# Using Big Data To Study Childhood Vision Disorders

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Prevent Blindness
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# University of Michigan
# Center for Eye Care Policy and Innovation

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- University of Michigan School of Natural Resources
  - Rebecca Anthopolos MS; Pam Maxson Ph.D; Marie Lynn Miranda Ph.D; Joshua Tootoo MS; Ellis Valentiner MS

# Optum Clinformatics DataMart Database

- 18 million children (age 0-21)
- Large nationwide managed care network
- Longitudinal follow-up: 2001-2012
- All diagnoses (ICD-9-CM billing codes) and all diagnostic and therapeutic procedures (CPT-4 billing codes)
- Info on SES factors: age, sex, race, net worth
- Info on all outpatient pharmacy records, lab test results
- Info on type of health care provider evaluating patient, place of care
- Info on all charges, standardized prices

# Medicaid MAX Database

- 50 million children (age 0-21)
- Nationwide database of all persons in Medicaid in all 50 US states
- Longitudinal follow-up: 2005-2010
- All diagnoses (ICD-9-CM billing codes) and all diagnostic and therapeutic procedures (CPT-4 billing codes)
- Info on SES factors: age, sex, race
- Info on all outpatient pharmacy records
- Some info on type of health care provider evaluating patient
- Info on costs

# The Impact of Gestational Age and Birth Weight on the Risk of Strabismus among Premature Infants


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- David C. Musch, PhD
- Paul P. Lee, MD, JD
- Joshua D. Stein, MD, MS

# Background

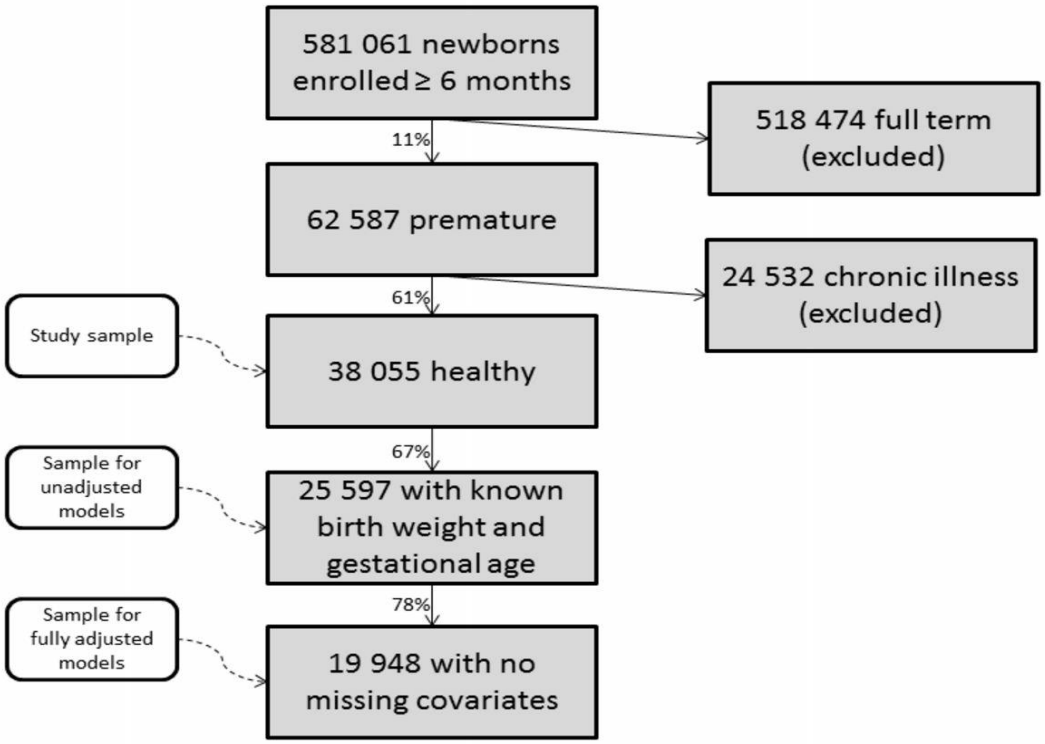
Fig. 1 Large-angle infantile-onset esotropia.

- Strabismus is a common childhood ocular condition estimated to affect 2–4% of children between the ages 6 months and 5 years
- Intervening early to correct strabismus results in improved BCVA, a reduced need for later surgical interventions, and reduced societal cost
- Well-recognized risk factors for strabismus include differences in the glasses prescription between the 2 eyes, genetics, older age of parents, maternal cigarette smoking during pregnancy, low APGAR score, craniofacial and chromosomal abnormalities, in utero toxin exposure, ROP and caesarian delivery
- It is unclear whether low birth weight (BW) and low gestational age (GA) are risk factors for strabismus

