RSV Among American Indian and Alaska Native Children: 2019 to 2020

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Respiratory syncytial virus (RSV) is the leading viral cause of acute lower respiratory tract infections, including bronchiolitis and pneumonia, in children under 5 years of age globally.[1] Historically, RSV-associated hospitalization rates among American Indian and Alaska Native (AI/AN) children have been among the highest in the world.[2–7] Contemporary estimates of RSV-acute respiratory infection (ARI) are needed to inform RSV prevention strategies for AI/AN children.

METHODS

We conducted active, facility-based surveillance for ARI among hospitalized AI/AN children < 5 years in Chinle, Arizona (Navajo Nation), Whiteriver, Arizona (White Mountain Apache Tribal lands), and Anchorage, and the Yukon-Kuskokwim (YK) Delta region of Alaska in November 2019 to May 2020. We identified all potentially eligible individuals through on-site surveillance. Participants who met the WHO case definition for extended severe ARI were enrolled following parental informed consent.[8] Study-specific midturbinate nasal swabs were stored in universal transport medium at −80°C until testing via single-plex reverse-transcription quantitative polymerase chain reaction (RT-qPCR) at Vanderbilt University Medical Center for RSV A and B. Demographic and clinical data were collected by questionnaire and chart review.

Overall and age-stratified incidence rates per 1000 for all-cause ARI and RSV-associated hospitalization were calculated using the Poisson distribution (SAS v9.4, Cary, NC). Numerators of enrolled children meeting the ARI case definition were adjusted to account for eligible but not enrolled cases (Supplemental Table 2). The age-stratified Indian Health Service (IHS) User Population was used as the denominator. This study was reviewed by the Centers for Disease Control and Prevention and relevant institutional review boards (IRBs) and was conducted consistent with applicable federal law and Centers for Disease Control and Prevention policy*. See Supplemental Information for additional details.

RESULTS

This study enrolled 324 children hospitalized with ARI (Chinle: 82, Whiteriver: 73, Anchorage: 33, YK Delta: 136) (Supplemental Figs 2 and 3, Supplemental Table 3 and 4). The mean age was 16.8 months in Southwest sites and 10.6 months in Alaska sites ($P < .01$). Household density was highest in YK Delta (2.4 persons per room), as was the proportion of homes without running water (35.3%).

All children enrolled had a RSV test result available; 171 (53%) tested RSV-positive. One-third of RSV-associated hospitalizations occurred in infants < 6 months old (Table 1). Among RSV-positive children, mean length of stay ranged from 3.5 days (Chinle) to 5.7 days (YK Delta) and use of supplemental oxygen ranged from 70% (Anchorage, elevation 102 feet) to 100% (Whiteriver, elevation 5290 feet). Among children < 6 months old, the annual RSV-associated hospitalization rates per 1000 children were: Anchorage 35.7 (95% confidence interval 20.4–62.6); Chinle 83.0 (52.0–132.5); Whiteriver 70.4 (36.3–136.6); and

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*See e.g., 45 C.F.R. part 46.102(l)(2).

YK Delta 132.3 (98.2–178.1). Among children < 5 years old, rates were: Anchorage 7.7 (5.3–11.1); Chinle 27.2 (21.4–34.4); Whiteriver 25.4 (18.7–34.5); and YK Delta 32.7 (26.9–39.7) (Fig 1; Supplemental Table 5).

DISCUSSION

AI/AN children in these communities experienced a high burden of RSV. Hospitalization rates among children < 5 years old were 1.7 to 7.1 times higher than recent estimates from the methodologically similar US New Vaccine Surveillance Network (NVSN).[9,10] These are the first active, population-based surveillance hospitalization data with laboratory-confirmed RSV among AI/AN children in over 15 years.

Similarities in duration of hospitalization and supplemental oxygen use compared with NVSN suggest that disease severity was similar in this population, consistent with previous findings.[4] As with prior studies, rates among AN children in Anchorage, the only urban site, were much lower than in YK Delta, the most rural, and were more similar to rates observed in NVSN.[5,9,11] This corroborates findings from other studies, implicating socioeconomic determinants of health (eg, lack of running water, household overcrowding, poor indoor air quality) as a root cause of elevated RSV hospitalizations among AI/AN children living in tribal lands.[2,6]

In this study the greatest burden of RSV was seen among full term infants < 6 months old. This underscores the importance of prevention strategies that are highly effective in early life (e.g., maternal immunization, monoclonal anti-bodies) and available to all infants. Substantial RSV burden is also seen between 6 and 36 months of life, indicating that active immunization in older infants and toddlers would also have clinical and public health value.[12]

The number of children hospitalized with ARI fell sharply after coronavirus disease 2019 (COVID) pandemic mitigation measures were implemented in spring 2020; therefore, our observations of ARI in the 2019 to 2020 season may underestimate the pre-COVID-19 rates, particularly in Alaska where the respiratory season typically extends into late April and May.

