Assessing Risk Factors and CHD Symptoms in Women

Dr. Jean McSweeney, RN, FAHA, FAAN
Associate Dean for Research
College of Nursing
University of Arkansas for Medical Sciences
KEY FACTS
Cardiovascular Diseases (CVDs)

• CVDs are the # 1 cause of death globally
• In 2012, 17.5 million people died from CVDs, (31% of global deaths)
• 7.4 million deaths due to CHD
• By 2030, almost 23.3 million will die from CVDs
  – Economic impact in billions
• Need translation of CVD research

CVD and Women

- CVD & Stroke cause 1 in 3 women’s death each year in the U.S.
  - Killing one woman every 80 seconds
- Estimated 44 million women are affected by CVD in the U.S.
- 80% of heart disease and stroke events may be prevented.
  - Lifestyle changes
  - Education

CVD Disease Mortality Trends for Males and Females (United States: 1979–2013)

Source: National Center for Health Statistics 2016; AHA 2016
CVD and Minority Women

Hispanic Women:
• Likely to develop heart disease 10 years earlier than Caucasian women
• CVD is the leading cause of death (21,000 annually in the U.S.)
• Only 34% of Hispanic women are aware heart disease is their greatest health risk
• Least likely to have usual source of health medical care
• Only 1 in 8 Hispanic women say their doctor has ever discussed their heart disease risk

AHA (2016) Heart Disease Statistics at a Glance
CVD and Minority Women

African American Women:

• Leading cause of death
  – Killing over 48,000 annually in the U.S.

• Only 36% of African American women are aware of that heart disease is their greatest health risk

• 48.3% of African American women 20 and older have CVD
  – Only 14% believe that CVD is their greatest health problem

• Only 50% of African American women know the signs and symptoms of a heart attack

AHA (2016) Heart Disease Statistics at a Glance
Leading Causes of Death: Females
(United States 2013)

A indicates cardiovascular disease plus congenital cardiovascular disease (ICD-10 I00-I99, Q20-Q28); B, cancer (C00-C97); C, accidents (V01-X59,Y65-Y86); D, chronic lower respiratory disease (J40-J47); E, diabetes mellitus (E10-E14); F, Alzheimer disease (G30). Source: NCHS.
Women’s Awareness of Heart Disease as #1 Cause of Death

Lori Mosca et al. Circulation. 2013;CIR.0b013e318287cf2f
Key Facts

- Heart disease kills more women than all forms of cancer combined.
- More than 1 in 3 women have some form of cardiovascular disease (CVD).
- 26% of women ≥ 45 with initial MI will die within 1 year compared to 19% of men.
  – Twice as likely to have reoccurrence.

Impact of CHD on Women as Compared to Men

- 47% of women as compared to 36% of men die within 5 years after MI
- If women under age 50 at time of MI, twice as likely to be fatal as in men of comparable age
- After MI, 46% women as compared to 22% are disabled within 6 years
- Have less obstructive CHD when referred for revascularization
- More microvascular disease

Sex Differences in CVD System

• After the reproductive system, the CV system has the most sex-based differences

• Differences between sexes in hematocrit and estrogen levels, frequency of mitral valve prolapse, left ventricular hypertrophy, myocardial blood flow, etc.

• Sex and racial differences in lab values used to diagnose CHD

How to Improve Women’s CHD Outcomes

- Must include greater number of women in research
- Must improve early detection of CHD in women so may prevent or delay MI
- Several obstacles to early detection and treatment of CHD in women exist
  - Lack of perception of risk
  - Psychosocial issues
  - Delay in seeking treatment
  - Difficulty recognizing women’s CHD symptoms
Sex-Specific Factors Associated with Women’s Delay

- Lack of MI symptom knowledge
  - Vague, atypical symptoms not perceived as serious
  - Misinterpretation of symptoms
- Initiate self-treatment rather than seeking medical assistance
- Symptom descriptions & interpretations influenced by gender, race, & culture
- A primary reason for missed diagnosis is patient’s communication of symptoms

Lack of Symptom Identification

- If CP is not chief symptom during MI, more likely to be misdiagnosed
- Twice as likely to die after misdiagnosis compared to those diagnosed with MI
- Women ≤ 55 years old or minorities with shortness of breath as chief complaint are most misdiagnosed

Contributors to Difficulty in Diagnosing CHD in Women

- Gender differences in presentation
- Paucity of research of women’s symptoms
- Possible racial differences in symptoms & descriptions of symptoms
To Make Diagnosis of CHD in Women

- Identify risk factors
- Assess for prodromal symptoms (PS)
- Implement primary & secondary prevention measures
Women and CHD

- Typically 10 years older than men at diagnosis
- ↑ risk factor prevalence with aging
- By midlife > 80% of women have 1 or more risk factors
  - Obesity
  - DM
  - Age
  - HTN
  - Inactivity
  - Smoking
- Rate of CHD ↑ with number of risk factors present

Modifiable Risk Factors for CHD in Arkansas and U.S.

