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

Michigan Department of Community Health
MDCH
Jennifer M. Granholm, Governor
Janet Olszewski, Director

Background

- Definition of hemoglobinopathy (HGB)
- Prevalence of HGB overall is unknown[1]
- Survival
  - Varies by sex and subtype[2]

Michigan Department of Community Health
MDCH
Jennifer M. Granholm, Governor
Janet Olszewski, Director

Background

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

Michigan Department of Community Health
MDCH
Jennifer M. Granholm, Governor
Janet Olszewski, Director

Background

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

Michigan Department of Community Health
MDCH
Jennifer M. Granholm, Governor
Janet Olszewski, Director

Study Objectives

- Investigate characteristics of individuals with HGB who died in Michigan
- Determine the potential influence of NBS on HGB mortality

Michigan Department of Community Health
MDCH
Jennifer M. Granholm, Governor
Janet Olszewski, Director

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

Michigan Department of Community Health
MDCH
Jennifer M. Granholm, Governor
Janet Olszewski, Director

Methods

- Data Sources
  - Census population data[11]
  - Death certificate data (1970-2004)

ICD-8-CM (1970- 1978)		ICD-9-CM (1979-1998)		ICD-10-CM (1999-2004)	
Code	Disorder	Code	Disorder	Code	Disorder
282.5	Hemoglobinopathy	282.4	Thalassemias	D56.0	Alpha thalassemia
		282.41	Sickle cell thalassemia without crisis	D57	Sickle cell disorders
		282.42	Sickle cell thalassemia with crisis	D57.0	Sickle cell anemia with crisis
		282.6	Sickle cell disease	D57.1	Sickle cell thalassemia without crisis
		282.60	Sickle cell disease, unspecified	D57.2	Double heterozygous sickling disorders
		282.61	Hb SS disease without crisis	D57.3	Sickle cell trait
		282.62	Hb SS disease with crisis	D57.8	Other sickle cell disorders
		282.63	Sickle cell/Hb C disease without crisis		
		282.64	Sickle cell/Hb C disease with crisis		
		282.68	Other sickle cell disease without crisis		
		282.69	Other sickle cell disease with crisis		
		282.7	Other hemoglobinopathies		