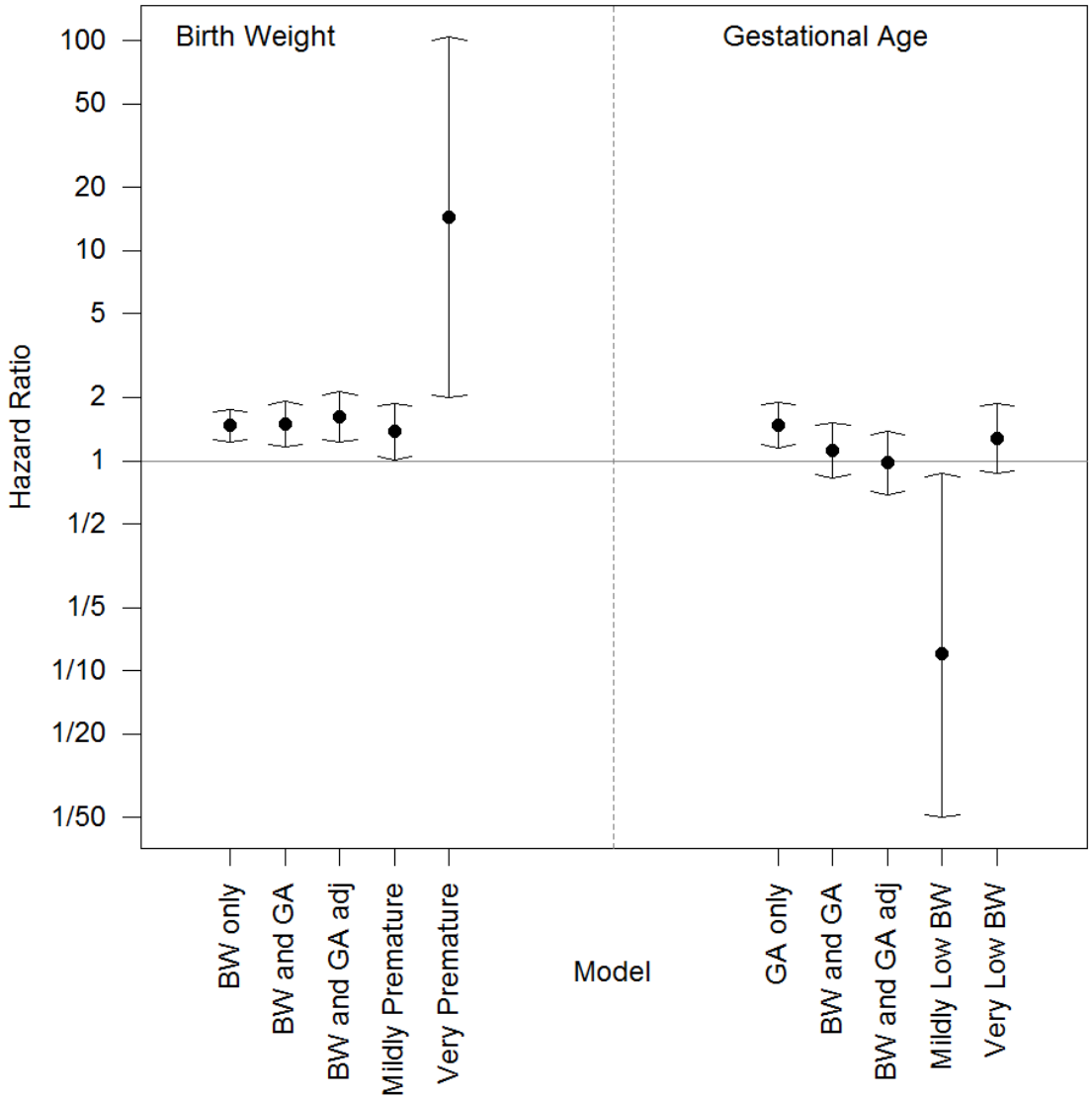
# Methods

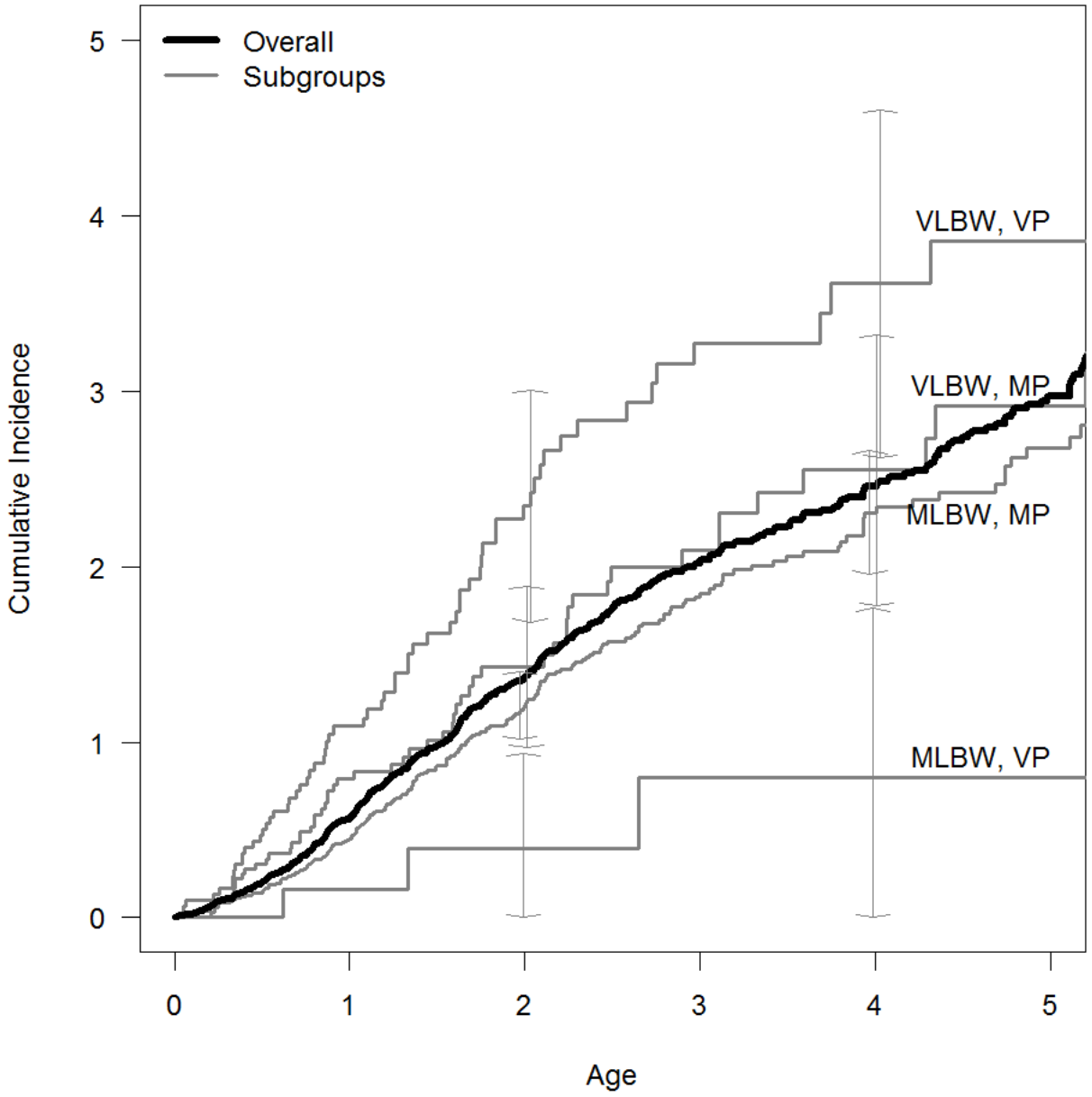
- **Data Source:** Clinformatics Data Mart Database
- **Inclusion / Exclusion Criteria:**
- Included those continuously enrolled in the medical plan ≥ 6 months from birth
- **Definitions of Key Predictors – GA and BW:**
- Infants with GA ≤32 weeks were defined as "very premature"; others with GA >32 weeks were defined as "mildly premature"
- Infants with BW <2000g were defined as "very low BW"; others with BW ≥2000g at birth were considered "mildly low BW"
- **Outcome of interest:**
- Diagnosis of strabismus was captured using ICD-9-CM code 378.xx; we required a confirmatory diagnosis submitted on a separate date to reduce error caused by miscoding

# Sample Selection



# Results

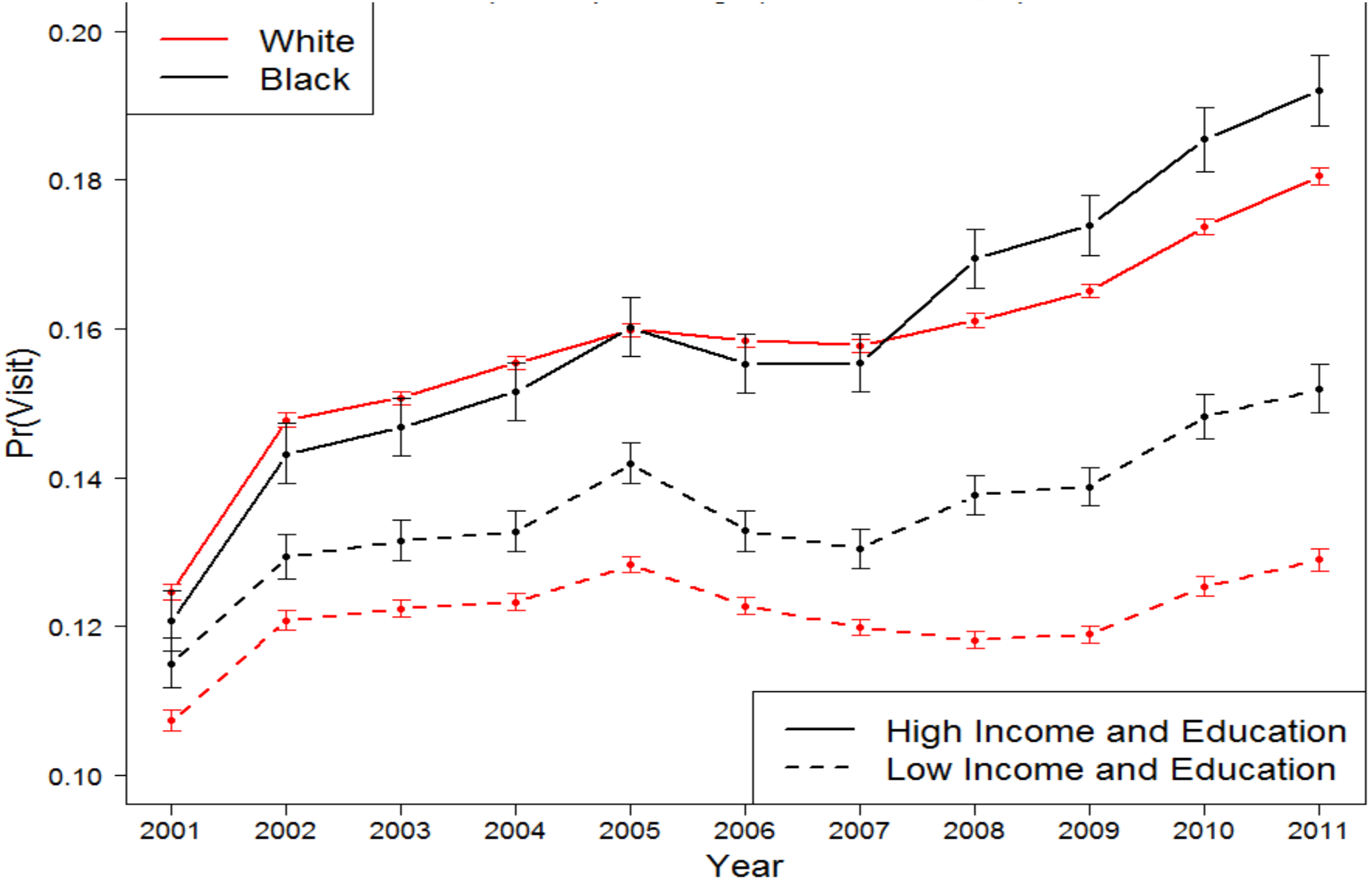

Birth Weight
Gestational Age
Hazard Ratio
100
50
20
10
5
2
1
1/2
1/5
1/10
1/20
1/50
BW only
BW and GA
BW and GA adj
Mildly Premature
Very Premature
Model
GA only
BW and GA
BW and GA adj
Mildly Low BW
Very Low BW


