Surfactant therapy in more mature preterm infants with respiratory distress syndrome in Northern California from 2019 to 2023

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BACKGROUND:

- Respiratory distress syndrome (RDS) affects roughly 24,000 newborns annually in the U.S., with high morbidity and mortality rates across all gestational ages (GA).[1,2]
- Early administration of surfactant and noninvasive respiratory support is recommended to reduce complications and improve outcomes, especially for extremely to very preterm GAs.[3-6]
- RDS is more common in preterm infants born ≤28 weeks but also affects up to 20% of moderate preterm (32–34 weeks) and 8% of late preterm (34–36 weeks) infants.[7]
- Management of more mature preterm infants with RDS lacks standardized guidelines leading to variability in clinical practice.[6]
- Surfactant use is increasing in moderate to late preterm infants[8]; however, studies are needed among more mature preterm infants (32–36 weeks) with RDS as data is limited.

OBJECTIVES:

1. To characterize treatment patterns and short-term clinical outcomes among moderate and late preterm infants with RDS.
2. To evaluate differences in clinical characteristics and treatment patterns between GA groups (moderate/late) and surfactant therapy groups (yes/no).

METHODS:

- This retrospective cohort study utilized comprehensive population-based data from Kaiser Permanente Northern California (KPNC) healthcare system, which has an integrated electronic medical record system that continuously tracks infant care allowing the examination of treatment patterns over time.
- This study analyzed live births delivered or infants treated at KPNC facilities between January 1, 2019, and December 31, 2023, including moderate (32 0/7–33 6/7 weeks) and late preterm infants (34 0/7–36 6/7 weeks) with RDS (ICD-10-DX code P22.0) requiring >12 hours of respiratory support after birth.
- The cohort was divided by surfactant therapy use (yes/no) and GA (<34 weeks and ≥34 weeks).
- Chi-square tests/fisher exact tests were used to determine differences among categorical variables and student's t-tests/Mann-Whitney U tests were used to determine differences among continuous variables.

RESULTS:

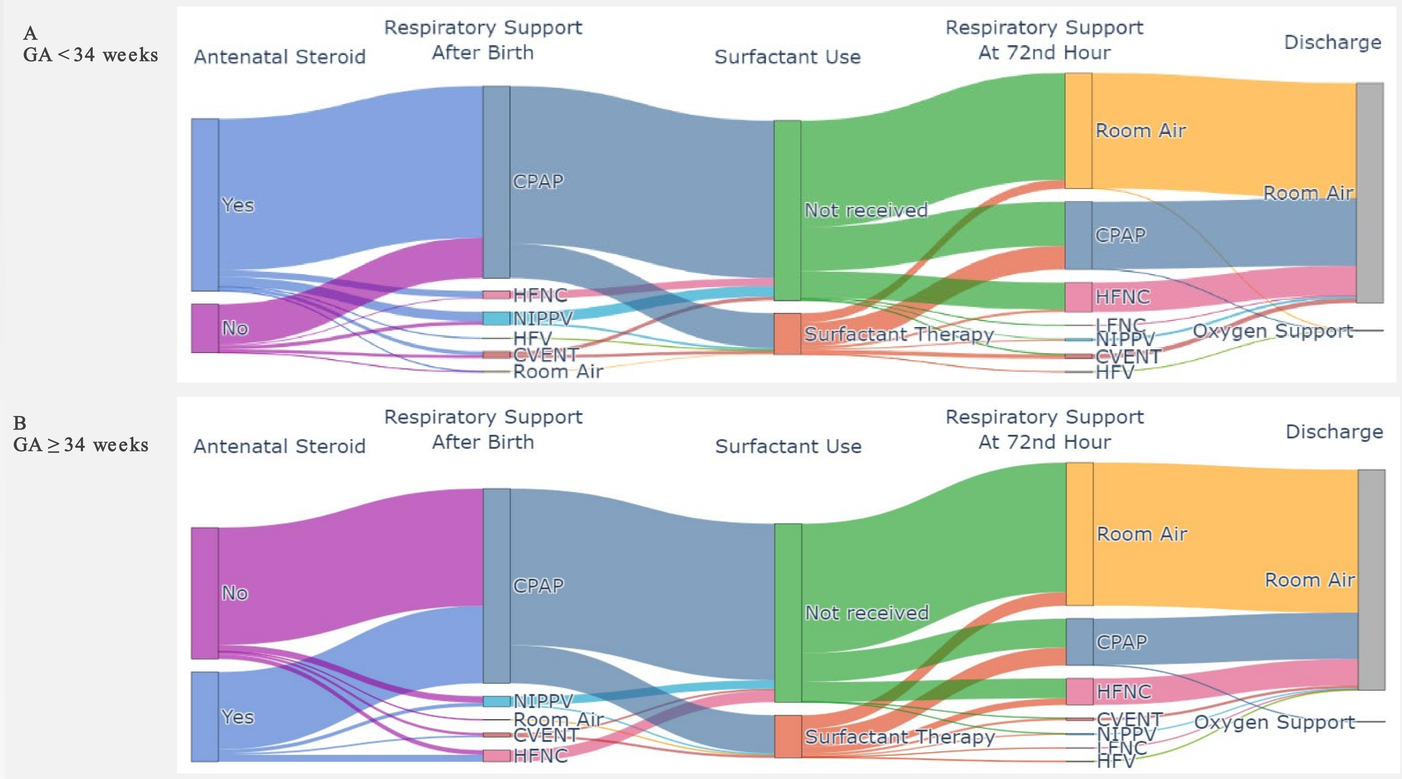
Table 1. Infant demographic and clinical characteristics by GA and surfactant administration.

