Hospital Length of Stay, Readmissions and Healthcare Costs Through 1 Year for Extremely Preterm Infants With and Without Bronchopulmonary Dysplasia: A Retrospective Claims Analysis

Sujata P. Sarda,¹ Alexandra Mangili,² Linda Han,³ Rajeev Ayyagari,⁴ Wei Gao,⁴ Jessie Wang,⁴ Jing Zhao,⁴ Meredith Mowitz⁵

¹Outcomes Research and Epidemiology (ORE), Shire, Lexington, MA, USA; ²Global Development, Shire, Zug, Switzerland; ³Global Clinical Development, Shire, Lexington, MA, USA; ⁴Analysis Group Inc., Boston, MA, USA; ⁵Department of Pediatrics, College of Medicine, University of Florida, Gainesville, FL, USA

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DISCLOSURES

Sujata P. Sarda, Alexandra Mangili and Linda Han are employees of and hold stock/stock options in Shire. Rajeev Ayyagari, Wei Gao, Jessie Wang and Jing Zhao are employees of Analysis Group, Inc., who were paid consultants to Shire in relation to this study. Meredith Mowitz was a paid consultant to Shire in relation to this study.

ACKNOWLEDGEMENTS

This study was funded by Shire. Under direction of the authors, Rosalind Bonomally, MSc, employee of Excel Scientific Solutions, provided writing assistance for this presentation. Editorial assistance in formatting, proofreading and copyediting also was provided by Excel Scientific Solutions. Shire provided funding to Excel Scientific Solutions for support in editing this presentation.

BACKGROUND

- Bronchopulmonary dysplasia (BPD) is the most frequent comorbidity of extremely preterm birth.¹
- Infants diagnosed with BPD often experience impaired lung function after discharge from the neonatal intensive care unit (NICU).²

OBJECTIVE

- To evaluate birth hospital length of stay (LOS), hospital readmissions and healthcare costs for extremely preterm infants (≤28 weeks gestational age [GA]), with and without BPD, through 1 year corrected age (CA).

METHODS

- This was a retrospective analysis of the Truven Health MarketScan claims database, which contains health insurance claims and electronic medical records for patients in the United States.
- We included infants born at ≤28 weeks GA who:
 - Were admitted to a NICU between January 2009 and June 2016
 - Had continuous eligibility through at least 3 months CA
 - Had no congenital heart disease, diaphragmatic hernia or congenital malformations.
- We excluded infants who died before 36 weeks postmenstrual age.
- BPD was identified by International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) or ICD-10-CM codes (which included chronic lung disease) during the period from birth to death or the end of continuous eligibility, whichever happened first (severity categorisation for BPD was not available).
- Infants were required to have follow-up for ≥3 months after discharge.
- Outcomes were evaluated utilising a person/time approach due to variable length of follow-up.
- Healthcare costs associated with birth hospitalisation, outpatient visits, emergency room visits and hospital readmissions were evaluated for infants with BPD versus no BPD.

RESULTS

- Overall, 2805 eligible infants were included in the current analysis (Figure 1).
- 1715 (61.1%) had BPD, and 1090 (38.9%) did not have BPD.
- Among infants with BPD, 60.8% were born at ≤26 weeks GA; among infants without BPD, 29.7% were born at ≤26 weeks GA (Table 1).
- A trend towards higher rates of comorbidities was observed among infants who experienced BPD (Table 1).
- Mean birth hospital LOS was longer for infants with BPD versus those without (Table 2).
- Hospital readmission rates after NICU discharge were significantly higher for infants with BPD versus those without BPD for all causes as well as for respiratory causes specifically (Table 2).
- Infants with BPD were more likely to have >1 hospital readmission versus infants without BPD.
- All healthcare costs were significantly higher for infants with BPD versus those without (Figure 2).
- After birth hospitalisation, outpatient visits accounted for the majority of costs for both groups.

Figure 1. Sample Selection Flowchart of the Truven MarketScan Database

BPD, bronchopulmonary dysplasia; CA, corrected age; GA, gestational age; ICU, intensive care unit; NICU, neonatal intensive care unit; PMA, postmenstrual age.