Overall
Subgroups
VLBW, VP
VLBW, MP
MLBW, MP
MLBW, VP
Cumulative Incidence
Age
0
1
2
3
4
5

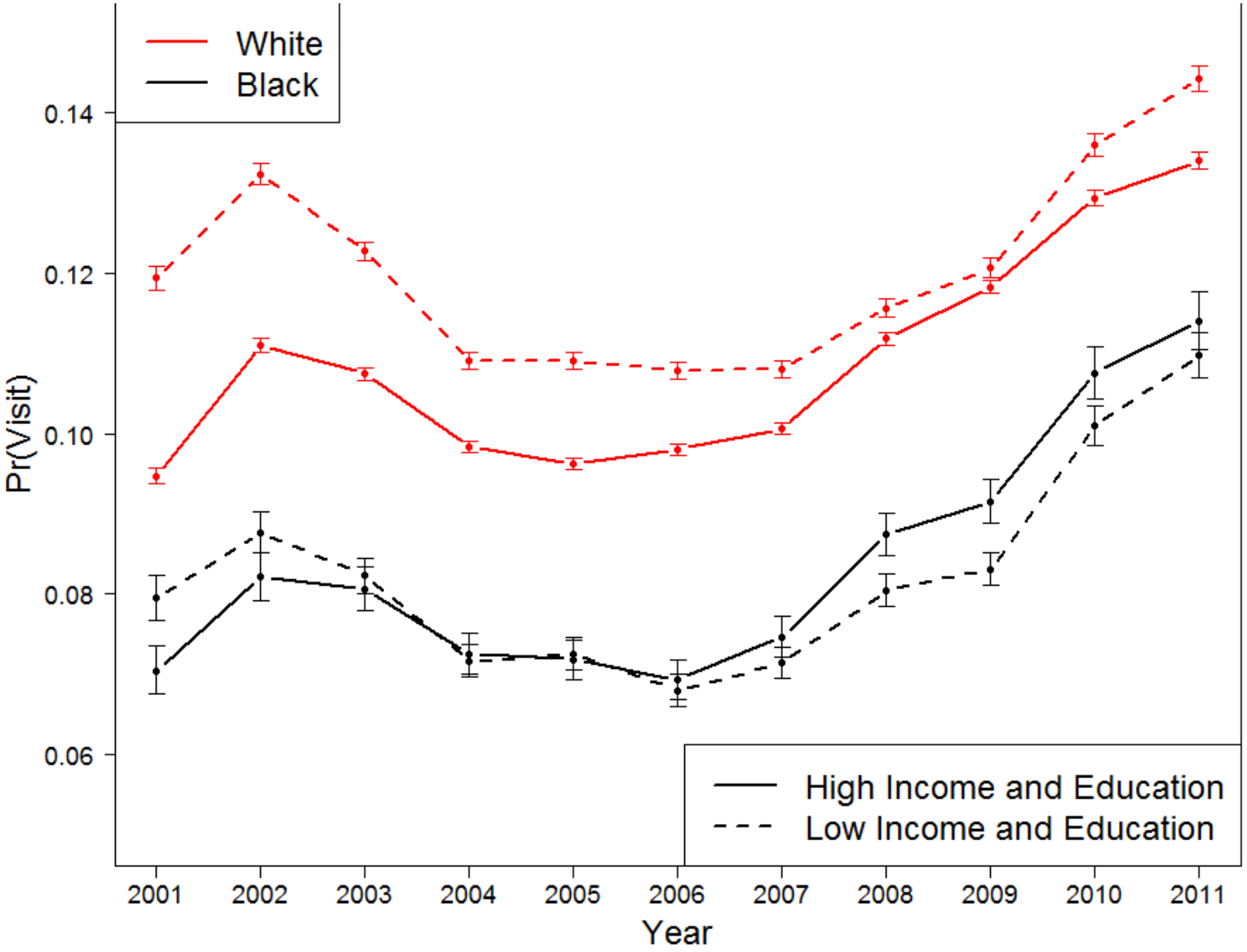
# Key Findings

- For premature babies, BW appears to impact the risk of strabismus much more than GA
- Premature infants who weighed <2000g at birth were found to have a 61% increased hazard of strabismus (relative to ≥2000g), independent of GA and other factors
- After accounting for BW and other variables, premature infants born earlier than 32 weeks had no significantly different risk of strabismus (relative to >32 weeks)
- Currently, neither AAO or AAP guidelines recommend that clinicians monitor premature infants of low BW for strabismus and amblyopia beyond the standard ROP monitoring in the first 10 weeks of life [7,11]
- Based on these study findings, existing guidelines should be reassessed for the inclusion of low BW as a key risk factor for developing strabismus requiring periodic evaluation