Variables	Total (N=1678)	<34 weeks GA (N=724)	≥34 Weeks GA (N=954)	No Surfactant (N=1359)	Surfactant (N=319)
Female sex	685 (40.8)	303 (41.9)	382 (40.0)	573 (42.2)	112 (35.1)
Race/Ethnicity					
Asian	292 (17.4)	137 (18.9)	155 (16.2)	252 (18.5)	40 (12.5)
Black	124 (7.4)	55 (7.6)	69 (7.2)	97 (7.1)	27 (8.5)
Hispanic	378 (22.5)	177 (24.4)	201 (21.1)	303 (22.3)	75 (23.5)
Other/Unknown	256 (15.3)	114 (15.7)	142 (14.9)	206 (15.2)	50 (15.7)
White	628 (37.4)	241 (33.3)	387 (40.6)	501 (36.9)	127 (39.8)
Birth Weight Category					
Normal[a]	532 (31.7)	62 (8.6)	470 (49.3)	411 (30.2)	121 (37.9)
Mod. Low[b]	1052 (62.7)	584 (80.7)	468 (49.1)	863 (63.5)	189 (59.2)
Very Low[c]	94 (5.6)	78 (10.8)	16 (1.7)	85 (6.3)	9 (2.8)
Level of NICU at Birth					
Level 2	235 (14.0)	68 (9.4)	167 (17.5)	172 (12.7)	63 (19.7)
Level 3 Community	1443 (86.0)	656 (90.6)	787 (82.5)	1187 (87.3)	256 (80.3)

[a]>2500g; [b]1500-2499g; [c]<1500g.
*For GA, significant differences were found in race/ethnicity, birth weight category, and level of NICU birth. For surfactant use, significant differences were found in sex, birth weight category, and level of NICU at birth.

- Among 1,678 infants with RDS (moderate: 43.1%; late: 56.9%), 319 (moderate: 42.3%; late: 57.7%) received surfactant therapy. Demographic and clinical characteristics are reported in **Table 1**.

Figure 1. Treatment pattern from birth to discharge based on GA of <34 weeks (A) and ≥34 weeks (B). Respiratory support after birth represents the highest level of respiratory support 24 hours after birth or before surfactant use.



- **Figure 1** characterized the treatment journey by GA groups.
  - Antenatal steroid therapy was reported for 77.5% of mothers in the moderate preterm group versus 39.0% in the late preterm group ($p<0.01$, Figure 1).
  - Before surfactant treatment (n=319) or within 24 hours of birth (infants not treated with surfactant, n=1359), 87.5% of infants received CPAP as the highest level of support, while 2.9% breathed room air without any respiratory support.

Figure 2. Distributions of the duration from birth to surfactant administration (A) and hours of respiratory support after surfactant to discharge (B).

- Among the infants treated with surfactant, FiO_2 (52.7%±23.8% vs 53.7%±23.1%) and pCO_2 (64.0%±15.3% vs 63.9%±15.1%) before surfactant administration did not significantly differ between GA groups.
  - LISA was the most common administration method (46.4%), followed by INSURE (34.2%) and ETT (19.1%).
  - Surfactant was administered a median of 7.2 hours after birth (moderate: 5.9 hours; late: 8.4 hours).
    - Within the first two hours, 12.2% received surfactant (moderate: 18.5%; late: 7.6%; **Figure 2A**).
    - While no difference was evident in the average duration of respiratory support before surfactant administration (moderate: 11.7 hours; late: 13.9 hours), moderate preterm infants had a significantly longer duration of respiratory support after surfactant administration (7.53 days vs 4.77 days, $p<0.01$; **Figure 2B**).
- After surfactant administration or within 72 hours after birth (infants not treated with surfactant), 59.4% were able to breathe room air without any respiratory support (moderate, 52.4%; late, 64.7%), 25.3% remained on CPAP (moderate, 30.7%; late, 21.2%), and 1.8% required invasive ventilation (moderate, 2.3%; late, 1.5%).
- At discharge, only 0.3% still required oxygen support.

CONCLUSION:

This study provides a description of respiratory treatment and surfactant use in more mature preterm infants with RDS, with moderate differences in surfactant treatment by GA.

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Acknowledgements: Medical writing support was provided by Lauren Mastrogiacomo, PhD from Sixsense Strategy Group Inc., a Herspiegel company, and was funded by Chiesi USA Inc.
Funding: Financial support for the study was provided by Chiesi USA Inc.

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Presented at: Hot Topics in Neonatology 2024