Table 1. Patient Characteristics During Birth Hospitalisation

Characteristic	Without BPD n=1090	With BPD n=1715
Female sex, n (%)	528 (48.4)	762 (44.4)
GA, n (%) ^a		
<24 weeks	18 (1.7)	107 (6.2)
24 weeks	43 (3.9)	268 (15.6)
25–26 weeks	263 (24.1)	668 (39.0)
27–28 weeks	766 (70.3)	672 (39.2)
Multiple birth, n (%)	264 (24.2)	460 (26.8)
Delivery method, n (%)		
Vaginal	275 (25.2)	398 (23.2)
Caesarean	731 (67.1)	1167 (68.0)
Unknown	84 (7.7)	150 (8.7)
Comorbidities, n (%)		
Chronic respiratory morbidity [†]	69 (6.3)	448 (26.1)
Intraventricular haemorrhage	229 (21.0)	582 (33.9)
Retinopathy of prematurity	298 (27.3)	743 (43.3)
Patent ductus arteriosus	383 (35.1)	1060 (61.8)
Necrotising enterocolitis	55 (5.0)	209 (12.2)

BPD, bronchopulmonary dysplasia; CRM, chronic respiratory morbidity; GA, gestational age. ^aGA was determined based on International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) or ICD-10-CM diagnosis codes. The upper bound of the GA range of each ICD-9-CM code was used as an approximate for the GA. [†]Chronic respiratory morbidity was defined as ≥1 of the following events in ≥2 quarters through 1 year corrected age: hospital readmission or emergency room visit due to a respiratory cause, use of daily respiratory medication or use of home oxygen therapy/respiratory aids.

CONCLUSIONS

- BPD places a substantial burden on the healthcare system in the form of longer birth hospital LOS, more hospital readmissions and higher healthcare costs than for infants without BPD.
- Beyond birth hospitalisation, outpatient visits and hospital readmissions are the main drivers of increased healthcare costs among infants with BPD.

REFERENCES

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Table 2. Length of Stay During Birth Hospitalisation, and Hospital Readmissions Within 1 Year After Birth Hospitalisation, in Extremely Preterm Infants With or Without BPD

	Without BPD n=1090	With BPD n=1715	Adjusted P Value [*]
Birth hospitalisation			
Mean ± SD length of stay, days	68 ± 23	95 ± 33	0.4308
Hospital readmission, all-cause, n (%)	131 (12.0)	447 (26.1)	<0.0001
No. of hospitalisations per person-year (incidence rate)	0.14	0.39	<0.0001
Length of stay among infants with ≥1 hospital readmission			
Days per person-year	7.35	11.33	0.0110
Median, days	4.00	5.00	—
Infants with >1 readmission, n (%)	20 (1.8)	129 (7.5)	<0.0001
Hospital readmission, respiratory cause, n (%)	70 (6.4)	290 (16.9)	<0.0001
No. of hospitalisations per person-year (incidence rate)	0.07	0.22	<0.0001
Length of stay among infants with ≥1 hospital readmission			
Days per person-year	6.05	12.10	<0.0001
Median, days	4.00	5.00	—
Infants with >1 readmission, n (%)	8 (0.7)	65 (3.8)	<0.0001

BPD, bronchopulmonary dysplasia. ^{*}Adjusted covariates included sex, gestational age, postmenstrual age at discharge, caesarean delivery, birth year, multiple birth, comorbidities (intraventricular haemorrhage, retinopathy of prematurity, periventricular leukomalacia, necrotising enterocolitis, bacterial sepsis and spontaneous intestinal perforation).

Figure 2. Total Healthcare Costs* per Patient During 1 Year CA Among Extremely Preterm Infants With or Without BPD When (A) Including Birth Hospitalisation and (B) Excluding Birth Hospitalisation

BPD, bronchopulmonary dysplasia; CA, corrected age; USD, US dollars. ^{*}Healthcare costs were inflated to 2017 USD using the US Medical Service Consumer Price Index. [†]Adjusted for sex, gestational age, postmenstrual age at discharge, caesarean delivery, birth year, multiple birth and comorbidities (intraventricular haemorrhage, retinopathy of prematurity, periventricular leukomalacia, necrotising enterocolitis, bacterial sepsis and spontaneous intestinal perforation). [‡]Total does not sum due to rounding.