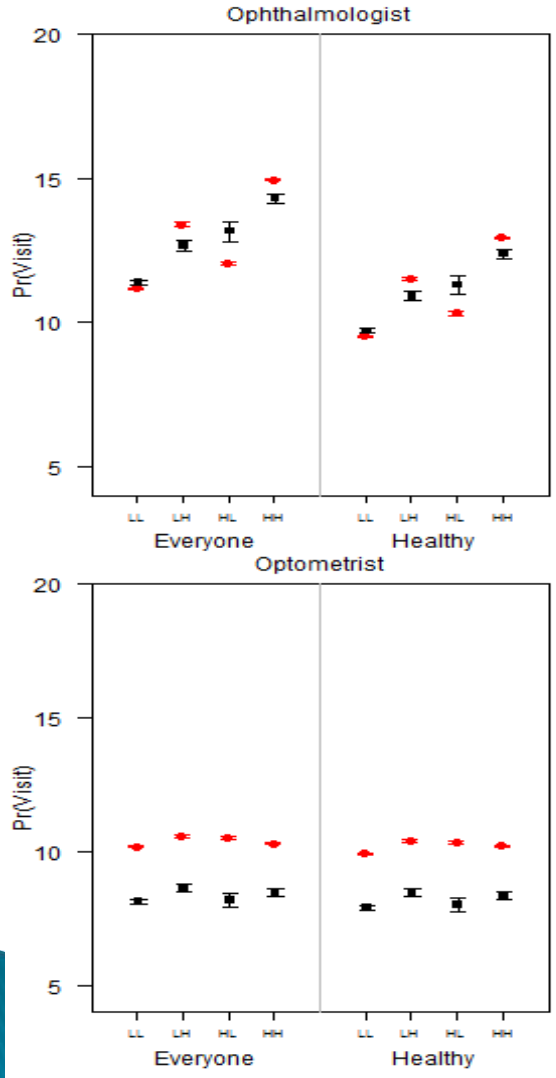
# Visits to Ophthalmologists



# Visits to Optometrists

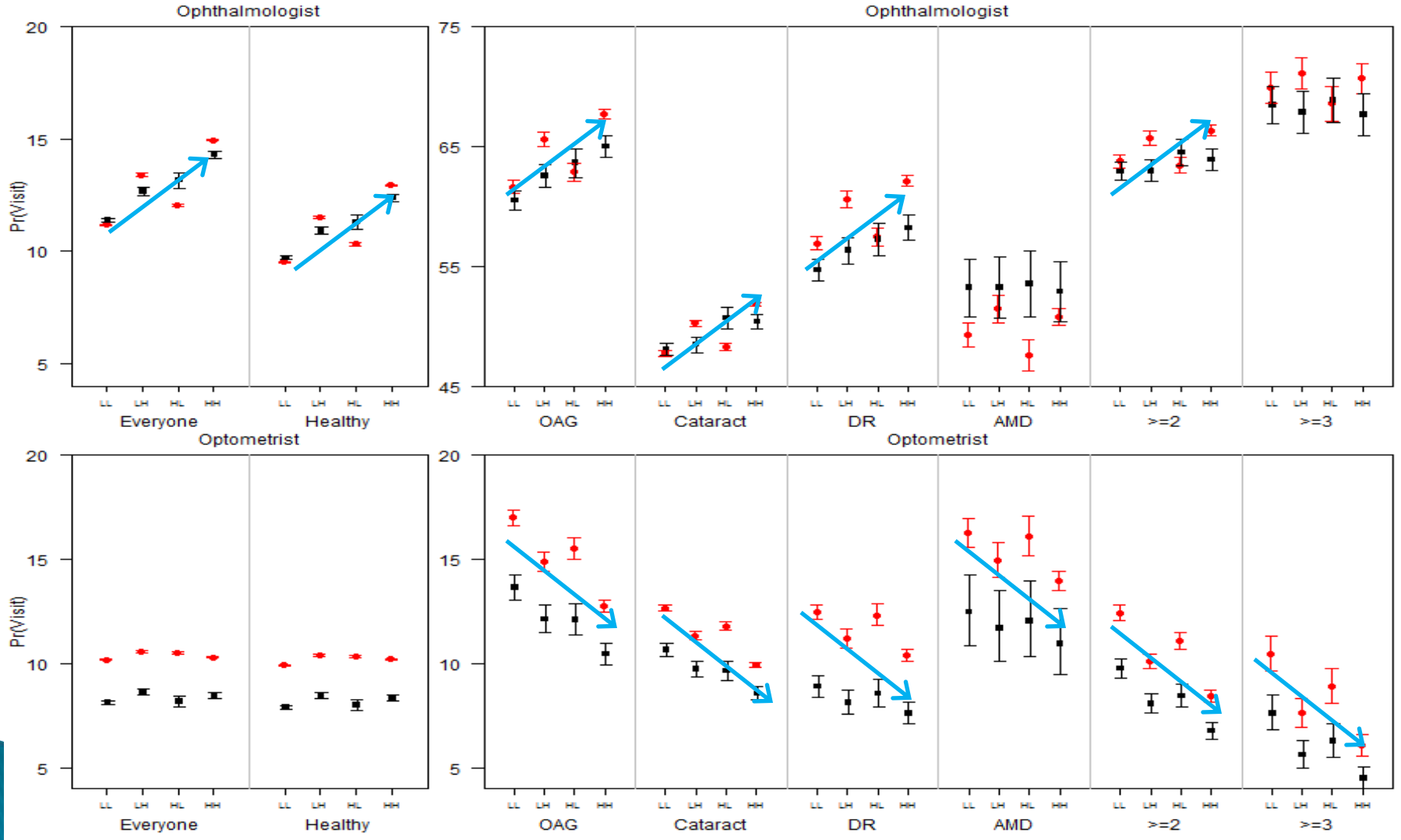


# Likelihood of Visits to Ophthalmologists versus Optometrists




**LL** = Low income / Low education, **LH** = Low income / High education, **HL**= High income / Low education, **HH** = High income / High education

# Likelihood of Visit Based on Ocular Diagnosis

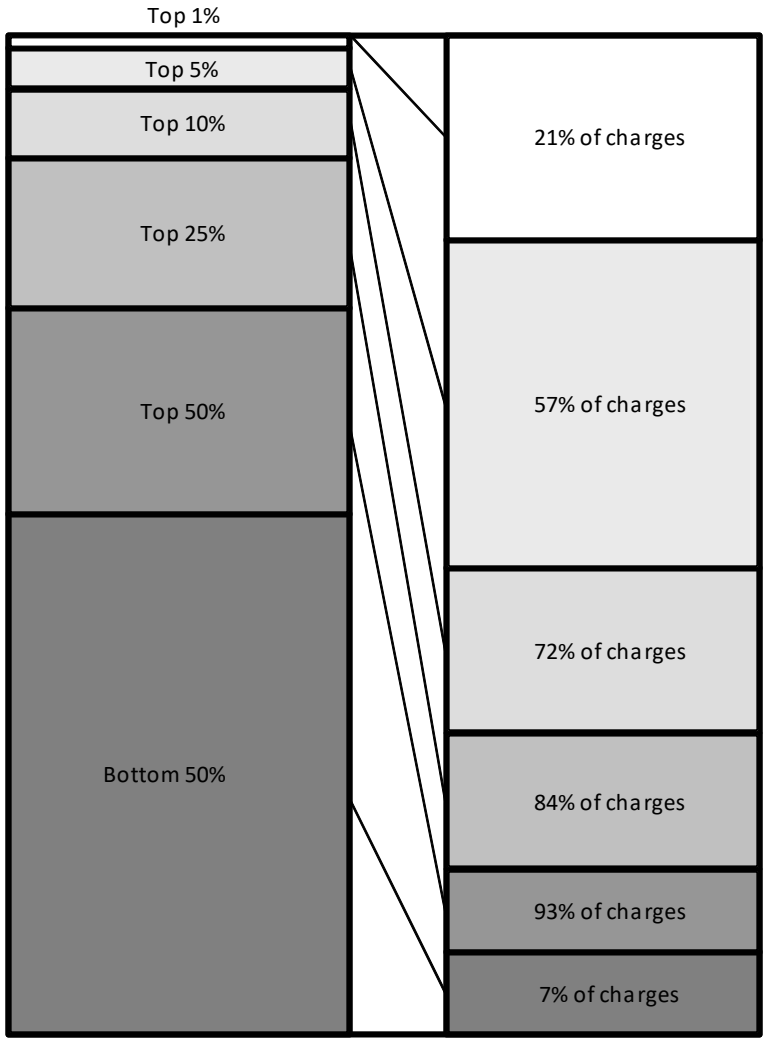



**LL** = Low income / Low education, **LH** = Low income / High education, **HL**= High income / Low education, **HH** = High income / High education

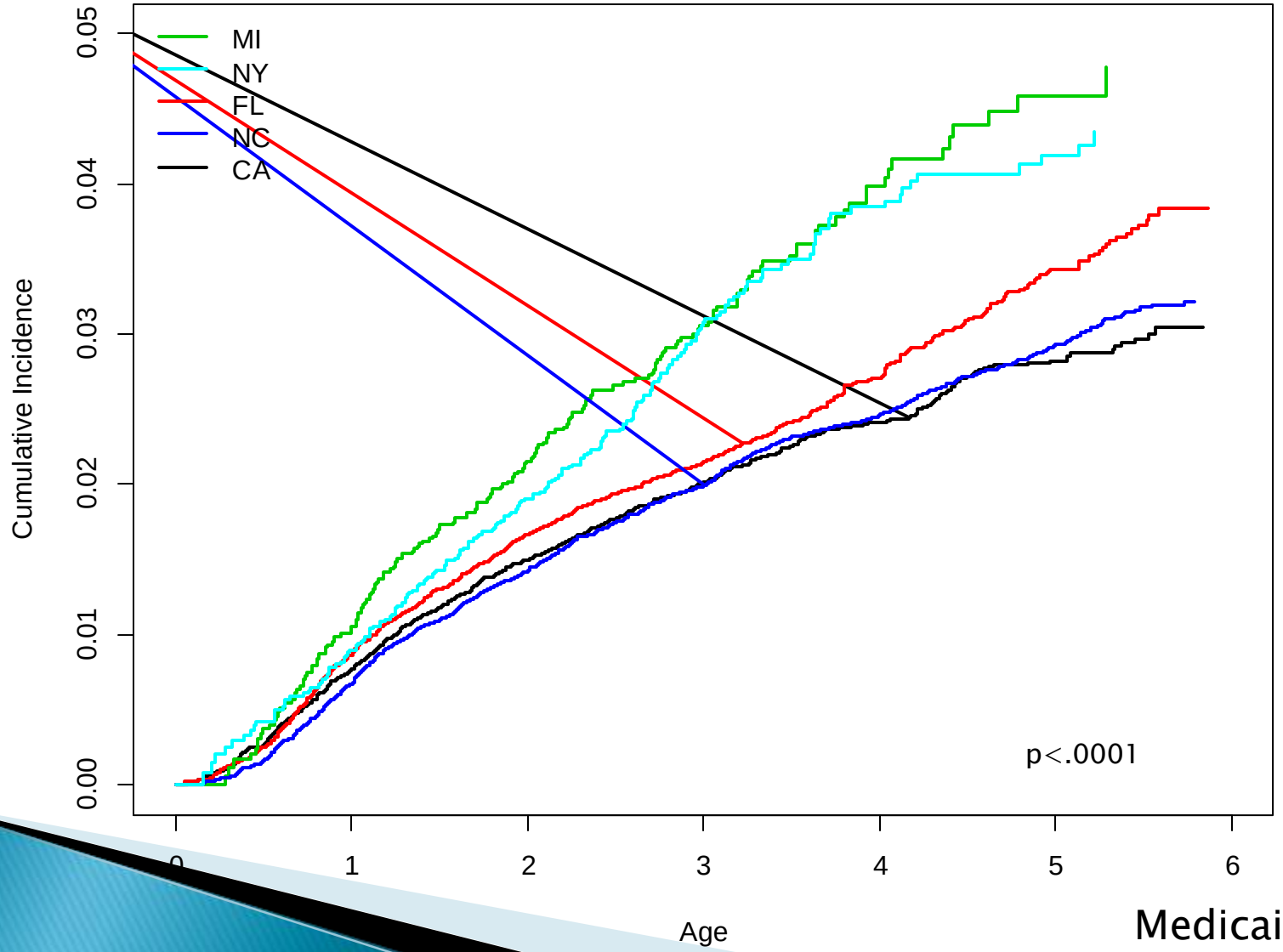
# Key Findings

- Despite possession of health insurance, the likelihood of seeking eye care is influenced by:
  - Race
  - Income
  - Education
- Disparities are growing
- Probability of a visit to **ophthalmologists** more influenced by **affluence**
- Probability of a visit to **optometrists** more influenced by **race**
  - In comparison to blacks, whites have a higher probability of visits irrespective of eye condition and income/education
- Need to address disparities among both
  - Racial minorities and
  - Socioeconomically disadvantaged patients

