Heart Disease Across the Lifecourse of Women

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Disclosures

• No relevant support
Burden of Heart Disease among Women

Lifecourse of Heart Disease among Women

Unique factors associated with management in women
Outline

Burden of Heart Disease among Women

Lifecourse of Heart Disease among Women

Unique factors associated with management in women
Who is a “woman”?

- Multidimensional
- Biological female (sex)
  - Female anatomy
- Gender identity
  - Does not need to align with sex
  - Personal identity
  - Cultural and social roles

- I will use the terminology used by the original authors in work I present

- If I am opining or summarizing, I will use the most inclusive definition of “woman” applicable to the example
Reproductive Lifecycle

Normal Productive Life

Premenopause

Perimenopause

Last regular period

Last period

Permanent cessation of period

0 35-45 ~51 AGE

ESTROGEN LEVEL

Northwestern Medicine
Feinberg School of Medicine
Social Lifecycle of women

- **Infancy and childhood:** Hormonal and physical changes, solidification of social roles, pregnancy and parenting.
- **Puberty:** Gender socialization and gender roles.
- **Adolescence and young adulthood:** Significant life events related to family dynamics and caregiving.
- **Adulthood:** End of reproduction, onset of menopause, greater caregiving roles.
- **Middle Age:** Social shifts, greater health challenges.
- **Later Life:**

The diagram illustrates the stages of life with corresponding events and challenges.
Intersection of the Reproductive/Biological and Social Lifecycle

How do reproductive and social factors combine across the lifecycle to inform risks of cardiovascular disease among women?

Macrosocial cultural and social attitudes inform the behaviors of women and the ways in which the world treats women to influence cardiovascular disease risk.
Facts about heart disease in women

• Cardiovascular disease (CVD) kills more women than all forms of cancer combined yet only 44% of women recognize this risk
• Nearly half (45%) of females aged >=20 years old are living with some form of cardiovascular disease
• Less than 50% of women entering pregnancy have good cardiovascular health
• Menopause itself does not cause heart disease but women’s CVD risk factors can accelerate due to hormonal changes and social shifts
• A disproportionate number of deaths from stroke are among women (58%)
Leading Causes of Death in Females and Males in the US

Age-adjusted death rates by cause of death per 100,000 people, by gender, 2021

- **Heart disease**: Age-adjusted female death rate 135.6, Age-adjusted male death rate 219.5
- **Cancer**: Age-adjusted female death rate 127.7, Age-adjusted male death rate 172.0
- **COVID-19**: Age-adjusted female death rate 81.7, Age-adjusted male death rate 131.3
- **Unintentional accidents**: Age-adjusted female death rate 40.4, Age-adjusted male death rate 89.8
- **Stroke**: Age-adjusted female death rate 40.2, Age-adjusted male death rate 41.5
- **Alzheimer’s disease**: Age-adjusted female death rate 35.4, Age-adjusted male death rate 24.0
- **Chronic lower respiratory diseases**: Age-adjusted female death rate 32.5, Age-adjusted male death rate 37.6
- **Diabetes**: Age-adjusted female death rate 20.0, Age-adjusted male death rate 31.8
- **Kidney disease**: Age-adjusted female death rate 11.4, Age-adjusted male death rate 16.4
- **Chronic liver disease and cirrhosis**: Age-adjusted female death rate 10.3, Age-adjusted male death rate 18.9
- **Hypertension**: Age-adjusted female death rate 9.9, Age-adjusted male death rate 11.4
- **Septicemia**: Age-adjusted female death rate 9.3, Age-adjusted male death rate 11.4
- **Influenza and pneumonia**: Age-adjusted female death rate 8.7, Age-adjusted male death rate 13.0
- **Parkinsons**: Age-adjusted female death rate 6.6, Age-adjusted male death rate 14.5
- **Suicide**: Age-adjusted female death rate 5.7, Age-adjusted male death rate 22.8
- **Nutritional deficiencies**: Age-adjusted female death rate 4.7, Age-adjusted male death rate 4.1
- **Assault (homicide)**: Age-adjusted female death rate 3.1, Age-adjusted male death rate 13.2

Kidney disease here refers to nephritis, nephrotic syndrome and nephrosis. Stroke refers to all cerebrovascular diseases.