Methods

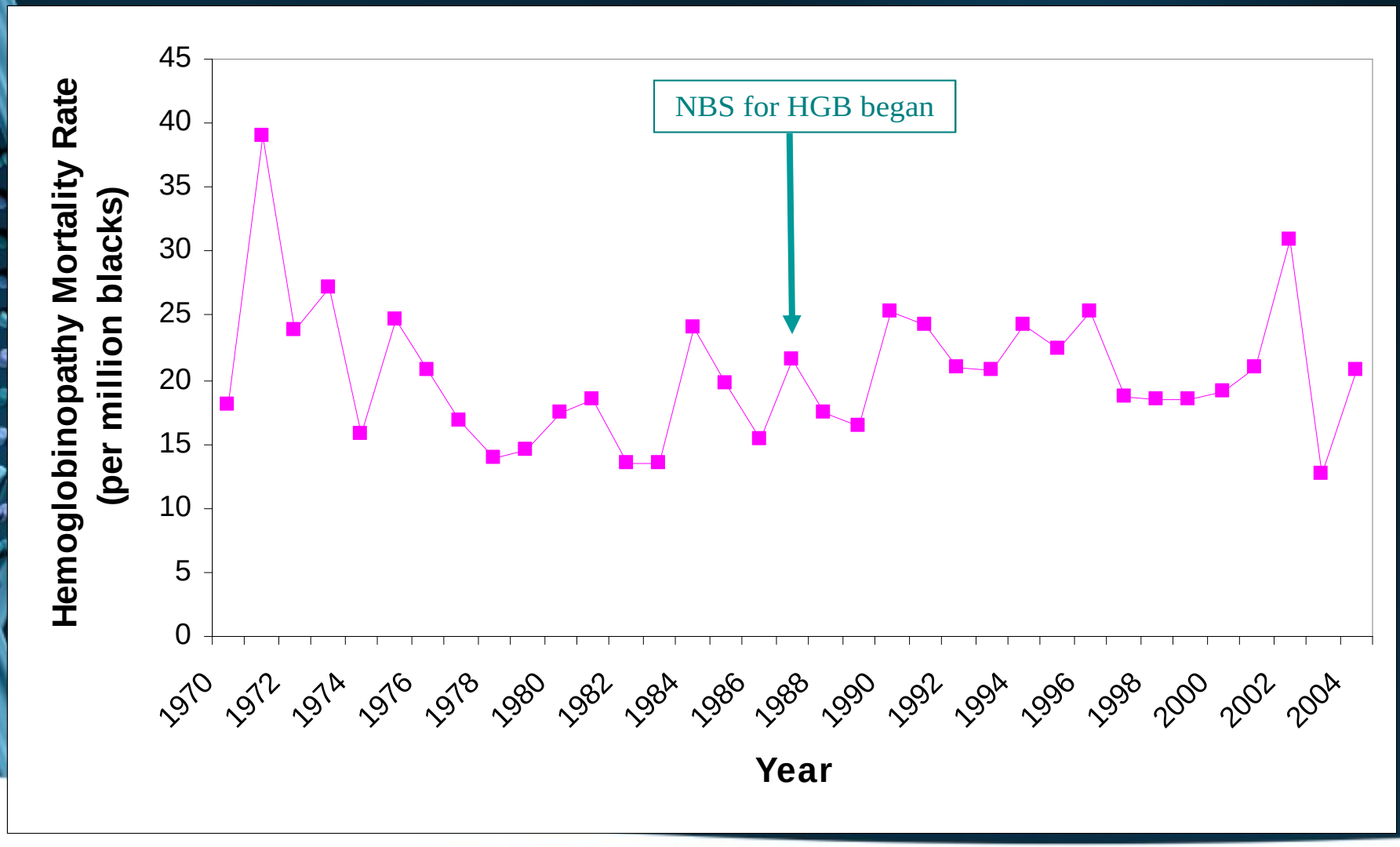
- Analytic methods for general characteristics of individuals with HGB who died in Michigan
  - Calculated yearly HGB mortality rate (MR)
  - Generalized linear modeling (GLM) to assess change in HGB MR over time
  - GLM to assess change in age at death over time