# Costliest Eye Care Recipients

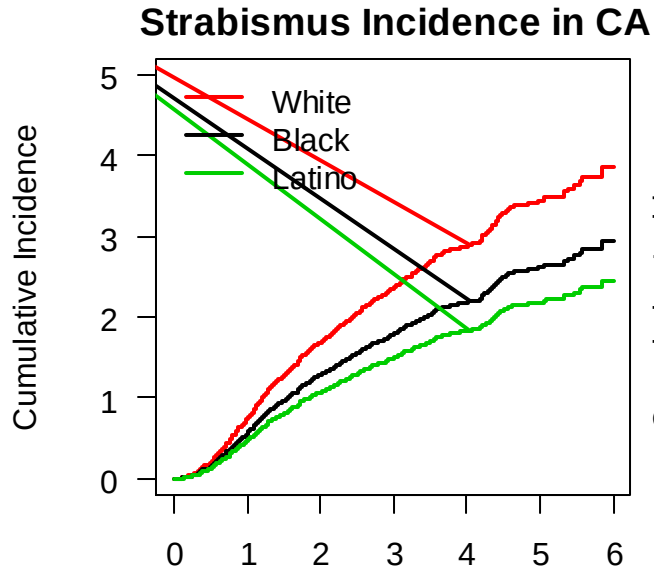


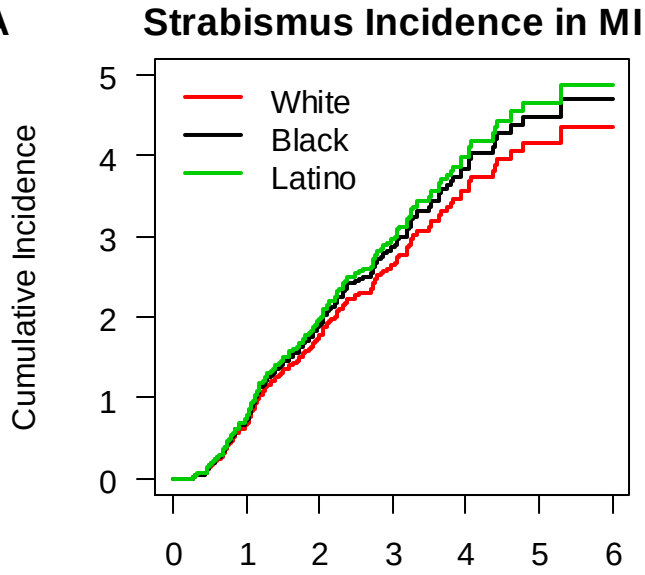
# Cumulative Incidence of Strabismus by State

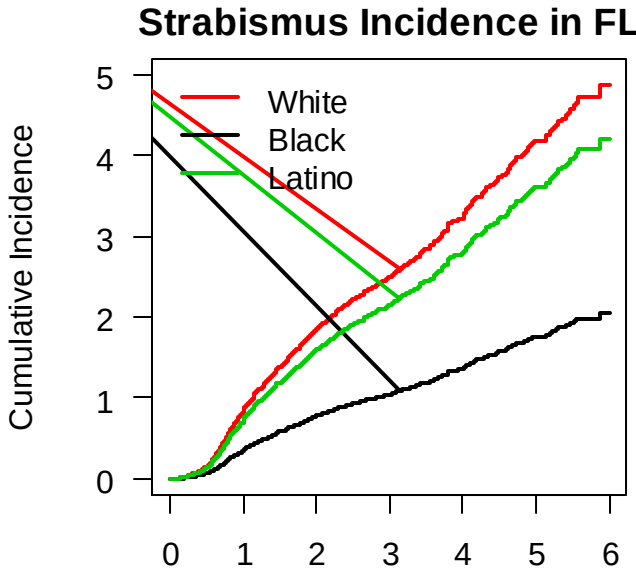


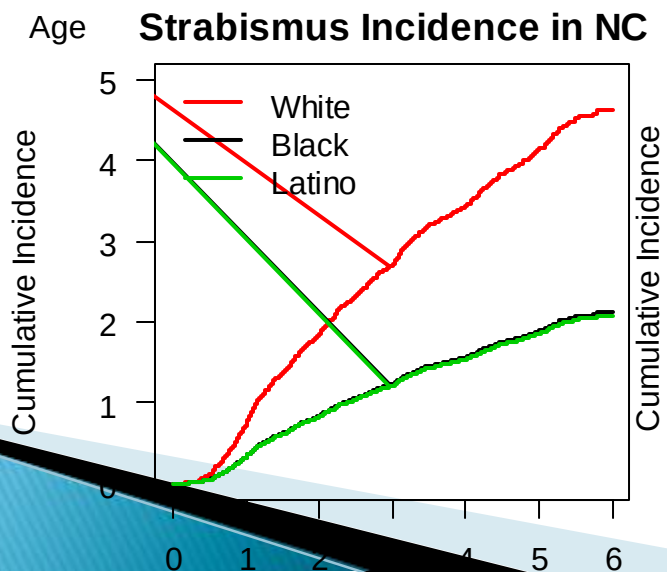

Medicaid MAX

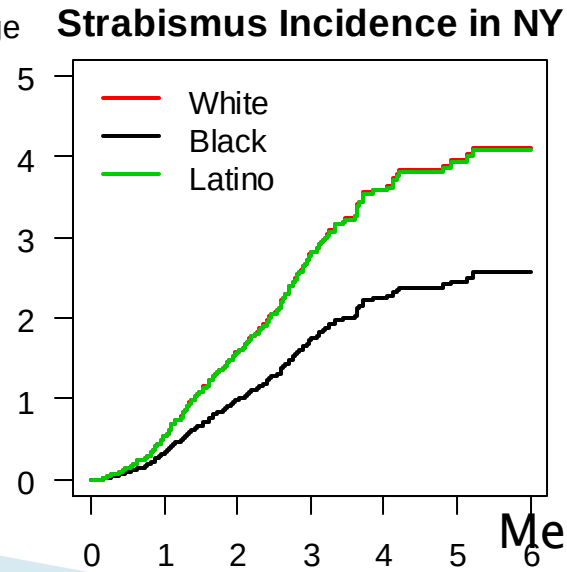
# Cumulative Incidence Curves by Race and State



