Race, Risk and Resilience:
A consideration of
3 Dimensions of Health Disparities

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Outline

1. American race-based health disparities are real, pervasive and persistent

2. The last 30 years have been an important era of establishing the severity and extent of race/ethnicity based health disparities

2. Group comparisons, while useful, may contribute to a monolithically negative view of Black health

4. Black resilience is overlooked; its study and may offer fresh insights
Background: A Nation at Risk: Cardiovascular Disease (CVD)

- CVD is the leading cause of death both globally and nationally.
- In the United States, about 600,000 people die each year from CVD.
- Heart disease costs about $207 billion dollars each year. This includes the cost of service, medications, and lost productivity.

Decline in Deaths from Cardiovascular Disease in Relation to Scientific Advances.

Age-adjusted heart disease mortality rates per 100,000 (1950–2000).
Selected Outcomes of Disparities Studies

Documentation of

– Excess deaths from preventable disease (acute and chronic)
– Access inequities
  • Utilization differences
  • Quality of care differences
    – Systems related (e.g., quality of facilities)
    – Medical encounter-related (e.g., trust, health literacy, cultural competency)
– Risk factor differences
– Potency of social determinants
– Highlight the need for more granular data on Blacks
A. In general, medical research treats people fairly (59.2% agree)
B. People put themselves at risk if they participate in medical research (32.5% agree)
C. Medical research is too hard for people like me to understand (38.9% agree)
D. Medical research is a way for the government to keep black people down (14.3% agree)
Clinic Exam Components: Traditional Risk Assessment

- **ANTHROPOMETRY**

- **BLOOD PRESSURE**
  - Sitting
  - ABI
  - 24 hr Ambulatory

- **ECHOCARDIOGRAPHY**

- **ELECTROCARDIOGRAPHY**

- **ULTRASOUND, B-MODE**
  - Carotid Arteries

- **PHYSICAL ACTIVITY MONITOR**

- **PULMONARY FUNCTION**
  - FEV1.0
  - FVC

- **Urine Collection 24 Hour**

- **VENIPUNCTURE**
  - Chemistries
  - Hematology
  - Hemostasis
  - Lipids
  - DNA & Transformed lymphocytes
<table>
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<tbody>
<tr>
<td>Seated blood pressure</td>
<td>Seated blood pressure</td>
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<tr>
<td>Height, weight</td>
<td>Height, weight, waist circumference</td>
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<tr>
<td>Interim medical history: CHD events/procedures</td>
<td>Interim medical history: CHD events/procedures questionnaire</td>
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<tr>
<td>Medication survey</td>
<td>Medication survey</td>
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<tr>
<td>Glucose, cholesterol, HgA1c</td>
<td>Personal history (smoking, alcohol)</td>
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<tr>
<td></td>
<td>Physical activity questionnaire</td>
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<td>Socioeconomic status questionnaire</td>
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<td>Sleep questionnaire</td>
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<tr>
<td></td>
<td>Phlebotomy with central laboratory measurement of fasting lipids, lipoproteins,</td>
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<tr>
<td></td>
<td>glucose and insulin, BUN and creatinine, CRP, e- and p-selectin</td>
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<tr>
<td></td>
<td>Spot urine for albumin and creatinine</td>
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<tr>
<td></td>
<td>Genotyping</td>
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<tr>
<td></td>
<td>Further DNA isolation and purification [on entire cohort]</td>
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<tr>
<td>Ankle-arm index</td>
<td>Ankle-arm index</td>
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<tr>
<td>Electrocardiogram</td>
<td>Electrocardiogram</td>
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<td>Cardiac MRI for LV and RV structure and function</td>
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</tbody>
</table>

- MDCT Scanning for CAC and Abdominal Fat Distribution
- Cardiac MRI for LV and RV structure and function

Distribute blood pressure monitor and instructions on use
BMI Distribution: Comparison of Jackson and Framingham

Taylor and C Fox, et al, *Obesity* 2010
CT and MRI imaging of the Heart & Body

The CT exam (N~2,800) provides measures of coronary artery disease and body composition.

The MRI exam (N=1,846) provides measures of heart and aortic function.
Refinement of Risk Profiling

Novel biomarkers and subclinical disease measures offer incremental predictive usefulness over standard CVD risk factors for predicting CVD risk in black adults.
Group comparisons focus on deficits and obscure within-group successes

Significant **Heterogeneity** among Blacks

- >50% without hypertension
- >85% without heart disease

Equal longevity among the elderly

**Resilience**

**Health maintenance in the face of risk**

Understanding the environmental and individual promoters of CV health within the Black population is vastly understudied
Resilience—Psychosocial/Behavioral

Organ (system) Resilience

Cellular resilience

Smirnova et al., 2015
Isn't Studying Risk Enough?