Centers for Disease Control & Prevention (2015)
Arkansans Risk Factors

Currently Smokers

Binge Drinking

Percentage of Adults 18+ Who are Current Smokers: Arkansas, 2010

Percentage of Adults 18+ Reporting Binge Drinking: Arkansas, 2010
Arkansans Risk Factors

No Exercise in past 30 days

Consuming < 5 Fruits & Vegetables
Obesity

• 24 states > 30% prevalence
  – These same states also have ↑ CVD prevalence & mortality

• Waist circumference greatest risk factor of mortality
  – ↑ abdominal fat associated with ↑ incidence CVD

• Rates as high as 40% of post-menopausal women are obese
  – Body fat redistributes post-menopause to favor ↑ abdominal fat rather than low hip

Centers for Disease Control and Prevention. Heart Disease Death Rates, Total Population Ages 35+. Centers for Disease Control and Prevention: Division for Heart Disease and Stroke Prevention. 4-16-2014.
Prevalence* of Self-Reported Obesity Among U.S. Adults by State and Territory

BRFSS, 2014 *Prevalence estimates reflect BRFSS methodological changes.

Prevalence of Self-Reported Obesity Among **White Adults** by State and Territory, BRFSS, 2012-2014

Prevalence of Self-Reported Obesity Among **Black Adults** by State and Territory, BRFSS, 2012-2014

Prevalence of Self-Reported Obesity Among **Hispanic Adults** by State and Territory, BRFSS, 2012-2014

CDC.gov; BRFSS 2014.
Arkansans Risk Factors

Diabetes

Obese or Overweight

Percentage of Adults 18+ with Diabetes: Arkansas, 2010

Percentage of Adults 18+ Who are Obese or Overweight (BMI 25.0 - 99.8): Arkansas, 2010
Risk Factors Women (Cont.)

• **Women with DM:**
  - Have > 6x ↑ risk of dying from CVD compared to women without DM
  - Have ↑ mortality compared to men

• **Dyslipidemia:**
  - Less likely to be prescribed lipid lowering medication compared to men
  - Less likely to achieve cholesterol goals compared to men

Arkansans Risk Factors

High Blood Pressure

High Blood Cholesterol
Women Aging and HTN

- SBP is the most important modifiable risk factor contributing to excess CHD risk with aging
- In 2000 26% of adult women were hypertensive worldwide and is predicted to ↑ to 29% in 2025

Women ≥ 20 with HTN 2005-08:
- 41% aged 45-64
- 68% aged 65-74
- 80% aged 75 or older

Men ≥ 20 with HTN 2005-08:
- 40% aged 45-64
- 64% aged 65-74
- 67% aged 75 or older

More women than men have undiagnosed HTN

Even when diagnosed women are less likely to be controlled with medications as compared to men
Tobacco Use in Women

- Leading cause of preventable death in the U.S.
- Estimated 17% women smoke cigarettes
- Smoking ↑ CHD risk > 25% compared to males
- CHD events are significantly higher in women smokers > 60 compared to women who don’t smoke
- Smoking cessation at any age has immediate benefits

Centers for Disease Control and Prevention. Adult smoking in the us. 2011.
Novel Risk Factors High Sensitivity (hs) C-Reactive Protein

- Independently associated with CHD progression in women only
  - Stronger relation between hsCRP & developing metabolic syndrome in women
  - Sex based differences in mechanisms of metabolic syndrome

- hsCRP & progression of early carotid atherosclerosis also show sex differences with women more

Association of Sleep Duration with CHD Mortality: Risk Factor?

- Substantial gender differences with women more susceptible to adverse cardiac effects of short sleep
  - Women with <5 hr sleep 2.3 X more likely to have fatal event than those >7 hr
  - No elevated risk in men
  - Reduced sleep in women associated with incident hypertension but not in men

Exposure to Particulate Matter – Risk Factor?

• CVD risks associated with exposure to particulate matter in air pollution
  – Automobile exhaust

• Living close to heavily trafficked freeways has been linked to increases in coronary artery calcification, a potent risk factor for MI

• Particulates set in place a series of responses triggering a systemic inflammatory response and is dose dependent

AHA, (2007); Brook et al., 2010; Nawrot, T. et al., 2011.
After adjusting for demographic variables and common risk factors, women with OA had an approximately 1.8 times higher risk of incident heart disease. Women with arthritis and activity limitation had more than a 2.5 times higher risk.