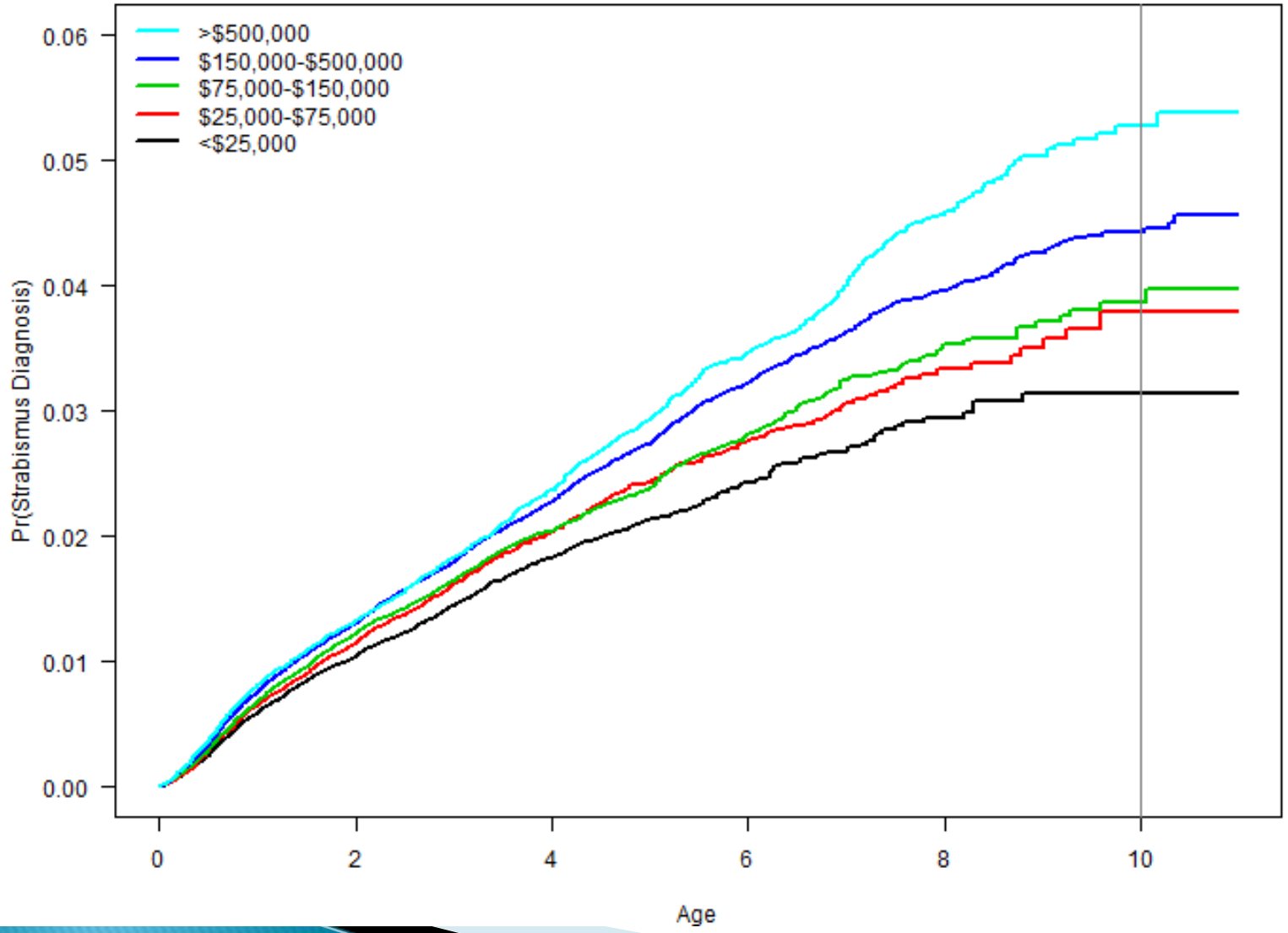



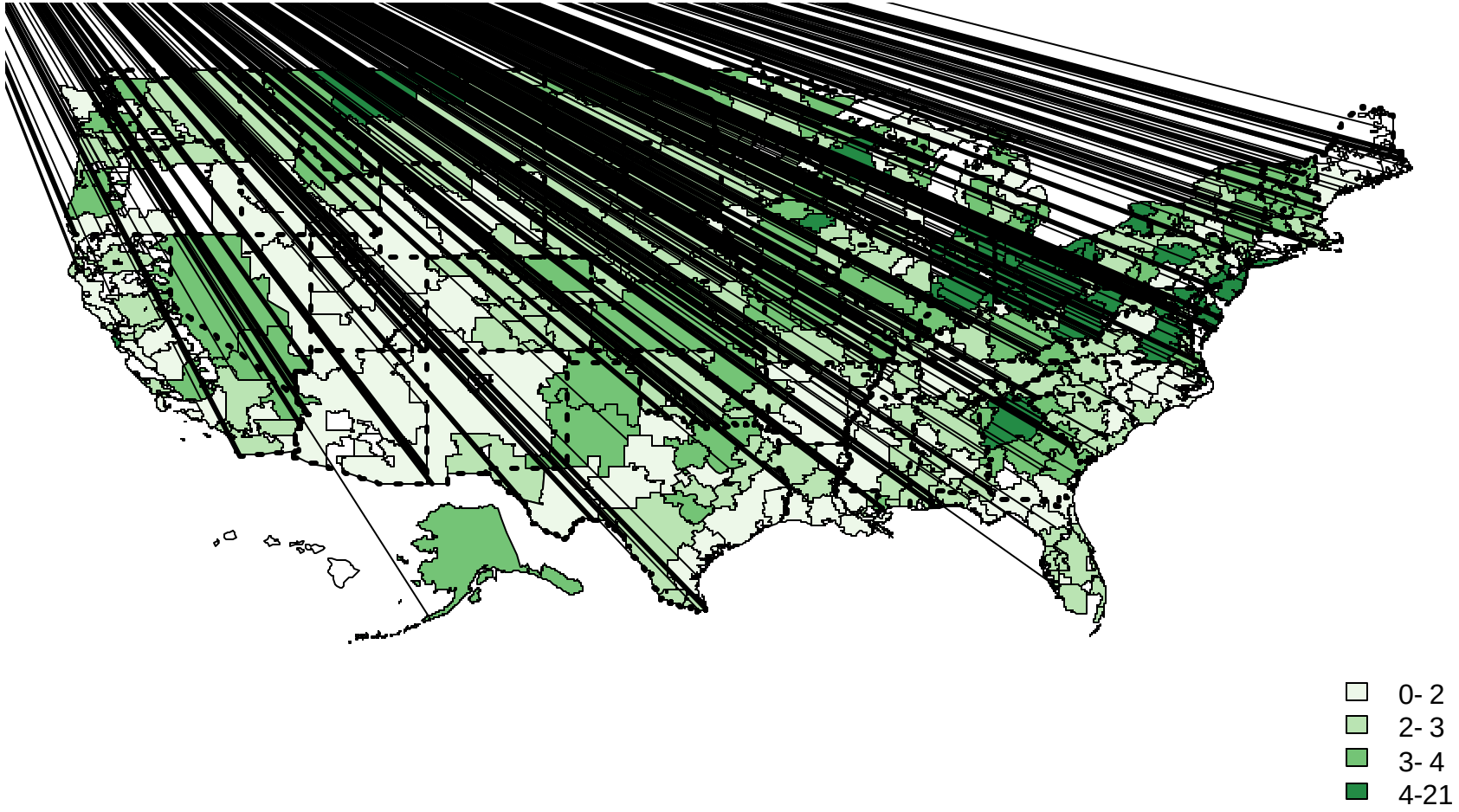



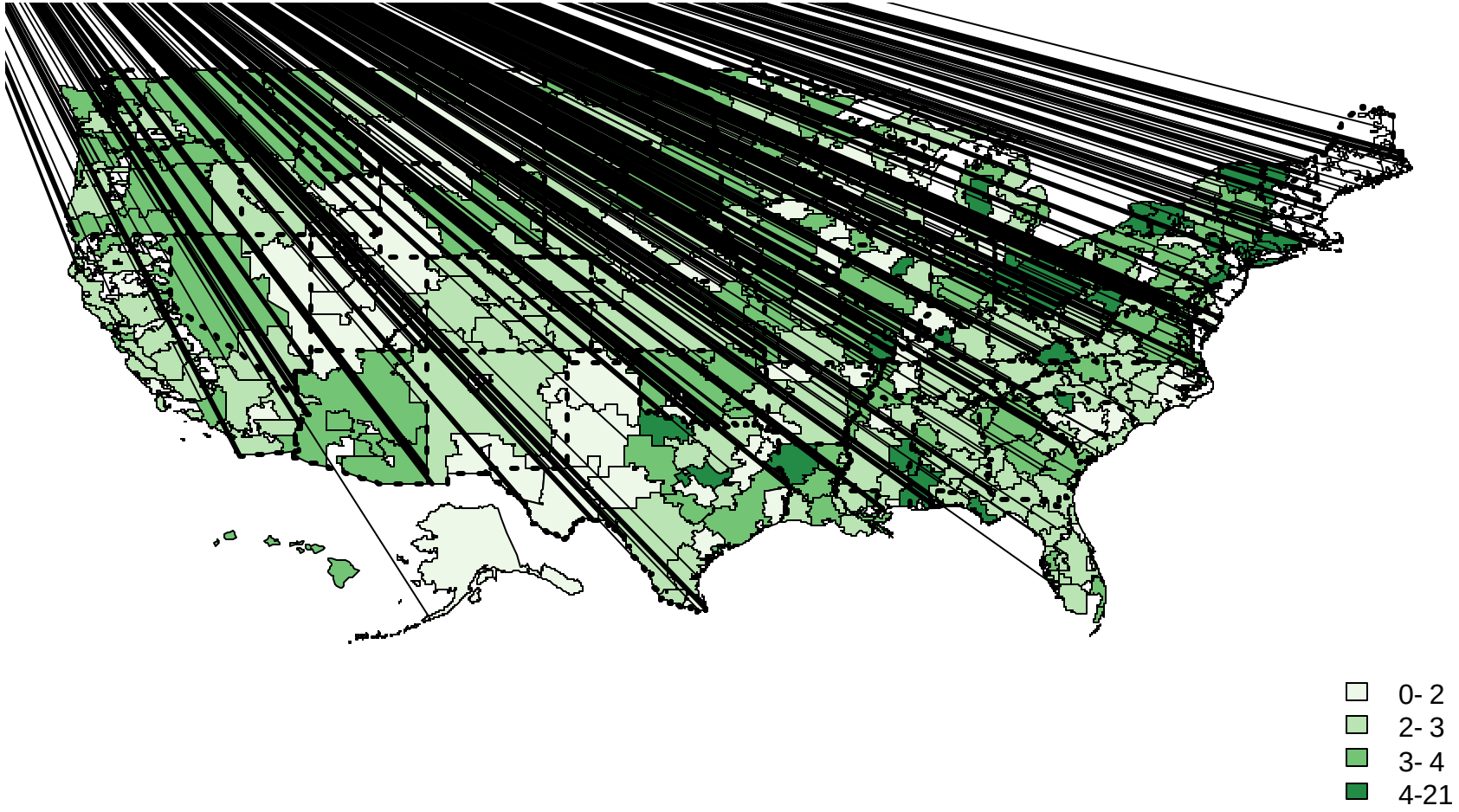
# Strabismus and Net Worth



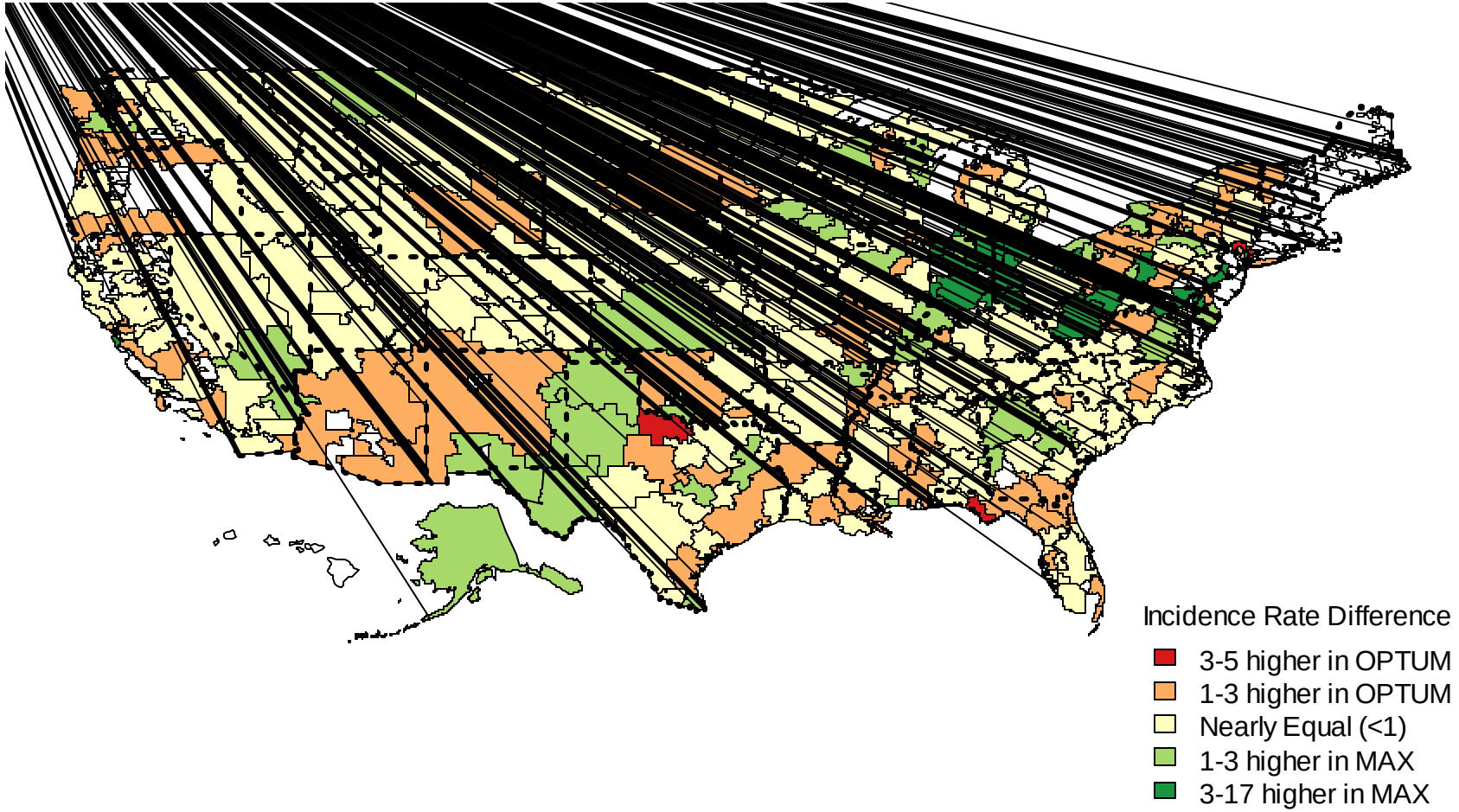
# Incidence of Strabismus at Age 3 Among Children in