- Factors that should reduce risk among Blacks often don’t:
  - Blacks don’t receive the same CV benefits from high SES that Whites do (shown in studies with BMI, HTN and sleep)
  - Social support not always as protective

- Factors that should increase risk among Blacks often don’t:
  - Some of the best health outcomes among Blacks observed in the poorest areas *Fry-Johnson YW, Levine R, Rowley D, Agboto V, Rust G.*, 2010

- Contextual level factors that are protective in the North may not be protective in the South (e.g. Green Spaces)

- *We actually know very little about factors that promote resilience among Blacks*
Atlanta: ideal “laboratory“
Black Heterogeneity and Resilience

- Exceptionally wide within-race Socioeconomic Spectrum
- Heterogeneous Communities
  - Different Combinations of SES and Racial Composition
  - Including High Income Black Neighborhoods
  - Urban and Suburban Areas
  - Less Segregation than Northeast and Midwest
- Atlanta has been underrepresented in large-scale studies of CVD in Blacks
  - CARDIA, MESA, ARIC, JHS
  - But has long been known as the “Black Mecca”
Morehouse-Emory Cardiovascular (MECA) Center for Health Equity
The Risk of Race

In Disparities Research, Black Race=Risk

“…independent of traditional risk factors, African American individuals ... have a 2-3 fold increase in ... risk of developing clinically manifest CVD ...

“...even after adjusting for relevant potentially confounding variables…”

“Black Americans are twice as likely to experience a stroke as non-Hispanic whites ...”

.... the relative risk of admission to a high-mortality hospital after adjusting for [relevant covariates]... in the logistic regression models an indicator variable for black race, was statistically significant...

“...even after controlling for TNM stage, ...adjusted for both disease- and socioeconomic-related factors, black race [equaled poorer outcome...]”
MECA: Exploring Facilitators of Resilience

– Contextual level ("Population Project")
  • Community, Neighborhood, Environment
    – Objective assessment of
      » CVD morbidity and mortality
      » Neighborhood assets
  – Subjective experience of environment

– Individual level: ("Clinical" and "Basic" Projects)
  • Psychosocial, behavioral
  • Vascular and epigenetic fingerprints of resilience
    – before and after clinical intervention
Aims of MECA Population Project

• **Aim 1.** Compare rate of CV hospitalizations, emergency department (ED) visits and death among Blacks across communities in metropolitan Atlanta in order to identify ‘resilient’ and ‘at risk’ communities.

• **Aim 2.** Elucidate factors that contribute to Black communities’ CV ‘resilience’ and ‘risk’, at both the census tract and individual levels.

• **Aim 3.** Examine the relationship between the ‘resilience’ and ‘risk’ factors and the AHA Life’s Simple 7 (LS7) score.
Aim 1: Identification of ‘at Risk’ and ‘Resilient’ Census Tracts

High Rates of CVD

“AT RISK” Census Tracts

ATLANTA Census Tracts (N=940)

Low Rates of CVD

“RESILIENT” Census Tracts
Aim 1: Identification of ‘at Risk’ and ‘Resilient’ Census Tracts

- Census Tracts in 36 County Atlanta-Athens-Clarke County-Sandy Springs, GA Combined Statistical Area
- African Americans aged 30-65
- 2010-2014 aggregate counts
- Mortality: CVD Mortality
- Morbidity: CVD related ED visits and hospitalizations

2010 Census data for denominators
Aim 1: Identification of ‘at Risk’ and ‘Resilient’ Census Tracts

<table>
<thead>
<tr>
<th></th>
<th>Resilient N=106</th>
<th>At Risk N=118</th>
</tr>
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<tbody>
<tr>
<td>Median Black Income</td>
<td>$46334.72</td>
<td>$44,721.35</td>
</tr>
<tr>
<td>Mortality Rate</td>
<td>8.09</td>
<td>14.04</td>
</tr>
<tr>
<td>ED Visit Rate</td>
<td>33.40</td>
<td>147.07</td>
</tr>
<tr>
<td>Hospital. Rate</td>
<td>28.05</td>
<td>131.54</td>
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</table>
Conclusions: Aim 1

• Census tracts across metro-Atlanta have variable rates of premature-CVD outcomes in Blacks

• This variation exists even when the median Black household income is taken into account

• Both ‘at Risk’ and ‘Resilient’ tracts are found throughout the Atlanta Metro-area
Aim 2. Identify factors contributing to CV ‘resilience’ and ‘risk’ in Black communities at the census tract (neighborhood) and individual levels.

