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Financial Outcomes of High Flow Nasal Cannula Use for Bronchiolitis on the General Pediatric Floor Across Children's Hospitals

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Financial Outcomes of High Flow Nasal Cannula Use for Bronchiolitis on the General Pediatric Floor

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IRB Number: Exempt

Describe role of Submitting/Presenting Trainee in this project (limit 150 words):

I (Jonathan) am the primary investigator and primary author for this research project. With assistance from the individuals listed above, I was responsible for the initial study idea, literature review, study design, and initial data interpretation.

Background, Objectives/Goal, Methods/Design, Results, Conclusions limited to 500 words

Background: Bronchiolitis is a leading cause of hospitalization for infants and results in over 1.7 billion dollars in yearly hospital charges (Hasegawa). The use of high flow nasal cannula (HFNC) on a general pediatrics floor may reduce hospital costs and length of stay (LOS, Kalburgi). However, the financial impact of HFNC use is not well-described.

Objective: The primary objective are the financial outcomes of HFNC utilization on the general pediatric floor. The secondary objective included financial outcomes stratified by All Patients Refined Diagnosis Related Groups (APR-DRG) severity of illness (SOI) and payor type. We hypothesize that costs outweigh reimbursement for HFNC for low severity bronchiolitis and in children with Public insurance.

Methods: This retrospective cohort study included children aged 0-24 months with a primary diagnosis of bronchiolitis (APR-DRG 138) between 1/1/2018 – 12/31/2019. We excluded newborns, observation status hospitalizations, children requiring ICU-level care, transfers in, and readmissions. We included eight hospitals that provided clinical information to the Children's Hospital Association's (CHA) Pediatric Health Information System database and cost and reimbursement data to the CHA Revenue Management Program. We calculated the ratio of reimbursements to costs (CCR) for children with bronchiolitis and compared the CCR stratified by HFNC and APR-DRG SOI groups (minor, moderate, and major/extreme) and payor type.

Results: Of 8,777 children hospitalized for bronchiolitis, nearly one-third (31%) were placed on HFNC (Table 1). The majority of children in all levels of severity did not receive HFNC, but was variable based upon APR-DRG SOI (29.2% of children in APR-DRG SOI mild, 25.7% in moderate, and 44.8% in major/severe).

We observed a significant difference between costs and reimbursements based upon HFNC administration for each APR-DRG SOI classification and by payor type (Table 2). A CCR <1.0 represents a financial liability to hospitals (costs exceed reimbursement). A plurality of hospitalizations for publicly insured children with bronchiolitis (83%) had a CCR <1.0 (the exception was a CCR of 1.10 for children with major/severe bronchiolitis requiring HFNC).

The CCR for children receiving HFNC was variable and increased linearly by APR-DRG SOI classification. CCR was highest for children with major/severe bronchiolitis but was substantially different based upon payor. For example, the CCR was 1.56 for privately insured children with minor bronchiolitis and HFNC use and 1.71 for major/severe bronchiolitis with HFNC use. In contrast, the CCR for publicly insured children with minor bronchiolitis and HFNC use was 0.68 and 1.10 for major/severe bronchiolitis with HFNC use. The differences for children without HFNC use was much less variable based upon APR-DRG SOI.

Conclusions: The CCR was <1.0 for bronchiolitis hospitalizations among most publicly insured children and was lowest for children with minor bronchiolitis receiving HFNC (CCR 0.68). The CCR varied substantially (a difference of 20% - 30% for privately and publicly insured children, respectively) by APR-DRG SOI for children with HFNC use, but less so among children without HFNC use. To gain further insight into CCR variation for children hospitalized with bronchiolitis, future work should assess billing practices, severity of illness classification, and variation in practice patterns.

Table 1. Clinical and Demographic Characteristics of Children Hospitalized with Bronchiolitis by APR-DRG SOI

