
Annie Noone
noonea@mail.nih.gov

Missy Jamison, Lynn Ries, Brenda Edwards

NAACCR 2012
Portland, OR
Outline

- Motivation
- Objective
- Methods
  - Estimation of hysterectomy prevalence
  - Correction
- Results
  - Hysterectomy estimates by race
  - Impact on rates and trends
- Discussion
Motivation

- Cancer incidence rates are typically calculated as:
  - Number of new cases / population (at-risk of disease)
- Underestimate incidence when the population contains cases that are not at-risk of disease

- Women who have had hysterectomy are no longer at risk of endometrial cancer
- Many women in the US undergo hysterectomy
  - Second most frequently preformed surgery in women
Motivation: Impact on Estimates

- **Rates**
  - Underestimation since denominator is too large

- **Trends**
  
  Hysterectomy prevalence is constant over time, so population is reduced by the same amount every year. Trend estimates are the same.

  Hysterectomy prevalence is increasing over time, so underestimation of rates is worse as time goes on. Trends are parallel and estimates are the same.
Previous Work: Increase in Incidence Rate by Race

<table>
<thead>
<tr>
<th>Paper</th>
<th>Data</th>
<th>White</th>
<th>Black</th>
<th>API</th>
<th>AI/AN</th>
<th>Hispanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merrill RM et al.</td>
<td>Utah</td>
<td>82%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sherman ME et al.</td>
<td>SEER-9</td>
<td>65%</td>
<td>95%</td>
<td>-</td>
<td>-</td>
<td>58%</td>
</tr>
<tr>
<td>Merrill RM</td>
<td>SEER-13</td>
<td>73%</td>
<td>93%</td>
<td>41%</td>
<td>86%</td>
<td>-</td>
</tr>
<tr>
<td>Wong CA et al.</td>
<td>NPCR &amp; SEER</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>67%</td>
<td>-</td>
</tr>
<tr>
<td>(2011)</td>
<td>1999-2004</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Objective

• Estimate incidence rates and trends for endometrial cancer corrected for hysterectomy prevalence by race/ethnicity and subtype
  – Correction will be done by removing women who have had hysterectomy (prevalent proportion) from the population-at-risk

• Epidemiology of endometrial cancer with focus on subtypes
Methods: Incidence Data

- SEER-13
  - Connecticut, Hawaii, Iowa, New Mexico, Utah, Detroit, Atlanta, rural Georgia, Seattle-Puget Sound, San Francisco-Oakland, San Jose-Monterey, and Los Angeles
- Diagnosed 1992 to 2008
- White, black, API and Hispanic women
- Age 50+
- Invasive endometrial cancer with microscopic confirmation
Methods: Uncorrected Incidence Rates & Trends

- Incidence Rates
  - Age-adjusted incidence rates standardized to a truncated 2000 US standard population
  - Ages 50-54, 55-59,…, 65-69, 70-99

- Incidence Trends
  - Estimated using Joinpoint regression from 1992 to 2008 using 3-year intervals
  - Trends summarized by the annual percent change (APC)
  - Statistically significant if p-value ≤ 0.05
Methods: Hysterectomy Data

- Behavioral Risk Factor Surveillance System (BRFSS)
  - Cross-sectional telephone survey
  - Adults age 18+ living in households
  - Included data from states that contained a SEER registry
    - California, Connecticut, Georgia, Hawaii, Iowa, Michigan, New Mexico, Utah, Washington
  - Hysterectomy status was assessed every year until 2000 then every other year for all included states
    - “Have you had a hysterectomy? A hysterectomy is an operation to remove the uterus (womb).”
Methods: Estimated Hysterectomy Prevalence

- Prevalence was the proportion of women who reported ever having a hysterectomy

- All available years of BRFSS data were used (e.g. 1992-94 estimate uses 1992, 1993, 1994 data 2001-03 estimate uses 2002 data)

- Estimated by race/ethnicity, 5-year age group, 3-year time interval
  - Collapsed into 3-year intervals to obtain large enough unweighted sample sizes
  - Could not estimate 3-year for API and Hispanic women since unweighted sample sizes still too small
Methods: Estimated Hysterectomy Prevalence