Men with OA were not found to have a significantly increased risk of developing heart disease.

This study supports a likely relationship between OA and the development of heart disease in women.
Polycystic Ovarian Syndrome (POS)

• Women with polycystic ovarian syndrome should be:
  – closely monitored for CV symptoms
  – assessed for worsening CV risk factor profile

• Longitudinal medical record review of women with and without POS for 30 years concluded women with POS did not have markedly higher mortality rates from overall CVD, but more women died from CHD than expected

Pierpoint, McKeigue, Isaacs, Wild, & Jacobs, 1998
Complications with First Pregnancy

- Closely watch for possible development of CVD
  - Retrospectively examined medical records of women having a single first birth in Scotland from 1981 to 1985
  - Linked subsequent medical care and death records for the next 15-19 years
  - Women giving birth to a first baby weighing <2500 grams had 11 X greater risk of death due to CHD as compared with women with babies weighing >3500 grams

Smith, Pell & Walsh 2001
Risk Factors in Women

- Women 18-39 years with no risk factors have an 88% lower rate of CVD mortality over 31 years compared to women with 2 or more risk factors

Research Supported by the National Institutes of Health

1 R01 NR05265 & NR004908
5/99-10/05
Purpose & Recruitment

- Describe and compare ethnic differences in prodromal and acute myocardial infarction (AMI) symptoms
- Recruited from 15 sites across USA
- Received 1935 names; Consented 67% (N=1270)

Methods

- Descriptive Retrospective Survey, (4-6 months post-MI)
- Blessed Cognitive Screen
- McSweeney Acute and Prodromal MI Symptom Survey (MAPMISS©)
  - 33 Prodromal and 37 Acute symptoms, RF & co morbidities

McSweeney, O'Sullivan, Cody, & Crane 2003
Sample Demographics
N= 1270

- Whites (67 years old ±13) were significantly older than Blacks (63 ±13) but not Hispanics (64 ±13)
- Whites significantly more educated than minorities
- Over 50% of minorities and 23% Whites reported annual incomes of < $10,000

* Statistical differences at P=.001
# Risk Factors and Co-morbidities

\[(N=1270) \ P<.001\]

<table>
<thead>
<tr>
<th>Risk factors/Co morbidities</th>
<th>Black (n=545) %</th>
<th>Hispanic (n=186) %</th>
<th>White (n=539) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family History, CHD</td>
<td>93</td>
<td>90*</td>
<td>97†</td>
</tr>
<tr>
<td>Second-hand smoke</td>
<td>63*</td>
<td>46†</td>
<td>67*</td>
</tr>
<tr>
<td>Hypertension</td>
<td>86*</td>
<td>73†</td>
<td>72†</td>
</tr>
<tr>
<td>Diabetes</td>
<td>53*</td>
<td>47*</td>
<td>32†</td>
</tr>
<tr>
<td>BMI &gt; 29</td>
<td>60*</td>
<td>38†</td>
<td>40†</td>
</tr>
<tr>
<td>High cholesterol</td>
<td>66*</td>
<td>73†</td>
<td>60*</td>
</tr>
<tr>
<td>Smoker</td>
<td>28*</td>
<td>10†</td>
<td>30*</td>
</tr>
</tbody>
</table>

Superscripts that differ indicate significant post hoc differences at \(P<.003\)}
Prodromal Symptoms
N= 1270

• 95% (n=1239) reported at least 1
• Unusual fatigue most frequent 
  (73%, n=930)
• Significant (p<.01) ethnic differences 
  in frequency of reporting 17 of 33 prodromal symptoms
10 Most Frequent Prodromal Symptoms

Superscripts that differ indicate significant post hoc differences at P<.003
10 Most Frequent Prodromal Symptoms (Cont.)

Superscripts that differ indicate significant post hoc differences at P<.003
Conclusions:
Prodromal Symptoms

• Over 95% of the women reported PS; fatigue #1
• Black women had highest number & intensity of PS, especially general symptoms
• Hispanics reported more pain/discomfort
• Whites least number of all symptoms
10 Most Frequent Acute Symptoms

Superscripts that differ indicate significant post hoc differences at P<.003

Any of 4 locations: generalized chest, high chest, L breast, R chest
10 Most Frequent Acute Symptoms (Cont.)