These findings show that AI/AN children continue to experience high rates of RSV-associated ARI hospitalization. Improvements in the socioeconomic determinants of health for AI/AN children and RSV-prevention products are urgently needed.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

ACKNOWLEDGMENTS

ABBREVIATIONS

AI/AN	American Indian or Alaska Native
ARI	acute respiratory infection
IHS	Indian Health Service
IRB	Institutional Review Board
NVSN	New Vaccine Surveillance Network
RSV	respiratory syncytial virus
RT-qPCR	reverse transcription quantitative polymerase chain reaction
YK	Yukon Kuskokwim

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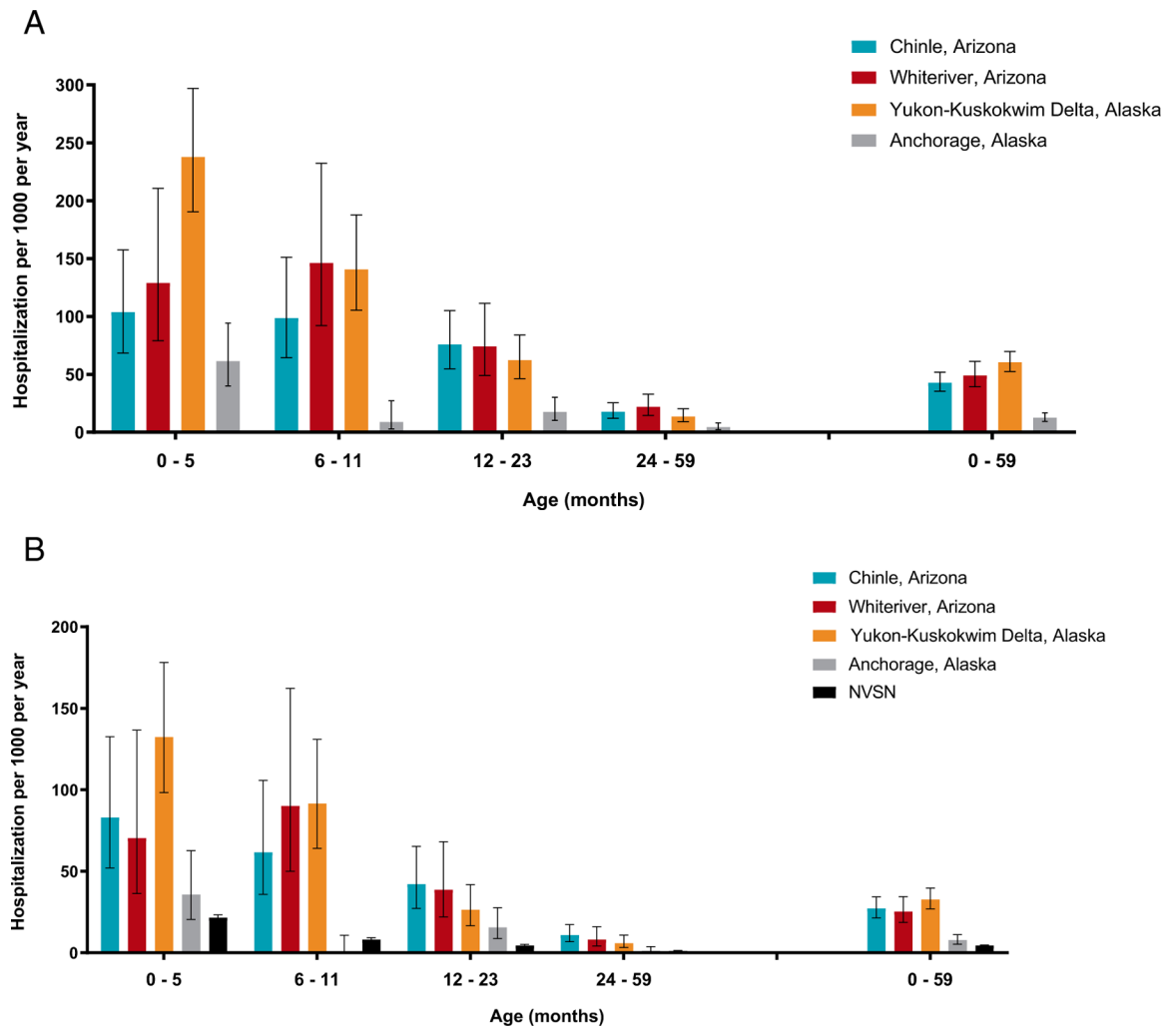
FIGURE 1.
Incidence among AI/AN children < 5 years of age of (A) all-cause acute respiratory infection (ARI) hospitalization and (B) RSV-associated ARI hospitalization, November 2019 to May 2020. NVSN for comparison.[9]

