Pediatric RESEARCH

COMMENT

Brief report: Acute care visits vary by race and ethnicity among publicly insured preterm infants

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Pediatric Research (2021) 90:712–716; https://doi.org/10.1038/s41390-021-01504-8

INTRODUCTION

In the United States, a history of racist policies and practices in social, economic, and political systems has resulted in an unequal distribution of resources for traditionally marginalized, non-White communities, including employment, education, wealth, and access to health care.[1] People of color visit acute care settings such as the emergency department (ED) for health care more often than other populations, likely in part due to these social factors that impact health and healthcare access.[2] Black and Hispanic populations are more likely to visit the ED in pediatric populations[3] and in the first 36 months of life.[4]

Preterm infants are at a high risk for morbidity, mortality, and increased healthcare utilization (HCU), which has important financial implications for families and healthcare systems.[5] Among this high-risk population, there are also racial and ethnic disparities in morbidity and mortality.[6,7] Although HCU varies by race and ethnicity among adults,[2] children,[3,4] and infants,[4,8] few studies exist for utilization among preterm infants.[9,10] Identifying disparities in HCU has important implications for future investigations of quality of care, severity of illness, and barriers in access to primary care. We therefore sought to investigate whether ED utilization differs by race and ethnicity among publicly insured preterm infants in a California cohort. We restricted our sample to publicly insured infants to compare infants with similar access to health care.

METHODS

We conducted a retrospective cohort study using linked birth certificates (maintained by California Vital Statistics), infant and maternal hospital discharge records, and ED visit records (maintained by the California Office of Statewide Health Planning and Development) through the first year of life for all liveborn infants born between 2011 and 2017 ($n = 3,448,707$). The dataset also includes maternal and infant demographics and health conditions from 1 year before to 1 year after birth for women and 1 year after birth for infants.

We restricted the sample to singleton liveborn infants born between 22 and 36 weeks gestational age (GA) without significant congenital anomaly diagnoses and for whom linked maternal and infant data available. Best obstetrical age was derived from birth certificate GA defined by ultrasound or last menstrual period. To ensure access to care was similar, we also restricted to publicly insured infants. We excluded infants who did not survive to the second acute care visit.

ED visits were identified from ED records linked to birth certificates. The outcome was "frequent" (≥2) acute care or ED visits (referred to as "acute care visits" for the remainder of the paper) based on a modified prior definition[4] of frequent ED visits. The prior definition specified "frequent" ED utilization to be 5 visits over 3 years, or roughly 2 per year. Given that we were limited to 1 year of follow-up data, we used two or more ED or acute care visits in 1 year as our definition of "frequent" acute care use.

We used maternal self-identification of race/ethnicity from infant birth certificates as a proxy for infant race/ethnicity including our reference group, non-Hispanic White (which we will refer to as "White"), non-Hispanic Black ("Black"), Hispanic, non-Hispanic Asian ("Asian"), and "Other" race/ethnicity, including American Indian/Alaska Native, Hawaiian/Pacific Islander, other race, >1 race, and unknown.

We constructed a Kaplan–Meier curve illustrating time to second acute care visit by race/ethnicity, performed a log-rank test for equality of survival curves, and calculated hazard ratios (HRs).

Logistic regression was used to calculate relative risks [RRs] of frequent acute care use, adjusting for the following factors associated with both race/ethnicity and infant outcomes: Model 1—unadjusted; Model 2—GA, growth (small for GA or <10th percentile for GA, appropriate for GA or 10–90th percentile for GA, and large for GA or >90th percentile for GA), sex, comorbidity, age at discharge; Model 3—additionally adjusting for maternal medical factors (maternal age, body mass index, parity, smoking, drug/alcohol use, hypertension, diabetes, mental health disorder, prenatal care); and Model 4—additionally adjusting for social factors (maternal education and WIC participation; Table 1). Methods and protocols for the study were approved by the Committee for the Protection of Human Subjects within the Health and Human Services Agency of the State of California.

RESULTS

Of 189,306 singleton infants born between 22 and 36 weeks GA without major malformations, 93,789 were publicly insured with linked data and survived to second acute care visit (Fig. 1). Demographics by race/ethnicity in this sample included 12.9% White, 67.2% Hispanic, 8.8% Black, 6.5% Asian, and 4.6% Other race. Black infants had the highest rate of acute care visits (30.1%)

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Received: 14 December 2020 Revised: 18 February 2021 Accepted: 16 March 2021
Published online: 6 May 2021

Table 1. Sample characteristics by race: births in California in 2007–2011.