Source: Centers for Disease Control and Prevention
Disparities in HF-related CVD Mortality in the US

Black women are experiencing significantly more heart failure mortality than white women at younger ages.

Rates in black women exceed those of white men.
Premature cardiometabolic disease deaths contribute to significant disparities in YPLL

<table>
<thead>
<tr>
<th>A. Heart Disease</th>
<th>Premature Mortality, %</th>
<th>Premature YPLL per 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black men</td>
<td>43%</td>
<td>992</td>
</tr>
<tr>
<td>White men</td>
<td>23%</td>
<td>517</td>
</tr>
<tr>
<td>Black women</td>
<td>28%</td>
<td>515</td>
</tr>
<tr>
<td>White women</td>
<td>11%</td>
<td>224</td>
</tr>
<tr>
<td>Total</td>
<td>26%</td>
<td>408</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B. Cerebrovascular Disease</th>
<th>Premature Mortality, %</th>
<th>Premature YPLL per 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black men</td>
<td>38%</td>
<td>160</td>
</tr>
<tr>
<td>White men</td>
<td>16%</td>
<td>49</td>
</tr>
<tr>
<td>Black women</td>
<td>22%</td>
<td>116</td>
</tr>
<tr>
<td>White women</td>
<td>8%</td>
<td>49</td>
</tr>
<tr>
<td>Total</td>
<td>14%</td>
<td>70</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C. Diabetes</th>
<th>Premature Mortality, %</th>
<th>Premature YPLL per 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black men</td>
<td>44%</td>
<td>192</td>
</tr>
<tr>
<td>White men</td>
<td>31%</td>
<td>88</td>
</tr>
<tr>
<td>Black women</td>
<td>33%</td>
<td>128</td>
</tr>
<tr>
<td>White women</td>
<td>23%</td>
<td>52</td>
</tr>
<tr>
<td>Total</td>
<td>29%</td>
<td>81</td>
</tr>
</tbody>
</table>

Shaded bars reflect life expectancy

More years of life lost for Black and White women given longer life expectancy

Shah NS...Khan SS. AHA EPI SS 2020
Summary: Burden among women

• Cardiovascular diseases are a leading cause of death among women
  – 6 of the top 10 leading causes of death are cardiovascular, metabolic or cerebrovascular
• Early onset cardiovascular and metabolic diseases are significant contributors to years of potential life lost
• Racial disparities in cardiovascular disease are even more pronounced at younger ages among women
Outline

Burden of Heart Disease among Women

Lifecourse of Heart Disease among Women

Unique factors associated with management in women
Outline

Lifecourse of Heart Disease among Women

- Infancy and childhood
- Adolescence
- Young adulthood
- Middle adulthood
- Older adulthood
Prevalence of Adverse Pregnancy Outcomes in the US

• Collectively 10-20% of pregnancies in the US are complicated by an adverse pregnancy outcome
  – Hypertensive disorders of pregnancy affect 912 out of 10,000 deliveries
  – Pre-term birth occurred in 9.9%
  – Low birthweight in 8.2% of births
  – Significant disparities in APOs with higher rates in blacks, Latinas and low SES

• Women with less favorable cardiovascular risk characteristics going into pregnancy are at higher risk for APOs
Pre-pregnancy, Pregnancy and Post Pregnancy

Hauspurg et al. Clinical Cardiology 2018; epub 2/15/19, DOI: 10.1002/clc.22887
Premenopausal period: Infancy and childhood

Intergenerational risk transmission of cardiovascular risk

Offspring of women who experienced APOs have a higher long-term risk of cardiovascular disease.
Congenital heart diseases

• Affects 1% of births (n=40,000) per year
• Growing proportion of CHD survivors are at risk for developing ASCVD with aging
• Women with congenital heart disease who become pregnant are at higher risk for APOs and deterioration of their cardiovascular function

Cardiometabolic risk factors

• Overweight and “at risk for obesity”
• High blood pressure
• Glucose disorders
• Dyslipidemia

Adverse Lifestyle Behaviors

• Physical inactivity
• Poor diet
• Sleep disturbances
• Cardiometabolic profiles are WORSE in boys than girls
Adolescence