Population Survey:

- Gather subjective impressions of the neighborhood environment of residents in “at risk” and “resilient” tracts

- Gather health, mental health, health behavior, and social information from residents in “at risk” and “resilient” tracts

- Compare outcomes and environments in the “at risk” vs. “resilient” tracts
Neighborhood and Respondent Characteristics– PRELIMINARY Results

- **Not Significant**
  - Walking Environment Score
  - Activities with Neighbor Score
  - Walkable grocery stores

- **Significant**
  - Global Health
  - Depression
  - Optimism

Trends: Optimism
Depressive Symptoms (CES-D > 16)

- At Risk: 12.6%
- Resilient: 9.4%

% Depressed
Specific Aim 1: To investigate the impact of social and environmental ‘risk and resilience’ factors on (i) biomarkers of cardiovascular (CV) risk and repair/regeneration, and (ii) sub-clinical vascular disease in Blacks.

Participants: 400 Black men and women from ‘at risk’ and ‘resilient’ communities in metro Atlanta.

Measurements:
Neighborhood/Individual ‘resilience’

Endpoints:
• Inflammation: HsCRP,
• Oxidative stress: plasma cystine, glutathione
• Regenerative capacity: CD34+ and subset cell counts.
• Vascular measures: pulse wave velocity and PAT reactive hyperemia index, augmentation index and CIMT.
• Adjust above markers for AHA LS7 score
Oxidative stress/Inflammation

- Glutathione/cystine ratio
- Hs CRP
- LogIL6
- LogTNFα
- LogCRP

Regenerative Capacity

- CD34+/CD133+ cells
- 905 patients

Neighborhood Effects

<table>
<thead>
<tr>
<th>NEIGHBORHOOD</th>
<th>LogIL6</th>
<th>LogTNFα</th>
<th>LogCRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment</td>
<td>-0.143**</td>
<td>-0.090*</td>
<td>-0.112*</td>
</tr>
<tr>
<td>Walkability</td>
<td>-0.061</td>
<td>0.029</td>
<td>-0.123*</td>
</tr>
<tr>
<td>Cohesion</td>
<td>-0.152**</td>
<td>-0.099*</td>
<td>-0.085</td>
</tr>
</tbody>
</table>

R value; *P<0.05; **= P<0.01

Patel RS, Quyyumi AA. Circ Res. 2015 Jan 16;116(2):289-97
Aim 2: Investigate effective method for driving behavior change using ehealth among Black participants with low AHA LS7 scores.
Aim 3: Effects of the two life-style interventions on biomarkers, repair/regeneration, and vascular function.

Participants:
- 150 participants from Aim 1;
- 75 from ‘resilient’ and 75 from ‘at risk’ neighborhoods
- AHA LS7 scores of ≤4
- Internet access, can participate in physical activity

Randomization:
Initial 6 months: 75 subjects to interventional randomization and 75 subjects to wait list controls after stratification for neighborhood.

Endpoints: (baseline, 3 months, 6 months)
Basic Project: MicroRNAs

- Mature microRNAs are short, single-stranded RNA molecules (~22 nt).
- Induce **gene silencing** by binding to target sites found within the 3’UTR of the targeted mRNA.
- Involved in a wide range of biological processes and several developmental and physiological processes.
- Intensely studied as candidates for diagnostic and prognostic biomarkers and predictors of drug response.
Novel high-resolution metabolomics

EMORY CLINICAL BIOMARKERS LABORATORY: Dean Jones
Assay broadly covers human exposures

New high-resolution metabolomics (HRM) measures >20,000 chemicals in human serum

- Core Nutritional Metabolome
- Non-nutritive Chemicals in Diet
- Microbiome-related Chemicals
- Supplements and Pharmaceuticals
- Commercial Products
- Environmental Chemicals

**Food metabolome**

- 40 Essential nutrients
- 2000 intermediates formed by enzymes encoded by the genome
- Plant metabolome >200,000 chemicals
- Largely uncharacterized (may be 10-40% of plasma metabolome)
- >1000 drugs in use

**Environmental metabolome**

- 100,000 registered with EPA
- 10,000 with high volume use

*Metabolome refers to chemicals associated with life*  
Jones, Park Ziegler Annu Rev Nutr 2012
Other Studies

• Sleep and resilience
  – Animal and human

• Angiogenesis as a mechanism of resilience

• mHealth Cohort studies
“...One thing we must of course expect to find, and that is a much higher death rate at present among Negroes than among whites ... They have in the past lived under vastly different conditions and they still live under different conditions...”

W.E.B. Dubois, 1899
The Philadelphia Negro, Chapter X, page 148
Summary

• Focus on unique levels of risk and vulnerability have been critical

• A singular emphasis on risk/poor outcomes neglects assets and positive aspects of Black health

• Recognition of heterogeneity and resilience in the face of adversity promotes a complementary, positive pathway towards the resolution of health disparities
Towards a more complete understanding of Black CV Health
Towards the advancement and creation of health equity
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