	White n (%)	Hispanic n (%)	Black n (%)	Asian n (%)	Other n (%)	Total n (%)
Sample	12,106	63,073	8,240	6,089	4,281	93,789
Male infant sex[a]	6363 (52.6)	34,552 (54.8)	4,162 (50.5)	3,307 (54.3)	2,213 (51.7)	50,597 (54.0)
GA (weeks)[a]						
<32	1,317 (10.9)	7,025 (11.1)	1,453 (17.6)	711 (11.7)	585 (13.7)	11,091 (11.8)
32–36	10,789 (89.1)	56,048 (88.7)	6,787 (82.4)	5,378 (88.3)	3,696 (86.3)	82,698 (88.2)
Birthweight[a]						
SGA	1,081 (8.9)	5,449 (8.6)	1,158 (14.1)	639 (10.5)	414 (9.7)	8,741 (9.3)
AGA	9,750 (80.5)	50,671 (80.3)	6,516 (79.1)	5,028 (82.6)	3,403 (79.5)	75,368 (80.4)
LGA	1,274 (10.5)	6,952 (11.0)	566 (6.9)	422 (6.9)	464 (10.8)	9,678 (10.3)
Missing	[b]	[b]	[b]	[b]	[b]	[b]
Maternal age (years)[a]						
<18	172 (1.4)	2,234 (3.5)	231 (2.8)	72 (1.2)	101 (2.4)	2,811 (3.0)
18–34	10,072 (83.2)	49,300 (78.2)	6,779 (82.3)	4,500 (73.9)	3,465 (80.9)	74,116 (79.0)
>34	1,861 (15.4)	11,534 (18.3)	1,229 (14.9)	1,517 (24.9)	713 (16.7)	16,854 (18.0)
Missing	[b]	5 (0.0)	[b]	[b]	[b]	8 (0.0)
Maternal education (years)[a]						
<12	1,952 (16.1)	26,326 (41.7)	1,796 (21.8)	653 (10.7)	614 (14.3)	31,341 (33.4)
12	4,358 (36.0)	20,973 (33.3)	3,122 (37.9)	1,893 (31.1)	1,132 (26.4)	31,478 (33.6)
>12	5,388 (44.5)	13,704 (21.7)	3,038 (36.9)	3,240 (53.2)	1,239 (28.9)	26,609 (28.4)
Missing	408 (3.4)	2,070 (3.3)	284 (3.5)	303 (5.0)	1,296 (30.3)	4,361 (4.7)
Maternal BMI[a]						
Underweight	844 (7.0)	1,839 (2.9)	436 (5.3)	567 (9.3)	202 (4.7)	3,888 (4.2)
Normal weight	5,136 (42.4)	20,845 (33.1)	2,987 (36.3)	3,159 (51.9)	1,569 (36.7)	33,696 (35.9)
Overweight	2,536 (21.0)	17,798 (28.2)	1,844 (22.4)	1,233 (20.3)	985 (23.0)	24,396 (26.0)
Obese	2,867 (23.7)	19,370 (30.7)	2,432 (29.5)	717 (11.8)	1,231 (28.8)	26,617 (28.4)
Missing	723 (6.0)	3,221 (5.1)	541 (6.6)	413 (6.8)	294 (6.9)	5,192 (5.5)
Parity[a]						
Nulliparous	4,338 (35.8)	18,232 (28.9)	2,467 (29.9)	2,355 (38.7)	1,384 (32.3)	28,776 (30.7)
Multiparous	7,748 (64.0)	44,797 (71.0)	5,751 (8.9)	3,730 (61.3)	2,866 (4.4)	64,892 (69.2)
Missing	20 (0.2)	44 (0.1)	22 (0.3)	[b]	31 (0.7)	121 (0.1)
Maternal smoking during pregnancy[a]	3,081 (25.5)	1,830 (2.9)	1,366 (16.6)	190 (3.1)	761 (17.8)	7,228 (7.7)
Maternal alcohol use[a]	123 (1.0)	208 (0.3)	131 (1.6)	14 (0.2)	55 (1.3)	531 (0.6)
Maternal illicit drug use[a]	2,124 (17.6)	2,840 (4.5)	1,173 (14.2)	143 (2.4)	725 (16.9)	7,005 (7.5)
WIC participation[a]						
Yes	7,875 (65.1)	54,600 (86.6)	6,497 (78.9)	4,294 (70.5)	2,911 (68.0)	76,177 (81.2)
No	4,040 (33.4)	8,142 (12.9)	1,674 (20.3)	1,748 (28.7)	1,289 (30.1)	16,893 (18.0)
Unknown	191 (1.6)	331 (0.5)	69 (0.8)	47 (0.8)	81 (1.9)	719 (0.8)
Maternal hypertension[a]	2,719 (22.5)	14,783 (23.4)	2,647 (32.1)	1,192 (19.6)	1,137 (26.6)	22,478 (24.0)
Maternal DM[a]	1,779 (14.7)	12,180 (19.3)	1,152 (14.0)	1,365 (22.4)	795 (18.6)	17,271 (18.4)
Maternal mental illness[a]	2,995 (24.7)	4,457 (7.1)	1,669 (20.3)	275 (4.5)	994 (23.2)	10,390 (11.1)
Maternal prenatal care[a]						
Adequate	8,128 (67.1)	47,079 (74.6)	5,441 (66.0)	4,509 (74.1)	2,623 (61.3)	67,780 (72.3)
Inadequate	3,537 (29.2)	13,795 (21.9)	2,361 (28.7)	1,394 (22.9)	1,462 (34.2)	22,549 (24.0)
Missing	441 (3.6)	2,199 (3.5)	438 (5.3)	186 (3.1)	196 (4.6)	3,460 (3.7)
Two or more ED visits[a]	2,722 (22.5)	16,596 (26.3)	2,479 (30.1)	846 (13.9)	947 (22.1)	23,590 (25.1)