Medicaid



# Incidence of Strabismus at Age 3 Among Children in Optum

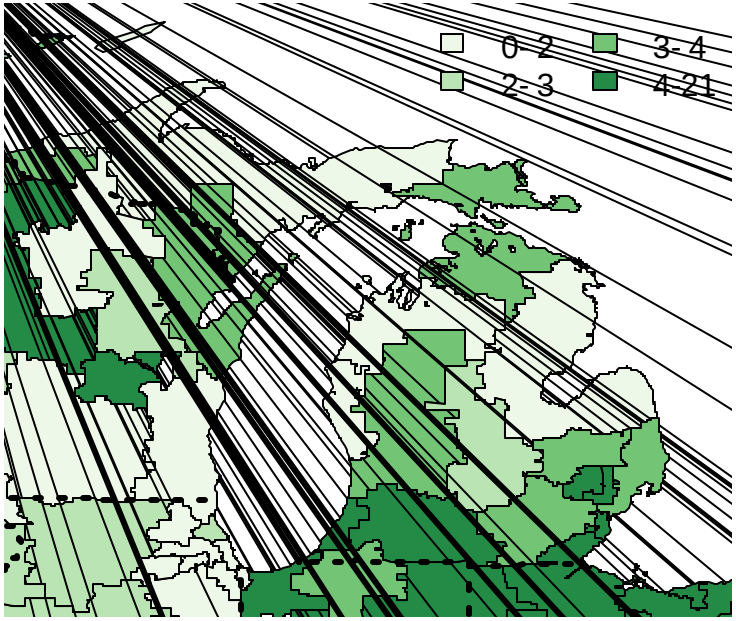


# Incidence of Strabismus at Age 3
## Difference between MAX and OPTUM



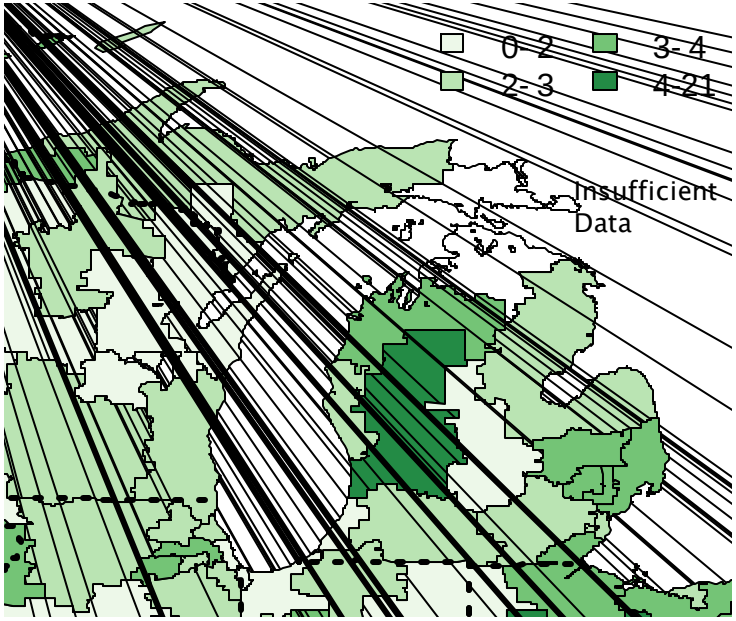

Difference (MAX - OPTUM)

