Perinatal Characteristics and Healthcare Utilization among Newborns with Sickle Cell Disease and Sickle Cell Trait, Michigan, 2004-2008

Mary Kleyn, MSc, Violanda Grigorescu, MD, MSPH
Michigan Department of Community Health

Background

In Michigan, newborn screening (NBS) for hemoglobinopathies began in 1987. Since the inception of NBS for hemoglobinopathies, more than one thousand newborns have been diagnosed with sickle cell disease (SCD) and tens of thousands have been diagnosed with sickle cell trait (SCT). However, little is known about the perinatal characteristics and healthcare experiences of these newborns.

Study Questions

Do perinatal characteristics or healthcare utilization after birth differ between newborns with SCD and newborns with SCT?

Methods

Study Population

All black infants born in Michigan from 2004 through 2008 who were identified with SCD or SCT through NBS

Data Sources

- NBS records
- Live births records
- Michigan Inpatient Database (MIDB)
  - The MIDB is a database of hospital discharge records. Nearly all hospitals in the state provide their records to the Michigan Health & Hospital Association (MHA). MDCH purchases this database from the MHA.

Core Linkage

- Probabilistic linkage of NBS and Live Births Records
  - In Michigan, this linkage began in 2007[1] and is now routinely conducted. The matching rate is typically 99.0% or greater.

Methods

Other Linkage

- Probabilistic:

  Live Births and MIDB Records
  - Maternal file resulting from the linkage of these two datasets has been created every year at MDCH
  - Newborn file has been first developed for a study related to NICU utilization (Grigorescu, 2005)

Final Linkage

- Deterministic:

  NBS and MIDB Records
  - Linked through the live birth certificate unique identifier

Dataset of birth hospitalization records among black infants with SCD and SCT born 2004 through 2008 was created.

Analytic Method

- Chi-square tests to compare the two groups (SCD and SCT) in regards to:
  - Birth weight (BW)
  - Gestational age
  - One-minute Apgar score
  - Type of delivery
  - Sex
- Regression modeling to assess the relations between disease status (SCD vs. SCT) and the following healthcare utilization outcomes:
  - Length of stay (LOS)
  - Total charges
  - NICU admission
- Generalized linear modeling (GLM) for LOS and total charges
- Logistic regression modeling for NICU admission
  - Crude and adjusted models (controlling for dichotomous BW) were constructed using SAS version 9.1

Results

- Of 14,827 newborns identified with SCD or SCT, 14,387 (97.0%) of the records were linked to live births records and 14,016 were linked to MIDB records (94.5% overall).
- After restricting to black infants only, the final study population included 11,471 newborns:
  - 11,119 with SCT
  - 272 with SCD
- None of the demographic or perinatal characteristics differed significantly between newborns with SCD and those with SCT (Table 1).
  - Newborns with SCD had non-significantly increased odds of being preterm compared to newborns with SCT (OR=1.3, 95% CI 0.97, 1.8).

Table 1. Demographic and Perinatal Characteristics of African American Newborns by Disease Status, MIDB linked with Newborn Screening Records, Michigan, 2004-2008

	Newborns with Sickle Cell Disease		Newborns with Sickle Cell Trait		Unadjusted OR	
Characteristic	N	%	N	%	OR	95% CI
Sex						
Female	143	52.6	5502	49.1	1.1	(0.9, 1.5)
Male	129	47.4	5697	50.9	1	
Type of Delivery						
C-section	87	33.3	3306	30.8	1.1	(0.9, 1.5)
Vaginal	174	66.7	7432	69.2	1	
Apgar score						
<8	39	18.7	1451	17.0	1.1	(0.8, 1.6)
>=8	170	81.3	7107	83.0	1	
Birth Weight						
<2500 g	34	12.5	1421	12.7	1.0	(0.7, 1.4)
>=2500 g	237	87.5	9764	87.3	1	
Gestational Age						
<37 weeks	49	19.4	1561	15.3	1.3	(1.0, 1.8)
>=37 weeks	204	80.6	8609	84.7	1	
NICU Admission						
Yes	17	6.3	663	5.9	1.1	(0.6, 1.7)
No	255	93.8	10536	94.1	1	

- No significant differences were found between mean LOS or mean charges for newborns with SCD compared to those with SCT in crude models or after adjustment for BW (Table 2).
- The odds of NICU admission did not differ between newborns with SCD and those with SCT in either crude or adjusted models (Table 3).

Results

Table 2. Crude and Adjusted Average Length of Stay (LOS) or Total Charges by Disease Status, MIDB linked with Newborn Screening Records, Michigan, 2004-2008

	Crude			Adjusted*		
Outcome	Sickle Cell Disease	Sickle Cell Trait	P-value	Sickle Cell Disease	Sickle Cell Trait	P-value
Average LOS (days)	4.2	3.8	0.5	8.2	7.8	0.4
Total Charges ($)	6,935	5,397	0.4	16,578	14,981	0.4

*Adjusted for dichotomous BW (<2500 g and ≥2500 g)

Table 3. Crude and Adjusted Associations between Disease Status and NICU Admission, MIDB linked with Newborn Screening Records, Michigan, 2004-2008

	Crude		Adjusted*	
Disease Status	OR	95% CI	OR	95% CI
Sickle Cell Disease	1.1	(0.6, 1.7)	1.1	(0.6, 1.8)
Sickle Cell Trait	1		1	

*Adjusted for dichotomous BW (<2500 g and ≥2500 g)

Conclusions

- Perinatal characteristics and healthcare utilization of newborns with SCD are similar to those of newborns with SCT.

Public Health Implications

- Similar short-term follow-up strategies may be used for newborns with SCD and newborns with SCT due to their comparable perinatal characteristics and healthcare utilization during the birth hospitalization.
- Routine link of NBS data with live births records allows for linkages with other files which contain useful information not available otherwise.

References

1. Korzeniewski SJ, Grigorescu V, Copeland G, Gu G, Thoburn KK, Rogers JD, Young WI. Methodological Innovations in Data Gathering: Newborn Screening Linkage with Live Births Records, Michigan, 1/2007-3/2008. Matern Child Health J 2010;14(3):360-4.

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