[a] $p < 0.0001$ by Chi-square test.
[b] $n < 5$.

and Asian infants had the lowest rate (13.9%, Table 1). Time to second acute care visit varied by race/ethnicity (Fig. 2, $P < 0.001$). Compared to White infants, Black and Hispanic infants were more likely to frequent the ED (HR 1.4, 95% confidence interval [CI] 1.4–1.5; HR 1.2, 95% CI 1.1–1.2) and Asian infants were less likely to frequent the ED (HR 0.6, 95% CI 0.5–0.6) at any given point during the first year of life (Fig. 2). Hispanic and Black preterm infants were more likely to have frequent acute care visits compared to White infants (unadjusted RR 1.2, 95% CI 1.1–1.2 and RR 1.3, 95% CI 1.3–1.4, respectively), even after adjusting for all covariates (RR 1.1, 95% CI 1.1–1.2 and RR 1.3, 95% CI 1.2–1.4, respectively). Asian infants were less likely to have frequent acute care visits during the first year of life compared to White infants before and after adjusting for all covariates (unadjusted RR 0.6, 95% CI 0.6–0.7; fully adjusted RR 0.7, 95% CI 0.6–0.7). Other race/ethnicity infants were not statistically different than White infants in terms of frequent

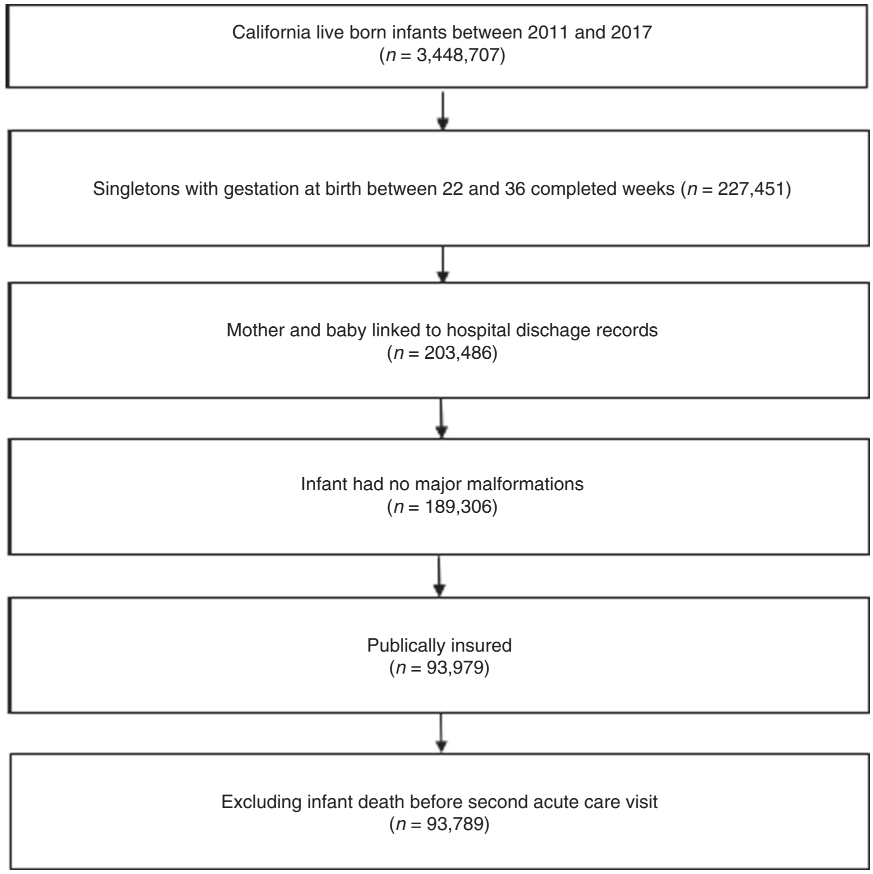

Fig. 1 Sample selection.

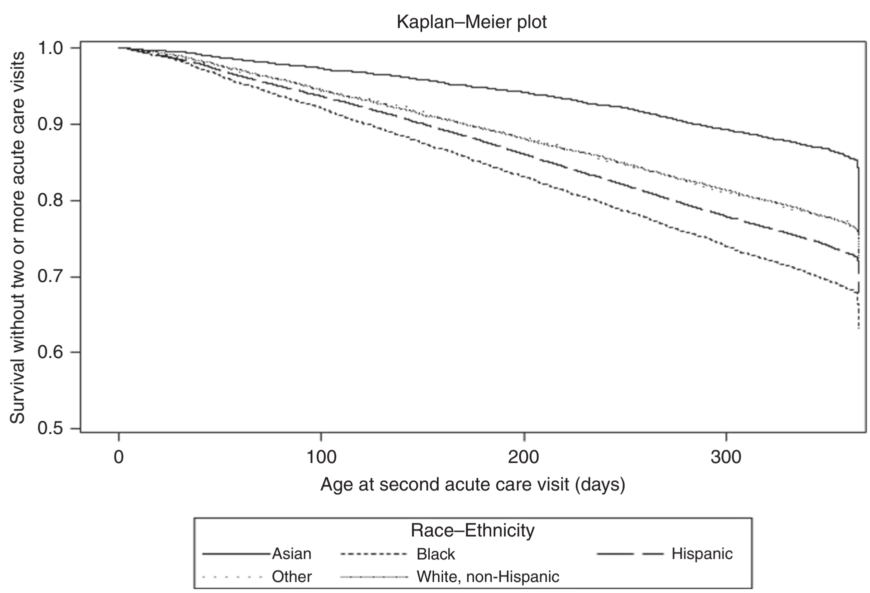

Fig. 2 Kaplan Meier: Time to second acute care visit by race/ethnicity.

acute care visits. When stratified by GA, disparities in acute care visits remained. Hispanic and Black infants born at <32 weeks were more likely to frequently visit acute care settings even after adjusting for all covariates (RR 1.3, 95% CI 1.1–1.5 and RR 1.4, 95% CI 1.2–1.7; Table 2).

DISCUSSION

Disparities in perinatal outcomes have been well described; however, there is a paucity of information on the evolution of disparities and their impact on health outcomes over time after discharge from the hospital. This is the first study of which we are

Table 2. Risk ratios for two or more acute care visits among preterm infants by race/ethnicity.