**Strabismus Incidence at Age 3**




Medicaid MAX

**Strabismus Incidence at Age 3**

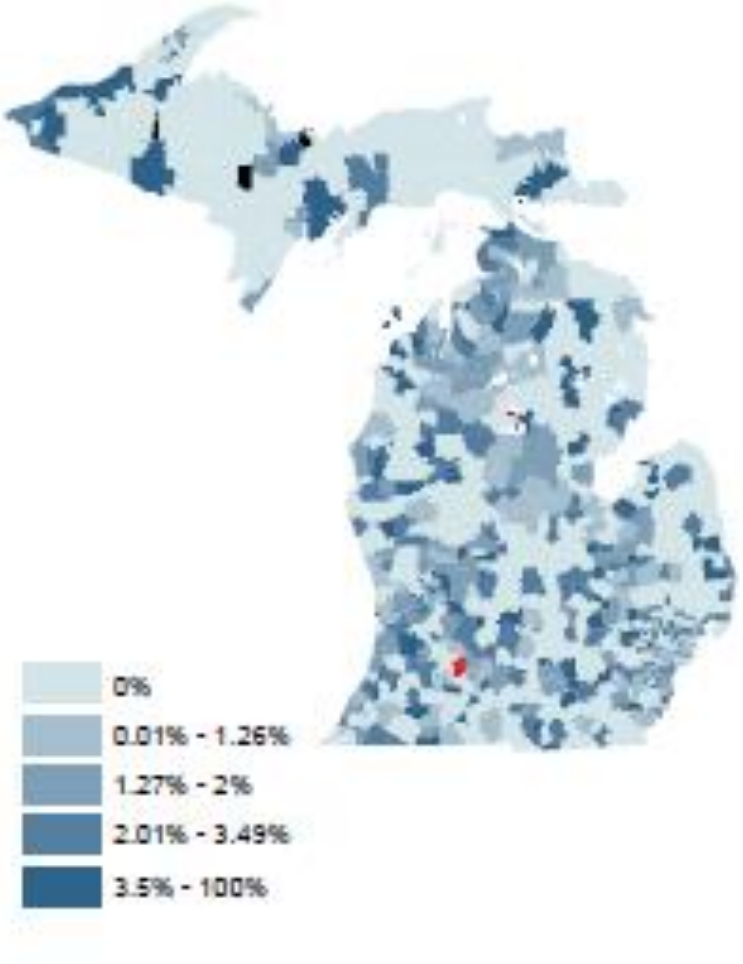


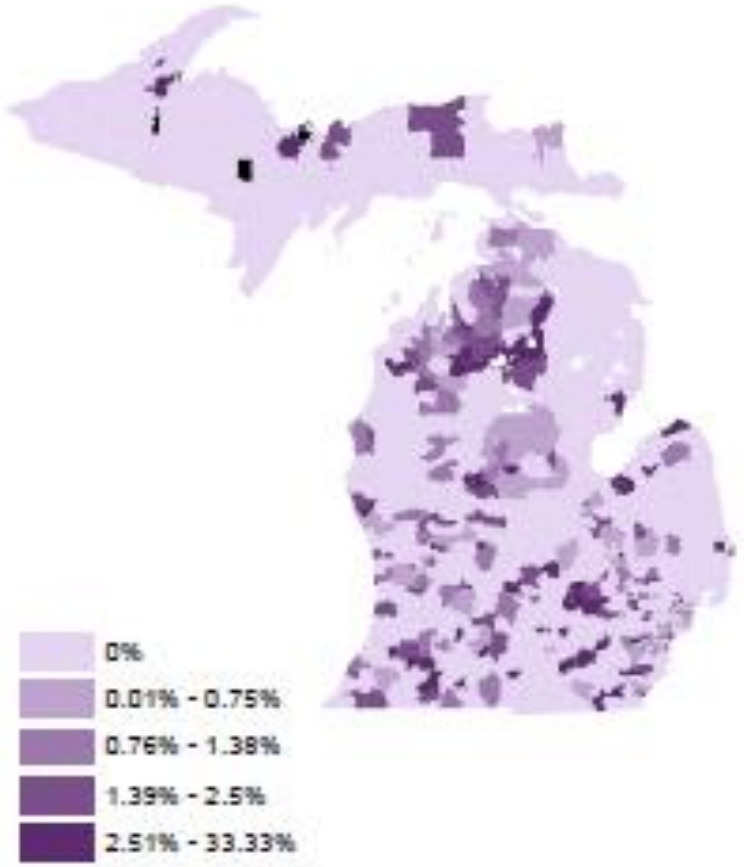

OPTUM

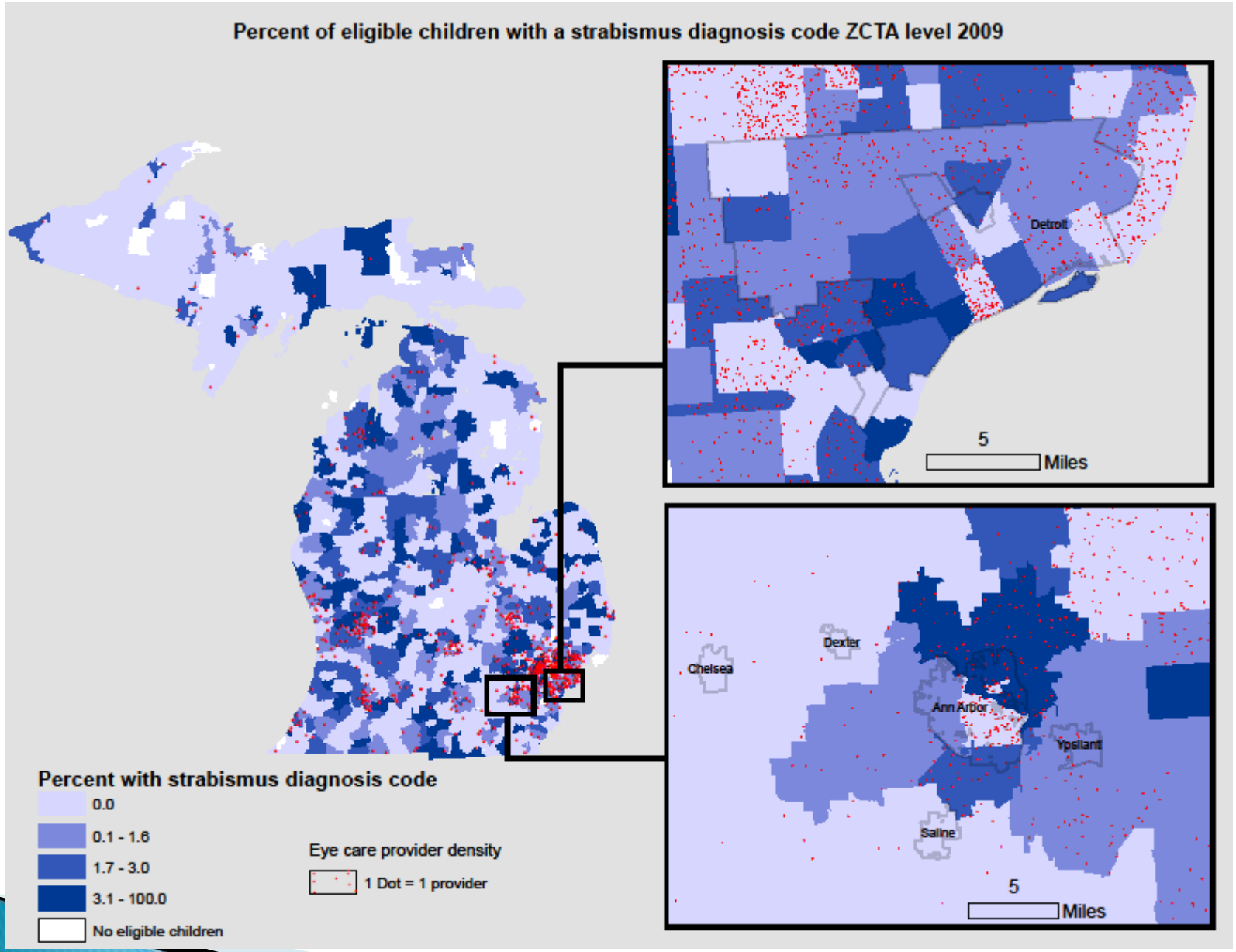
# Strabismus in MAX and OPTUM at HRR level

- Weak correlation between strabismus incidence in two datasets. (r=0.21)
- Even weaker in MI (r=0.12)
- 4 (of 15) MI HRRs are below average in both datasets:
  - Lansing
  - Marquette
  - Muskegon
  - Saginaw

# Incidence of Strabismus and Amblyopia by ZCTA




Percent of eligible children with a strabismus diagnosis code ZCTA level 2009
Detroit
5
Miles
Dexter
Chelsea
Ann Arbor
Ypsilanti
Saline
5
Miles
Percent with strabismus diagnosis code
0.0
0.1 - 1.6
1.7 - 3.0
3.1 - 100.0
No eligible children
Eye care provider density
1 Dot = 1 provider

231,495/9,883,638 or 2.3 % of Michigan's total population is more than a 30 minute drive from either an ophthalmologist, or an optometrist

# Conclusion

- Large databases can be very useful:
  - Epidemiology of diseases
  - Utilization patterns of diagnostic and therapeutic procedures
  - Outcomes of care
  - Risk Factors
  - Costs of care
  - Disparities / inequities in care
- When working with these datasets, important to understand the capabilities and limitations of these sources