Superscripts that differ indicate significant post hoc differences at P<.003

Any L arm, hand or shoulder sensation: burning, numbness, tingling, discomfort and/or pain
Conclusions: Acute Symptoms

- Minorities had more acute symptoms than White women
  - Dyspnea was #1 symptom

- 42% White, 37% Black, 27% Hispanic reported no acute chest discomfort
  - Supported by others

Chen, et al., 2005; Brieger et al., 2004
Research Supported by the National Institutes of Health

R01 NR004908
Predict Study

• **Longitudinal observational study to:**
  
  – Assess MAPMISS reliability by race
  
  – Assess the extent to which the MAPMISS PS score predicts CHD events requiring clinical intervention in women
  
  – Identify the most predictive components of the MAPMISS

Inclusion Criteria

• Black and White women referred for initial cardiac evaluation to clinics in Arkansas and Kentucky

• 21 years of age and older

• Cognitively intact
  – Blessed cognitive screen
Data Collection

- The MAPMISS was administered by telephone at baseline and at 3-month intervals thereafter for 2 years.
- Each interview assessed the previous 3 month period for PS.
- CHD events were confirmed via hospital or ED medical records:
  - Events = CABG, angioplasty, stent, MI.
Participation & Events

• A total of 1114 women participated

• 1097 (98.5%) completed data collection

• 77 (7%) reported a CHD event during the 2 year follow-up
# Cohort Characteristics

N=1097

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>n</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td></td>
<td>146</td>
<td>13</td>
</tr>
<tr>
<td>White</td>
<td></td>
<td>951</td>
<td>87</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age &lt;= 50yrs</td>
<td></td>
<td>427</td>
<td>39</td>
</tr>
<tr>
<td>Age &gt; 50yrs</td>
<td></td>
<td>670</td>
<td>61</td>
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<tr>
<td><strong>Education</strong></td>
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<tr>
<td>High school or less</td>
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<tr>
<td>College/vocational</td>
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<td>571</td>
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<tr>
<td>Post graduate or</td>
<td></td>
<td>132</td>
<td>12</td>
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<tr>
<td>doctorate degree</td>
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<tr>
<td><strong>Income</strong></td>
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<td></td>
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<tr>
<td>Less than $30,000</td>
<td></td>
<td>383</td>
<td>35</td>
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<tr>
<td>$30,000 - $60,000</td>
<td></td>
<td>440</td>
<td>40</td>
</tr>
<tr>
<td>Greater than $60,000</td>
<td></td>
<td>222</td>
<td>20</td>
</tr>
<tr>
<td>Refused/Unknown</td>
<td></td>
<td>52</td>
<td>5</td>
</tr>
</tbody>
</table>
## Strongest Predictors

Strongest predictors based on presence or absence of symptoms:

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Hazard Ratio (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tired</td>
<td>2.59 (1.48, 4.52)</td>
<td>0.0008</td>
</tr>
<tr>
<td>Jaw/teeth</td>
<td>2.50 (1.39, 4.50)</td>
<td>0.0023</td>
</tr>
<tr>
<td>Arms intensity</td>
<td>2.42 (1.43, 4.08)</td>
<td>0.0010</td>
</tr>
<tr>
<td>Shortness of breath</td>
<td>1.98 (1.18, 3.33)</td>
<td>0.0096</td>
</tr>
</tbody>
</table>
Predictive Ability – Strongest Predictors

- Women reporting ≥1 of the 4 strongest predictor symptoms were 4.4 times as likely to have an adverse cardiac event as women reporting none of these 4 symptoms (95%CI = 2.64 - 7.47).
Prevention

• Earlier and more aggressive measures needed to identify, control, and eliminate risk factors

• Further gender-specific research to develop evidence-based practice

• Need to change our focus from treatment to prevention and early treatment to delay progression

• Evidence based tailored, gender-specific education for women and HC professionals

How can the Burden of CVD be Reduced?

• Individuals can reduce their risk of CVDs by modifying behavior:
  – engaging in regular physical activity
  – avoiding tobacco use and second-hand smoke
  – choosing a diet rich in fruit and vegetables, avoiding foods high in fat, sugar and salt
  – maintaining a healthy body weight
  – control pollution

WHO; CVD Fact sheet, January 2011
**Lifestyle Interventions**

- **Cigarette smoking**
  - Providers **must** advise not to smoke and to avoid environmental tobacco smoke

- **Physical activity**
  - Accumulate at least 150 min/wk of moderate exercise, 75 min/wk of vigorous exercise, or equivalent performed in 10 minute bouts/week
  - Muscle-strengthening activities

- **Cardiac rehabilitation**
  - Recommended to women with ACS, after revascularization, or angina

*Mosca et al., Guidelines for the Prevention of CVD in Women—2011 Update*
Projected Results of Prevention

- 78% of all adults alive in U.S. today (20-80 years old) are candidates for modification of at least 1 CHD risk factor

- If implemented, estimate MI’s could be reduced by 63%
  - Smoking cessation most cost saving intervention

Summary

• CVDs are primarily preventable disease
• Causes 1/3 of all female deaths worldwide
• Must change focus to one of prevention to significantly improve women’s health
Questions