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

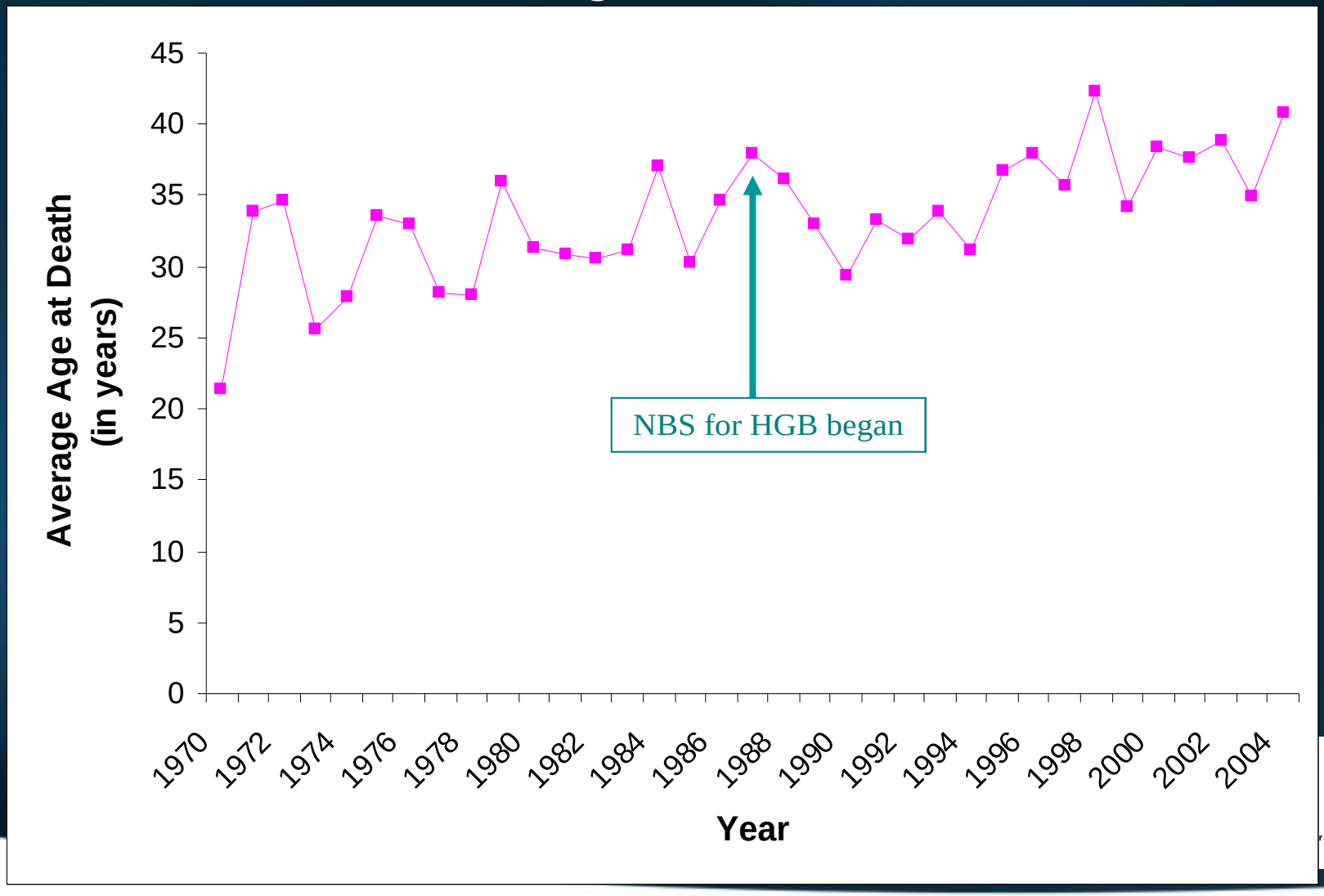
Results

Hemoglobinopathy mortality rates among blacks, Michigan, 1970-2004



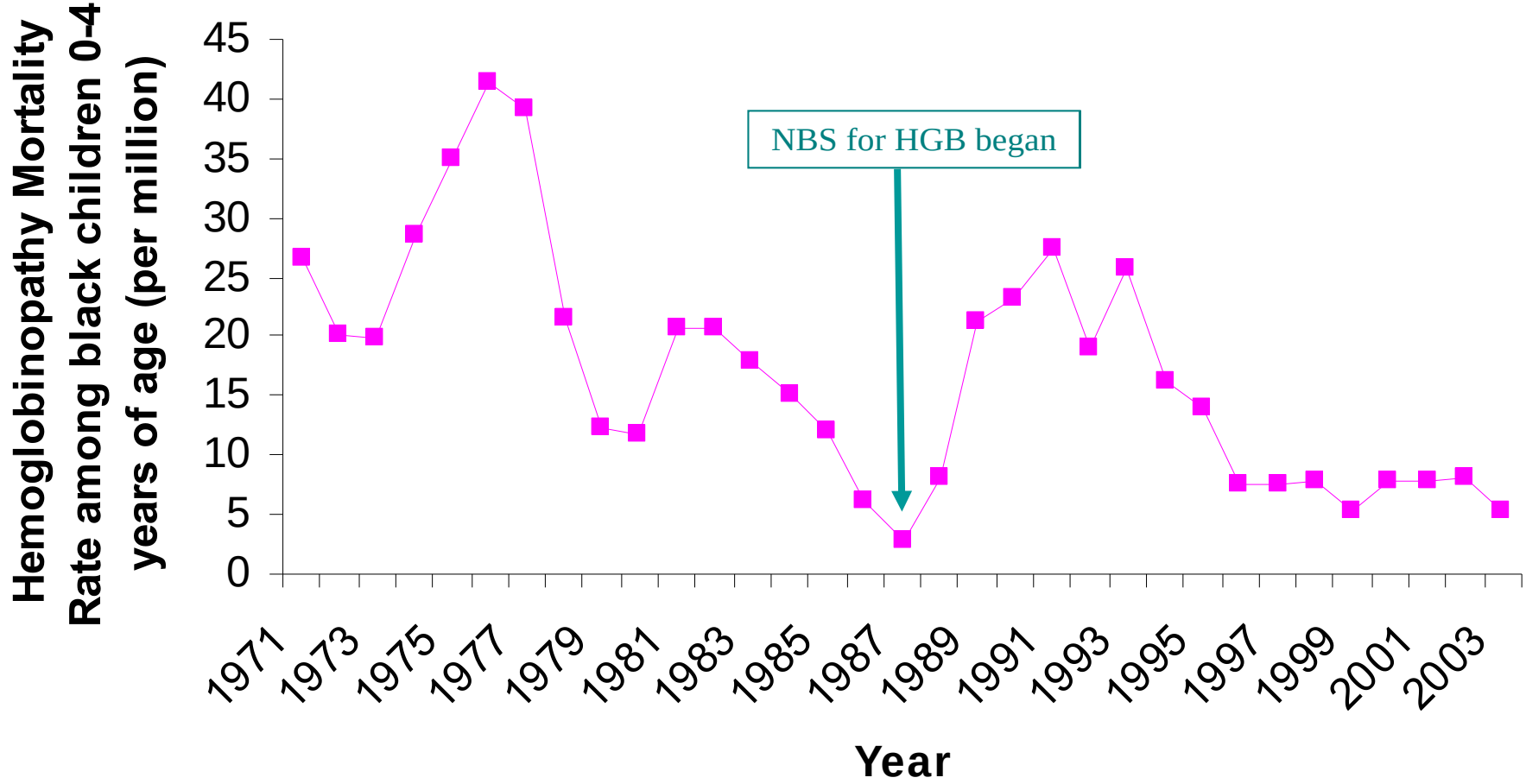
Results

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



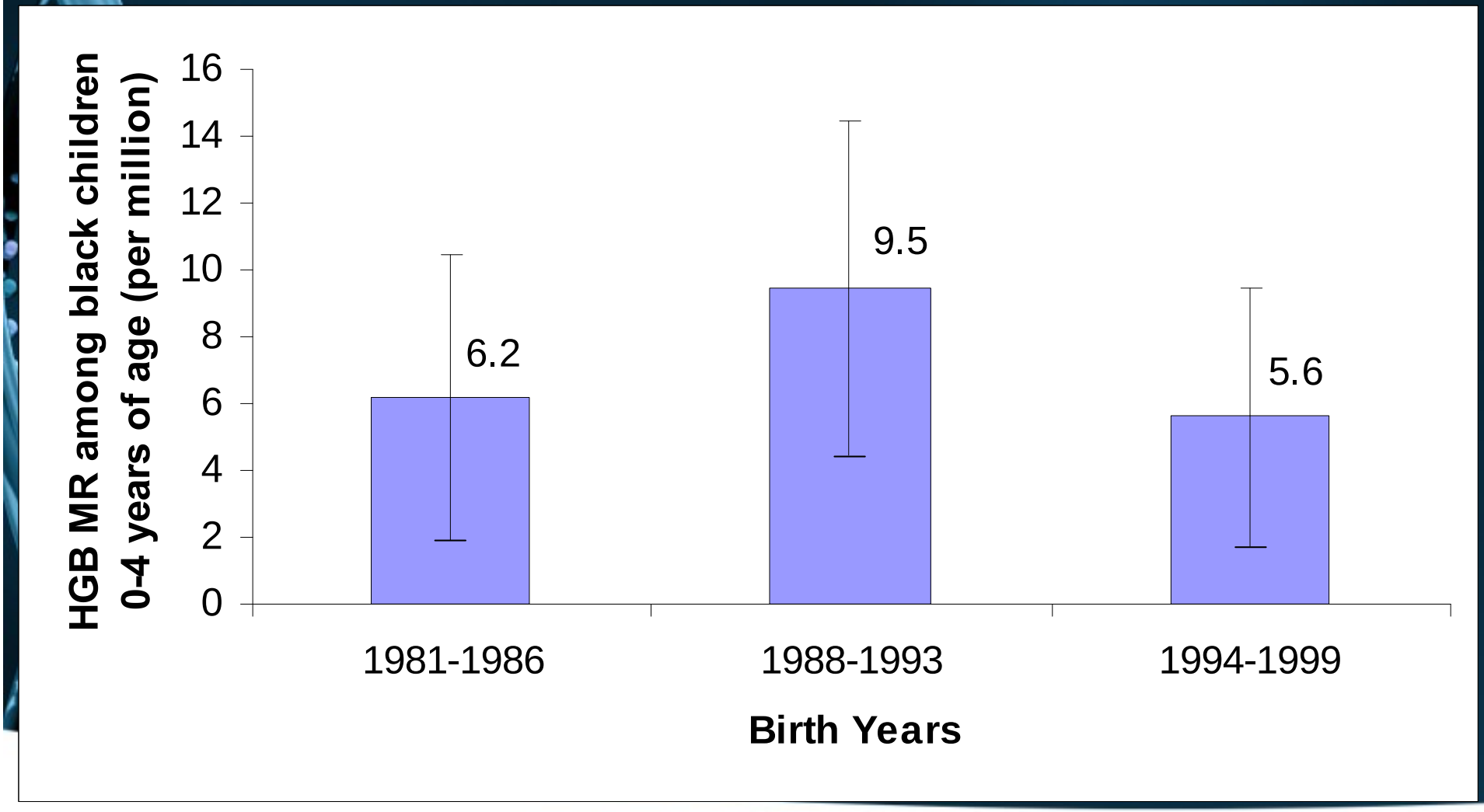
Results

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

Birth Years	Percent of deaths among those 0-4 years of age with:	
	confirmed infectious disease component	**confirmed or probable** infectious disease component
1981-1986	37.5	50.0
1988-1993	21.4	50.0
1994-1999	37.5	50.0

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.

Michigan Department of Community Health
MDCH
Jennifer M. Granholm, Governor
Janet Olszewski, Director

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

1. National Heart, Lung and Blood Institute, National Institute of Health. Sickle cell anemia: Who is at risk? Downloaded on 5/14/2009 from http://www.nhlbi.nih.gov/health/dci/Diseases/Sca/SCA_WhoIsAtRisk.html