TABLE 1

Demographics and Clinical Characteristics of AI/AN Children < 5 y of Age Hospitalized With RSV-associated Acute Respiratory Infection by Site, November 2019 to May 2020

Variable[f]	Chinle, Arizona N = 50	Whiteriver, Arizona N = 32	Anchorage, Alaska N = 20	Yukon-Kuskokwim Delta, Alaska N = 69
Male, n (%)	28 (56.0)	14 (43.8)	10 (50.0)	34 (49.3)
Age in months, mean (range)	17.3 (0–54)	14.9 (0–41)	10.6 (1–54)	9.8 (0–56)
Age group (months), n (%)				
0 to <3	4 (8.0)	2 (6.3)	8 (40.0)	15 (21.7)
3 to <6	8 (16.0)	4 (12.5)	3 (15.0)	14 (20.3)
6 to <12	10 (20.0)	9 (28.1)	0	22 (31.9)
12 to <24	15 (30.0)	11 (34.4)	8 (40.0)	11 (15.9)
24 to <36	7 (14.0)	4 (12.5)	0	5 (7.3)
36 to <48	3 (6.0)	2 (6.3)	0	1 (1.5)
48 to <60	3 (6.0)	0	1 (5.0)	1 (1.5)
Other children <5 y in home, n (%)	48 (96.0)	28 (87.5)	19 (95.0)	52 (75.4)
Currently breastfed (children <2 y)[a], n (%)	10 (27.0)	5 (19.2)	6 (31.6)	23 (37.1)
Tobacco smoker in the home, n (%)	2 (4.0)	1 (3.1)	9 (45.0)	31 (44.9)
Running water in the home, n (%)	41 (82.0)	32 (100)	18 (90.0)	39 (56.5)
Any underlying condition[b], n (%)	22 (45.8)	10 (33.3)	15 (79.0)	46 (71.9)
History of prematurity (<37 wk) (children <2 y), n (%)	3 (8.1)	6 (23.1)	5 (26.3)	15 (24.2)
Any underlying condition or history of prematurity, n (%)	23 (46.9)	13 (40.6)	16 (80.0)	49 (73.1)
Received palivizumab (children <2 y)[c], n (%)	0	1 (3.9)	0	3 (4.8)
Length of hospital stay (days), mean (range)	3.5 (1–14)	4.5 (1–11)	4.3 (1–13)	5.7 (1–45)
Lowest oxygen saturation (percent)[d], mean (range)	86.2 (77–93)	83.0 (71–87)	89.1 (75–98)	89.0 (40–97)
Supplemental oxygen during hospitalization, n (%)	46 (92.0)	32 (100)	14 (70.0)	50 (72.5)
RSV subtype[e]				
RSV A	30	24	15	48
RSV B	5	1	2	12

[a] For age group restricted variables, percentages calculated out of total RSV-associated hospitalized children by age group.

[b]Underlying conditions included chronic pulmonary and/or airway, cardiac, gastrointestinal, kidney, endocrine, neurologic and/or neuromuscular, hematologic and/or oncologic, genetic and/or metabolic, or immunocompromised conditions.

[c]Received Palivizumab during the months of September 2019 through May 2020.

[d]Documented in the first 24 h of admission.

[e]Subtyping not available on all samples.

[f]Variables with missing data: other children < 5 (Chinle $n = 1$, Whiteriver $n = 1$, Anchorage $n = 1$, Yukon-Kuskokwim (YK) Delta $n = 5$); currently breastfed (Chinle $n = 1$, Whiteriver $n = 2$, Anchorage $n = 1$, YK Delta $n = 4$); smoker in home (Chinle $n = 1$, Anchorage $n = 1$, YK Delta $n = 4$); running water (Chinle $n = 1$, Anchorage $n = 1$, YK Delta $n = 4$); under-lying conditions or prematurity (YK Delta $n = 1$, Anchorage $n = 1$, YK Delta $n = 4$); supplemental oxygen (Chinle $n = 4$; Anchorage $n = 4$, YK Delta $n = 13$); oxygen saturation (Whiteriver $n = 1$, Anchorage $n = 1$, YK Delta $n = 1$); length of stay (YK Delta $n = 5$); oxygen saturation (Whiteriver $n = 1$, Anchorage $n = 1$, YK Delta $n = 1$).