multivariable logistic regression modeling identified patient-specific factors associated with reduced likelihood of receiving radiation or radical prostatectomy.

Treatment Omission

- factors associated with reduced likelihood of local therapy for N1M0 patients included:
  - Race: black race vs white race
    • 44% vs 49%, AOR 0.76; P=.001
  - SES: bottom vs top income quartile
    • 45% vs 53%, AOR 0.69; P=.001
  - Age: age >66yo vs ≤66yo
    • 41% vs 55%, AOR 0.48; P<.001
  - Insurance: Medicaid or no insurance vs private insurance
    • 41% vs 49%, AOR 0.41; P<.001
  - Year of diagnosis before vs after 2005
    • 31% vs 62%, AOR 0.66; P<.001

Diagnostic/Staging

Plot of adjusted* (dashed line) and unadjusted (solid line) odds ratios of prostate magnetic resonance imaging utilization for black vs white men from the multivariable analysis stratified by risk-group. *Adjusted for age, poverty, primary insurance type, distance, and clinical stage.
Clinical Outcomes: clinical trials

<table>
<thead>
<tr>
<th>References</th>
<th>Stages</th>
<th>Treatment</th>
<th>No Disease Evidence/Survival Difference</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crawford et al</td>
<td>American Urologic System D2</td>
<td>Leuprolide with or without flutamide</td>
<td>Not available</td>
<td>Race not significant when corrected for severity/extent of disease</td>
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<tr>
<td>Vogelzang et al</td>
<td>American Urologic System D2</td>
<td>Goserline vs. orchidectomy</td>
<td>Not available</td>
<td>Race not significant when corrected for severity/extent of disease</td>
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<tr>
<td>Smith et al</td>
<td>Refractory metastatic</td>
<td>Systemic</td>
<td>No/No</td>
<td>Black men tended to do better than white men</td>
</tr>
<tr>
<td>Thompson et al</td>
<td>American Urologic System D2</td>
<td>Orchietomy with or without flutamide</td>
<td>Yes</td>
<td>Black men had worse outcome despite adjustment for other factors</td>
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<tr>
<td>Roach et al</td>
<td>T1–T4</td>
<td>Radiotherapy with or without LH-RH drugs with or without flutamide</td>
<td>No/No</td>
<td>Race not significant when corrected for severity/extent of disease</td>
</tr>
<tr>
<td>Present series</td>
<td>Nx–1</td>
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</tbody>
</table>

Comparable care was assumed because care was delivered on standardized protocols.

<table>
<thead>
<tr>
<th>References</th>
<th>Stages</th>
<th>Institution</th>
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<tbody>
<tr>
<td>Nautiyal et al</td>
<td>T1–T3NXM0</td>
<td>University of Chicago</td>
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<tr>
<td>Zagars et al</td>
<td>T1NxM0-T4NxM0</td>
<td>M. D. Anderson Cancer Center</td>
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<tr>
<td>Hart et al</td>
<td>T1NxM0-T4NxM0</td>
<td>Wayne State University</td>
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<td>Sohayda et al</td>
<td>T1NxM0-T4NxM0</td>
<td>Cleveland Clinic</td>
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<tr>
<td>Preston et al</td>
<td>T1NxM0-T4NxM0</td>
<td>Walter Reed Medical Center</td>
</tr>
<tr>
<td>Young et al</td>
<td>T1NxM0-T4NxM0</td>
<td>University of California-San Francisco</td>
</tr>
</tbody>
</table>

Comparable care was assumed because the same type of treatment was delivered at the same institution, and there were no differences in no evidence of disease or survival data.