2. Platt OS et al. Mortality in sickle cell disease: life expectancy and risk factors for early death. NEJM 1994; 330:1639-1644.
3. Emad Yanni, Scott D. Grosse, Quanhe Yang, Richard S. Olney: Trends in Pediatric Sickle Cell Disease-Related Mortality in the United States, 1983-2002, J Pediatr. 2009 Apr;154(4):541-5. Epub 2008 Nov 22.
4. Davis H, Schoendorf KC, Gergen PJ, et al. National trends in the mortality of children with sickle cell disase, 1968 through 1992. Am J Public Health 1997;87:1317-22.
5. Quinn CT, Rogers ZR, Buchanan GR. Survival of children with sickle cell disease. Blood 2004;103:4023-7.
6. Centers for Disease Control. Update: Pneumococcal polysaccharide vaccine usage-United States. MMWR Morb Mortal Wkly Rep 1984;33:273-6, 281.
7. Schoendorf KC, Adams WG, Kiely JL, Wenger JD. National trends in *Haemophilus influenzae* meningitis mortality and hospitalization among children, 1980 through 1991. Pediatrics 1994;93:663-8.
8. American Academy of Pediatrics. Red Book: Report of the Committee on Infectious Diseases. 26th Edition. Elk Grove Village, IL: American Academy of Pediatrics; 2003.
9. Gaston MH, Verter JI, Woods G, Pegelow C, Kelleher J, Presbury G, et al. Prophylaxis with oral penicillin in children with sickle cell anemia: a randomized trial. N Engl J Med 1986;314:1593-9.
10. Consensus conference: newborn screening for sickle cell disease and other hemoglobinopathies. JAMA 1987;258:1205-9.
11. United States Department of Commerce, U.S. Census Bureau, Population Division; Census Population 1970-2000 for Public Health Research, CDC WONDER On-line Database, March 2003. Centers for Disease Control and Prevention (CDC), National Center for Health Statistics (NCHS), Bridged-Race Population Estimates, United States 1990 - 2003, July 1st resident population by state, county, age, sex, race, and Hispanic origin, on CDC WONDER On-line Database, June 2005. Accessed at http://wonder.cdc.gov/census.html on Feb 8, 2010.

Michigan Department of Community Health
MDCH
Jennifer M. Granholm, Governor
Janet Olszewski, Director

Thank You!

- Any questions/comments?
- Contact information:
  - KleynM@michigan.gov

Michigan Department of Community Health
MDCH
Jennifer M. Granholm, Governor
Janet Olszewski, Director