Prevalence of 1-Year Chronic Respiratory Morbidity Among Extremely Preterm Infants and Related Hospital Length of Stay, Readmissions and Healthcare Costs: 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.

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BACKGROUND

- Chronic respiratory morbidity (CRM) is associated with extremely preterm birth.¹

OBJECTIVE

- To evaluate the prevalence of CRM, as well as the birth hospital length of stay (LOS), hospital readmission rates and healthcare costs for extremely preterm infants (≤ 28 weeks gestational age [GA]) with and without CRM, 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 neonatal intensive care unit (NICU) between January 2009 and June 2016
 - Survived to 36 weeks postmenstrual age
 - Had no congenital heart disease, diaphragmatic hernia or congenital malformations
 - Had continuous insurance eligibility from birth to 1 year CA or death, whichever occurred first.
- CRM was defined as ≥ 1 of the following events in ≥ 2 quarters (3-month time intervals) through 1 year CA: hospital readmission or emergency room visit due to a respiratory cause, use of daily respiratory medication or use of home oxygen therapy/respiratory aids.
- Healthcare costs associated with birth hospitalisation, outpatient visits, emergency room visits and hospital readmissions were evaluated for infants with CRM versus without CRM.

RESULTS

- The MarketScan database included 112,187 premature infants (< 37 weeks GA) born between January 2009 and June 2016 (Figure 1).
- Overall, 1782 eligible infants born at ≤ 28 weeks were included in the current analyses.
 - 1265 (71.0%) did not have CRM, and 517 (29.0%) had CRM.
- The proportion of female infants was higher in the cohort without versus with CRM (Table 1).
- A trend towards higher rates of comorbidities (bronchopulmonary dysplasia [BPD], intraventricular haemorrhage, retinopathy of prematurity, patent ductus arteriosus and necrotising enterocolitis) was observed among infants who experienced CRM (Table 1).
 - Approximately 86.7% of infants with CRM had BPD.
- Mean birth hospital LOS was significantly longer for infants with CRM versus those without (Table 2).
- Hospital readmission rates after NICU discharge, for all causes as well as for respiratory causes specifically, were significantly higher for infants with CRM versus those without (Table 2).
- Infants with CRM were more likely to have > 1 hospital readmission, for all causes and respiratory causes, versus infants without CRM.
- All healthcare costs were substantially higher for infants with CRM versus those without (Figure 2).
 - After the birth hospitalisation, which accounted for the highest costs, the largest drivers of increased costs were outpatient visits and hospital readmissions.

Figure 1. Sample Selection Flowchart of the Truven MarketScan Database

CA, corrected age; CRM, chronic respiratory morbidity; GA, gestational age; ICU, intensive care unit; NICU, neonatal intensive care unit; PMA, postmenstrual age.

Table 1. Patient Characteristics During Birth Hospitalisation

Characteristic	Without CRM n=1265	With CRM n=517
Female sex, n (%)	601 (47.5)	214 (41.4)
GA, n (%) ^a		
<24 weeks	37 (2.9)	39 (7.5)
24 weeks	102 (8.1)	98 (19.0)
25–26 weeks	404 (31.9)	212 (41.0)
27–28 weeks	722 (57.1)	168 (32.5)
Multiple birth, n (%)	342 (27.0)	130 (25.1)
Delivery method, n (%)		
Vaginal	313 (24.7)	134 (25.9)
Caesarean	854 (67.5)	348 (67.3)
Unknown	98 (7.7)	35 (6.8)
Comorbidities, n (%)		
Bronchopulmonary dysplasia	674 (53.3)	448 (86.7)
Intraventricular haemorrhage	334 (26.4)	193 (37.3)
Retinopathy of prematurity	403 (31.9)	229 (44.3)
Patent ductus arteriosus	595 (47.0)	322 (62.3)
Necrotising enterocolitis	114 (9.0)	68 (13.2)

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.

CONCLUSIONS

- The prevalence of CRM is considerable, as 29% of extremely preterm infants experience CRM through 1 year CA.
- CRM places a significant burden on healthcare systems.
- Compared with infants without CRM, infants with CRM have a longer birth hospital LOS, an increased rate of hospital readmission and increased healthcare costs.

REFERENCE

1. Keller RL, et al; Prematurity and Respiratory Outcomes Program. *J Pediatr*. 2017;187:89–97.e3.

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

	Without CRM n=1265	With CRM n=517	Adjusted P Value ^a
Birth hospitalisation			
Mean $\pm$ SD length of stay, days	78 $\pm$ 31	98 $\pm$ 33	<0.0001
Hospital readmission, all-cause, n (%)	180 (14.2)	209 (40.4)	<0.0001
No. of hospitalisations per person-year (incidence rate)	0.18	0.64	<0.0001
Length of stay among infants with ≥ 1 hospital readmission			
Days per person-year	7.53	10.40	0.0480
Median, days	4.00	5.00	—
Infants with > 1 readmission, n (%)	32 (2.5)	69 (13.3)	<0.0001
Hospital readmission, respiratory cause, n (%)	82 (6.5)	160 (30.9)	<0.0001
No. of hospitalisations per person-year (incidence rate)	0.07	0.44	<0.0001
Length of stay among infants with ≥ 1 hospital readmission			
Days per person-year	7.62	10.01	0.0877
Median, days	4.00	5.00	—
Infants with > 1 readmission, n (%)	3 (0.2)	48 (9.3)	<0.0001

CRM, chronic respiratory morbidity. ^aAdjusted 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 CRM When (A) Including Birth Hospitalisation and (B) Excluding Birth Hospitalisation

CA, corrected age; CRM, chronic respiratory morbidity; USD, US dollars. ^aHealthcare costs were inflated to 2017 USD using the US Medical Service Consumer Price Index. ^bAdjusted 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).