| | | APR DRG Severity of Illness | | | | | | | |
|----------------------------------|----------------------|-----------------------------|-------------|--------------------|-------------|------------------------|------------|------------------------------|------------|
| | | Overall [†] | | Minor [*] | | Moderate ^{**} | | Major/Extreme ^{***} | |
| | | No HFNC | HFNC | No HFNC | HFNC | No HFNC | HFNC | No HFNC | HFNC |
| Overall, N (%) | | 6023 (68.6) | 2754 (31.4) | 2521 (70.8) | 1038 (29.2) | 2420 (74.3) | 839 (25.7) | 1082 (55.2) | 877 (44.8) |
| Age, N (%) | | | | | | | | | |
| | Birth - 2 months | 1042 (17.3) | 219 (8) | 377 (15) | 65 (6.3) | 462 (19.1) | 65 (7.7) | 203 (18.8) | 89 (10.1) |
| | >2 month - 12 months | 3165 (52.5) | 1475 (53.6) | 1195 (47.4) | 532 (51.3) | 1407 (58.1) | 488 (58.2) | 563 (52) | 455 (51.9) |
| | >12 months | 1816 (30.2) | 1060 (38.5) | 949 (37.6) | 441 (42.5) | 551 (22.8) | 286 (34.1) | 316 (29.2) | 333 (38) |
| Sex, N (%) | | | | | | | | | |
| | Male | 3431 (57) | 1682 (61.1) | 1413 (56) | 650 (62.6) | 1380 (57) | 488 (58.2) | 638 (59) | 544 (62) |
| | Female | 2592 (43) | 1072 (38.9) | 1108 (44) | 388 (37.4) | 1040 (43) | 351 (41.8) | 444 (41) | 333 (38) |
| Race/Ethnicity, N (%) | | | | | | | | | |
| | Non-Hispanic White | 3188 (52.9) | 1459 (53) | 1325 (52.6) | 579 (55.8) | 1309 (54.1) | 472 (56.3) | 554 (51.2) | 408 (46.5) |
| | Non-Hispanic Black | 860 (14.3) | 587 (21.3) | 345 (13.7) | 216 (20.8) | 346 (14.3) | 192 (22.9) | 169 (15.6) | 179 (20.4) |
| | Hispanic | 1168 (19.4) | 397 (14.4) | 566 (22.5) | 155 (14.9) | 436 (18) | 91 (10.8) | 166 (15.3) | 151 (17.2) |
| | Asian | 370 (6.1) | 90 (3.3) | 114 (4.5) | 27 (2.6) | 120 (5) | 26 (3.1) | 136 (12.6) | 37 (4.2) |
| | Other | 437 (7.3) | 221 (8) | 171 (6.8) | 61 (5.9) | 209 (8.6) | 58 (6.9) | 57 (5.3) | 102 (11.6) |
| Insurance, N (%) | | | | | | | | | |
| | Public | 3125 (51.9) | 1610 (58.5) | 1351 (53.6) | 589 (56.7) | 1167 (48.2) | 486 (57.9) | 607 (56.1) | 535 (61) |
| | Private | 2774 (46.1) | 1085 (39.4) | 1108 (44) | 423 (40.8) | 1204 (49.8) | 335 (39.9) | 462 (42.7) | 327 (37.3) |
| | Other | 124 (2.1) | 59 (2.1) | 62 (2.5) | 26 (2.5) | 49 (2) | 18 (2.1) | 13 (1.2) | 15 (1.7) |
| Complex Chronic Condition, N (%) | | 723 (12) | 278 (10.1) | 62 (2.5) | 15 (1.4) | 364 (15) | 115 (13.7) | 297 (27.4) | 148 (16.9) |
| LOS (days), Geometric Mean (SD) | | 2.2 (1.8) | 2.6 (1.8) | 1.8 (1.7) | 2.3 (1.7) | 2.2 (1.8) | 2.4 (1.8) | 3.1 (1.9) | 3.1 (1.8) |

[†] All comparisons significant at p<0.001

^{*} All comparisons significant at p<0.001 except payor (p=0.213) and CCC (p=0.059)

^{**} All comparisons significant at p<0.001 except sex (p=0.565) and CCC (p=0.347)

^{***} All comparisons significant at p<0.001 except sex (p=0.168), payor (p=0.041), and LOS (p=0.708)

Table 2. Cost, Reimbursement, and Cost Coverage Ratio (CCR) by APR-DRG Severity of Illness

| | | APR DRG Severity of Illness | | | | | |
|---------|----------------------------------|-----------------------------|---------------------|--------------------|---------------------|--------------------|----------------------|
| | | Minor | | Moderate | | Major/Extreme | |
| | | No HFNC | HFNC | No HFNC | HFNC | No HFNC | HFNC |
| Private | | | | | | | |
| | Cost, Geo Mean (95% CI) | 4230 (3085, 5800) | 6499 (4713, 8963) | 5124 (3611, 7272) | 8472 (5913, 12140) | 5122 (3722, 7049) | 10625 (7757, 14553) |
| | Reimbursement, Geo Mean (95% CI) | 5988 (4195, 8549) | 10132 (7042, 14577) | 7158 (4806, 10661) | 14359 (9504, 21694) | 7207 (4768, 10896) | 18213 (12113, 27386) |
| | CCR | 1.42 | 1.56 | 1.40 | 1.69 | 1.41 | 1.71 |
| Public | | | | | | | |
| | Cost, Geo Mean (95% CI) | 4230 (3085, 5800) | 6499 (4713, 8963) | 5124 (3611, 7272) | 8472 (5913, 12140) | 5122 (3722, 7049) | 10625 (7757, 14553) |
| | Reimbursement, Geo Mean (95% CI) | 5988 (4195, 8549) | 10132 (7042, 14577) | 7158 (4806, 10661) | 14359 (9504, 21694) | 7207 (4768, 10896) | 18213 (12113, 27386) |
| | CCR | 0.83 | 0.68 | 0.85 | 0.85 | 0.93 | 1.10 |