Hemoglobinopathy as a Cause of Death: Characteristics of a Michigan Population, 1970-2004

Mary Kleyn, M.Sc.
Epidemiologist,
Newborn Screening Program
Michigan Department of Community Health (MDCH)
Co-authors

- Violanda Grigorescu, MD, MSPH (MDCH)
- William Young, PhD (MDCH)
- Steven Korzeniewski, MA, MSc
Background

- Definition of hemoglobinopathy (HGB)
- Prevalence of HGB overall is unknown \(^1\)
- Survival
  - Varies by sex and subtype \(^2\)
Background

- Childhood mortality due to sickle cell disease has decreased over time\textsuperscript{3-5} potentially due to:
  - Vaccination recommendations (1984, 1988, 2000)\textsuperscript{6-8}
  - Penicillin prophylaxis recommendation (1986)\textsuperscript{9}
  - Universal newborn screening recommendation (1987)\textsuperscript{10}
Background

- Michigan’s NBS Program began screening for HGB in 1987
- 1,447 infants have been confirmed with HGB since screening began
Study Objectives

- Investigate characteristics of individuals with HGB who died in Michigan

- Determine the potential influence of NBS on HGB mortality
Methods

• Study Population
  – All people who died in Michigan from 1970-2004 with HGB listed as a cause of death
  • Restricted to deaths among black individuals (99.1% of deaths)
    – All who died 0-4 years of age
Methods

- **Data Sources**
  - Census population data
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Code</td>
<td>Disorder</td>
<td>Code</td>
</tr>
<tr>
<td>282.5</td>
<td>Hemoglobinopathy</td>
<td>282.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>282.41</td>
</tr>
<tr>
<td></td>
<td></td>
<td>282.42</td>
</tr>
<tr>
<td>282.6</td>
<td>Sickle cell disease</td>
<td>D57.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>282.60</td>
</tr>
<tr>
<td>282.61</td>
<td>Hb SS disease without crisis</td>
<td>D57.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>282.62</td>
</tr>
<tr>
<td>282.63</td>
<td>Sickle cell/Hb C disease without crisis</td>
<td></td>
</tr>
<tr>
<td>282.64</td>
<td>Sickle cell/Hb C disease with crisis</td>
<td></td>
</tr>
<tr>
<td>282.68</td>
<td>Other sickle cell disease without crisis</td>
<td></td>
</tr>
<tr>
<td>282.69</td>
<td>Other sickle cell disease with crisis</td>
<td></td>
</tr>
<tr>
<td>282.7</td>
<td>Other hemoglobinopathies</td>
<td></td>
</tr>
</tbody>
</table>
Methods

- Analytic methods for general characteristics of individuals with HGB who died in Michigan
  - Calculated yearly HGB mortality rate (MR)
  - Generalized linear modeling (GLM) to assess change in HGB MR over time
  - GLM to assess change in age at death over time
Methods

• Analytic methods for exploring differences in mortality before and after NBS for HGB
  – Those who died 0-4 years of age by birth year cohorts
  • Hemoglobinopathy mortality rate and 95% confidence intervals
  • Percent of deaths with infectious disease among causes of deaths
Results

Hemoglobinopathy mortality rates among blacks, Michigan, 1970-2004

![Graph showing hemoglobinopathy mortality rate over time, with a peak around 1972 and a note indicating when NBS for HGB began.]
Results

Average age at death by year among blacks with hemoglobinopathy listed as a cause of death, Michigan, 1970-2004

NBS for HGB began
Results

Hemoglobinopathy mortality rates (3 year moving averages) among black children 0-4 years of age, Michigan, 1971-2003
Results

Hemoglobinopathy mortality rates by birth cohort among black children 0-4 years of age, Michigan
Results

Percent of deaths among those 0-4 years of age involving infectious disease by birth year cohort, Michigan

<table>
<thead>
<tr>
<th>Birth Years</th>
<th>Percent of deaths among those 0-4 years of age with:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>confirmed infectious disease component</td>
<td>confirmed or probable infectious disease component</td>
</tr>
<tr>
<td>1981-1986</td>
<td>37.5</td>
<td>50.0</td>
</tr>
<tr>
<td>1988-1993</td>
<td>21.4</td>
<td>50.0</td>
</tr>
<tr>
<td>1994-1999</td>
<td>37.5</td>
<td>50.0</td>
</tr>
</tbody>
</table>
Strengths and Limitations

- **Strengths**
  - Population-based
  - Data available for many years

- **Limitations**
  - Includes both disease and trait
  - Death certificate coder errors
  - Inability to control for all potential confounders
  - Small numbers
Conclusions

- Overall HGB MR has not significantly changed over time.

- Average age at death for people with HGB has increased after NBS for HGB began.

- HGB MR among those 0-4 years of age by year has significantly decreased over time, but has not decreased using birth year cohorts.

- Percent of deaths with an infectious disease component among those 0-4 years of age has not decreased since NBS for HGB began.
Public Health Implications

- Use epidemiological skills and expertise to develop initiatives and pathways for assessing both horizontal and vertical dimensions of life span of HGB.

- Further studies are in planning phase in Michigan to tease out the effects of NBS on survival for those with HGB.
  - For survival 0-4 years of age
    - Penicillin compliance
    - Vaccination coverage
  - For reproductive age group
    - Access to care
    - Associated morbidities
    - Maternal mortality
    - Survival
References


Thank You!

• Any questions/comments?

• Contact information:
  – KleynM@michigan.gov