- Within each race and age strata, the estimates changed sharply over time

- Jumps in hysterectomy prevalence may introduce jumps in the corrected incidence rates

- Linear regression was performed to smooth the estimates
  - Models by race and age estimated on log-transformed prevalence estimates
  - Predicted values were back-transformed and used for correction
Methods: Correction

- For each race, age, and year group
  - SEER populations were reduced by the corresponding estimated hysterectomy prevalence
- Age-adjusted corrected incidence rate for a specific year and race:
  \[
  \sum_{i=50-54}^{70-99} \left( \frac{C_i}{L_i} \times \frac{1}{1-P_i} \right) \times 100,000 \times \left( \frac{\text{stdpop}_i}{\sum_{j=50-54}^{70-99} \text{stdpop}_j} \right)
  \]

  where \( C \) is the number of cases, \( L \) is the population, \( P \) is the estimated hysterectomy prevalence, \( 1-P \) is the estimated proportion of women with a uterus

- Standard error was calculated from the equation assuming prevalence was a constant
Methods: Sensitivity Analysis for Trends

- Prevalence estimates from BRFSS for some age and year groups had large standard errors

- Increased and decreased prevalence estimates
  - 10% for white women
  - 25% for black women

- Re-estimated incidence trends
### Results: Hysterectomy Prevalence, 1992-2008

<table>
<thead>
<tr>
<th></th>
<th>White</th>
<th>Black</th>
<th>API</th>
<th>Hispanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992-2008</td>
<td>41%</td>
<td>47%</td>
<td>29%</td>
<td>36%</td>
</tr>
</tbody>
</table>
Results: Hysterectomy Estimates

White Women

Hysterectomy Prevalence (%)

Year


50-54 years 55-59 years 60-64 years 65-69 years 70+
Results: Hysterectomy Estimates

Black Women

Hysterectomy Prevalence (%)

Year


50-54 years 55-59 years 60-64 years 65-69 years 70+

White Women
## Results: Age-Adjusted Incidence Rates, 1992-2008

<table>
<thead>
<tr>
<th></th>
<th>White</th>
<th>Black</th>
<th>API</th>
<th>Hispanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected</td>
<td>136.0</td>
<td>115.5</td>
<td>67.4</td>
<td>82.3</td>
</tr>
<tr>
<td>Uncorrected</td>
<td>78.8</td>
<td>60.9</td>
<td>47.5</td>
<td>51.0</td>
</tr>
<tr>
<td>% Difference</td>
<td>73%</td>
<td>90%</td>
<td>41%</td>
<td>61%</td>
</tr>
</tbody>
</table>

% lower compared to white women

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected</td>
<td>-</td>
<td>15%</td>
<td>50%</td>
<td>39%</td>
</tr>
<tr>
<td>Uncorrected</td>
<td>-</td>
<td>23%</td>
<td>40%</td>
<td>35%</td>
</tr>
</tbody>
</table>
Results: Trends

![Graph showing trends in age-adjusted incidence rate by year of diagnosis for White Women (uncorrected and corrected), and Black Women.](image)

- **White Women**
  - Uncorrected: Increasing trend with a slope of 3.1*
  - Corrected: Increasing trend with a slope of -0.8*

- **Black Women**
  - Uncorrected: Increasing trend with a slope of -0.5*
  - Corrected: Increasing trend with a slope of 1.8*
## Results: Sensitivity Analysis of Prevalence Estimation

<table>
<thead>
<tr>
<th></th>
<th>Corrected</th>
<th>Change</th>
<th>Increase</th>
<th>Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>-0.8* (-1.2, -0.4)</td>
<td>10%</td>
<td>-0.9* (-1.3, -0.5)</td>
<td>-0.8* (-1.2, -0.4)</td>
</tr>
<tr>
<td>Black</td>
<td>3.1* (1.8, 4.3)</td>
<td>25%</td>
<td>4.3* (2.4, 6.1)</td>
<td>2.5* (1.4, 3.6)</td>
</tr>
</tbody>
</table>
Discussion

• Correction for hysterectomy prevalence
  – Largest for black women
  – Changes magnitude of trend and also relative ranking over time for white and black women

• Estimating hysterectomy prevalence
  – Data source
  – Fixed interval vs. over time