- Hormonal changes during puberty
  - Social and physical effects
- Cognitive development and socialization
  experience rapid growth
  - Gender “Role” behavior intensifies during adolescence
    and a diverge emerges between girls and boys
  - Behavior changes follow changing identities
  - Interpersonal relationships outside of the family
    influence behavioral shifts
Physical activity declines among girls

- 4 distinct patterns of physical activity were identified over time
  - 2 groups maintained activity over time (green and red)
  - 2 groups decreased activity
- Fewer Black girls maintained activity
- Comparable data are not available for other race/ethnic groups
Percent of US students in grades 9-12 who were active for 60 minutes/day for 7 days

Virani et al. Heart Disease and Stroke Statistics—Update 2020
Longitudinal Studies Demonstrate that Health Behaviors “Track” from Youth to Adulthood

- Few longitudinal studies measure youth as they transition into adulthood
- Consistent patterns when these data are available
  - Inactive youth and children become inactive adults
  - Diet patterns (good or bad) show relative stability
  - Youth who start out obese become more overweight or obese with time
- Pregnancy is an “inflection points” in young adulthood where behavior patterns and health risk factors worsen
What happens after pregnancy (even in a “healthy” pregnancy)?

At 1 year postpartum:
- 24% of women retain 10 lbs
- 47% retain >10 lbs
- 75% are heavier than pre-pregnancy

Figure B-1: Graphical Depiction of Weight During Pregnancy and Postpartum

Endres et al. Obstetrics and Gynecology. 2015; 125: 144
Disparities in Adverse Pregnancy Outcomes

- Discharged 2 days after a c-section
- Developed a hematoma that had to be drained and had home nursing support to change the wound dressing
- Nurse noted blood pressure of 158/100 without other symptoms
- Subsequent weight gain, swelling and mild headaches
- Some time afterward, she collapsed and died

Shalon Irving, PhD
CDC Epidemiologist studying disparities

Black women are 243% more likely to die following childbirth than white women
Long-Term CVD Risk after Hypertensive Disorders of Pregnancy associated with a diversity of Cardiovascular Diseases

<table>
<thead>
<tr>
<th>Cardiovascular Condition</th>
<th>HR</th>
<th>95% CI</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronary artery disease</td>
<td>1.8</td>
<td>1.3-2.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Heart failure</td>
<td>1.7</td>
<td>1.04-2.6</td>
<td>0.03</td>
</tr>
<tr>
<td>Aortic stenosis</td>
<td>2.9</td>
<td>1.5-5.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mitral regurgitation</td>
<td>5.0</td>
<td>1.5-17.1</td>
<td>0.01</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>1.1</td>
<td>0.8-1.6</td>
<td>0.56</td>
</tr>
<tr>
<td>Ischemic stroke</td>
<td>0.8</td>
<td>0.4-1.8</td>
<td>0.57</td>
</tr>
<tr>
<td>Peripheral artery disease</td>
<td>1.0</td>
<td>0.4-2.3</td>
<td>0.94</td>
</tr>
<tr>
<td>Venous thromboembolism</td>
<td>1.0</td>
<td>0.6-1.7</td>
<td>0.97</td>
</tr>
</tbody>
</table>

Sex Differences in CVD Risk During Middle- and Later-adulthood

- Higher rates in the younger two age groups but comparable prevalence in older adulthood
- Loss of protection from progesterone with the onset of perimenopause
Social Role Stress, Reward and Cardiovascular Health in Midlife Women
Findings from the Study of Women Across the Nation (SWAN)

Table 3. Relationship Between Role-Related Stress and Reward and the AHAS7 Components at SWAN From Longitudinal SWAN Data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Stress β (95% CI)</th>
<th>Reward β (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of AHAS7 ideal components</td>
<td>-0.05 (-0.08 to -0.02)</td>
<td>0.04 (0.01 to 0.08)</td>
</tr>
<tr>
<td>AHAS7 component*</td>
<td>Stress OR (95% CI)</td>
<td>Reward OR (95% CI)</td>
</tr>
<tr>
<td>Glucose</td>
<td>0.89 (0.81 to 0.97)</td>
<td>1.06 (0.96 to 1.18)</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>0.95 (0.88 to 1.03)</td>
<td>1.00 (0.92 to 1.09)</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>0.94 (0.87 to 1.00)</td>
<td>0.94 (0.87 to 1.02)</td>
</tr>
<tr>
<td>BMI</td>
<td>0.89 (0.81 to 0.99)</td>
<td>1.10 (0.98 to 1.23)</td>
</tr>
<tr>
<td>Physical activity</td>
<td>0.83 (0.75 to 0.91)</td>
<td>1.38 (1.24 to 1.53)</td>
</tr>
<tr>
<td>Any healthy diet</td>
<td>0.92 (0.85 to 0.99)</td>
<td>1.05 (0.97 to 1.15)</td>
</tr>
<tr>
<td>Smoking</td>
<td>0.90 (0.81 to 0.99)</td>
<td>1.10 (0.98 to 1.23)</td>
</tr>
</tbody>
</table>

- When both stress and reward are studied simultaneously, the presence of stressors doesn’t overcome the positive benefit of rewards.

- **Women’s social role quality is associated with cardiovascular health at midlife.**
- **Women who report greater stressful roles are less likely to achieve ideal cardiovascular health whereas women who report more rewards are more likely to report better health.**

*J Am Heart Assoc. 2020;9:e017489. DOI: 10.1161/JAHA.120.017489*
Older adulthood

• Life expectancy is longer in women as compared with men
  – Socially, more women are living alone
  – More women are caring for male partners with chronic diseases (introducing stressors)

• More women are survivors of incident cardiovascular disease
  – Enhanced risks of CVD mortality

• Higher rates of overweight and obesity among older women than older men
  – May convey higher risks for diabetes and CVD
Incidence of heart attack or fatal CHD by age, sex, and race (ARIC Surveillance: 2005–2013).

Source: National Heart, Lung, and Blood Institute

**Incidence and fatal heart attack rates in black women mirror those of white men**
Psychosocial stressors among minority women and CV Risk Disparities

• Intersection of “sex” and “race” and the resulting “isms” can magnify the stress borne by minority women
  – Mistreatment/inadequate treatment by providers
  – Lack of access to health promoting resources

• Multiple pathways by which stress enhances cardiovascular risk
  – Adverse behavioral coping
  – Physiological stress response (e.g., sympathetic stress response, inflammation)
What is the Superwoman Schema?

**Definition:** A set of characteristics found in a woman who performs or attempts to perform all the duties typically associated with several different full-time roles, such as wage earner, mother, homemaker, and wife.

What happens when the responsibilities become too much?
Summary: Cardiovascular Risks Associated with Life Stages

- Cardiovascular risk in women is the culmination of a lifecourse of exposure
- Childhood behaviors track into adulthood
- Young and middle-adulthood
  - Pre-pregnancy exposures can enhance risk
  - Adverse pregnancy outcomes are associated with a diversity of cardiovascular diseases
- Older adulthood is associated with greater equality in cardiovascular risk between men and women
Outline

- Burden of Heart Disease among Women
- Lifecourse of Heart Disease among Women
- Unique factors associated with management in women
Are different preventive strategies and treatments warranted?

- If you think different strategies for management are warranted, why?
- What type of additional training is warranted in medical school to support the need for different treatments?
  - Which disciplines outside of medicine contribute to this education?
Health Services
Women are diagnosed with multiple forms of CVD later than men

Findings from the Medicare Panel Expenditure Survey, 2008-2017

**Reasons**

- Some of these cardiovascular diseases develop later
- Risk factors for CVD may be “different” between men and women
- Clinical presentation is different
- Women don’t “look” like they are at risk for CVD

![Bar chart with data on age at diagnosis for different conditions and statistical significance levels.](chart.png)
Women don’t look “at risk” and are less likely to receive bystander CPR

- In her 30s and collapsed from sudden cardiac arrest in her kitchen with her 4 kids present
- Her 15 year old learned CPR and performed it at work
- Women are less likely than men to receive bystander CPR
- Surveys cite concerns over “modesty” and touching women’s chests
Frieden’s Health Impact Pyramid

- Base of the pyramid are interventions that have the broadest impact on populations
- Top of the pyramid are those that require the greatest individual effort

Summary

• Despite clear and consistent data that heart disease is a significant cause of morbidity and mortality among women, women are less often presumed to have CVD
• Medical training should emphasize that women can have a different profile of symptoms
• Training and education should support intervention when women have cardiovascular events
Thank you

- Acknowledgements to the American Heart Association
- Scientific collaborators both inside and outside of Northwestern University