	White	Hispanic	Black	Asian	Other	Total
Infants with GA < 32 weeks	1,317	7,025	1,453	711	585	11,091
n (%)	253 (18.5)	1,710 (24.3)	391 (26.9)	99 (13.9)	114 (19.5)	2,557 (23.1)
Model 1	Reference	**1.3 (1.2, 1.5)**	**1.5 (1.2, 1.7)**	**0.7 (0.6, 0.9)**	1.0 (0.8, 1.3)	
Model 2	Reference	**1.3 (1.2, 1.5)**	**1.5 (1.3, 1.8)**	**0.7 (0.6, 0.9)**	1.1 (0.9, 1.3)	
Model 3	Reference	**1.3 (1.2, 1.5)**	**1.5 (1.3, 1.8)**	0.8 (0.7, 1.1)	1.1 (0.9, 1.4)	
Model 4	Reference	**1.3 (1.1, 1.5)**	**1.4 (1.2, 1.7)**	0.8 (0.6, 1.1)	1.2 (0.9, 1.5)	
Infants with GA 32–36 weeks	10,789	56,048	6,787	5,378	3,696	82,698
n (%)	2,479 (23.0)	14,886 (26.6)	2,088 (30.8)	747 (13.9)	833 (22.5)	21,033 (25.4)
Model 1	Reference	**1.2 (1.1, 1.2)**	**1.3 (1.3, 1.4)**	**0.6 (0.6, 0.7)**	1.0 (0.9, 1.1)	
Model 2	Reference	**1.2 (1.1, 1.2)**	**1.3 (1.3, 1.4)**	**0.6 (0.6, 0.7)**	1.0 (0.9, 1.1)	
Model 3	Reference	**1.2 (1.1, 1.2)**	**1.3 (1.3, 1.4)**	**0.6 (0.6, 0.7)**	1.0 (0.9, 1.1)	
Model 4	Reference	**1.1 (1.1, 1.2)**	**1.3 (1.2, 1.4)**	**0.6 (0.6, 0.7)**	1.0 (0.9, 1.1)	
All <37 weeks infants	12,106	63,073	8,240	6,089	4,281	93,789
n (%)	2,722 (22.5)	16,596 (26.3)	2,479 (30.1)	846 (13.9)	947 (22.1)	23,590 (25.2)
Model 1	Reference	**1.2 (1.1, 1.2)**	**1.3 (1.3, 1.4)**	**0.6 (0.6, 0.7)**	1.0 (0.9, 1.1)	
Model 2	Reference	**1.2 (1.1, 1.2)**	**1.4 (1.3, 1.4)**	**0.6 (0.6, 0.7)**	1.0 (0.9, 1.1)	
Model 3	Reference	**1.2 (1.1, 1.2)**	**1.4 (1.3, 1.4)**	**0.7 (0.6, 0.7)**	1.0 (0.9, 1.1)	
Model 4	Reference	**1.1 (1.1, 1.2)**	**1.3 (1.2, 1.4)**	**0.7 (0.6, 0.7)**	1.0 (0.9, 1.1)	

Values in bold type denote statistical signficance for HR with 95% CI ($p < 0.01$).
Model 1: Unadjusted.
Model 2: Adjusted for GA, growth (small for GA, average GA, large for GA), sex, infant morbidity (severe intraventricular hemorrhage, respiratory distress syndrome, bronchopulmonary dysplasia, necrotizing enterocolitis, patent ductus arteriousus, retinopathy of prematurity, periventricular hemorrhage), and age at discharge.
Model 3: Additionally adjusted for maternal medical factors: maternal age, body mass index, parity, smoking, drug/alcohol use, hypertension, diabetes, mental health disorder, and prenatal care.
Model 4: Additionally adjusted for maternal education and Special Supplemental Nutrition Program for Women, Infants, and Children participation.

aware to find racial/ethnic disparities in acute care utilization, including ED visits over the first year of life among preterm infants. In this study of over 90,000 publicly insured infants, we found that Black and Hispanic infants were more likely to utilize acute care multiple times at any given time in the first year of life compared to White infants. Our findings are consistent with prior studies of other populations,[2–4,8] have important health and financial implications, and should prompt investigation of disparities in discharge readiness, discharge education, and access to resources and primary care after discharge.

Our findings are consistent with previous literature in different cohorts including adults and children.[2,3] While one study of preterm infants did not find racial and ethnic disparities in high clinic use,[11] the outcome included multiple types of visits including well child checks, subspecialty, and ED visits. Our study was restricted to publicly insured infants to compare infants with similar access to care and additionally controlled for social factors including WIC use as a proxy for income and maternal education. Despite restricting to publicly insured infants and controlling for social factors, Black and Hispanic infants were still more likely to frequently utilize acute care, which is worrisome for inadequate access to primary care and/or increased severity of illness. Recent studies describe disparities in markers of illness severity where Black infants were at higher risk for persistent respiratory morbidities[12] and post-discharge mortality[7] and Black and Hispanic preterm infants were more likely to be readmitted after discharge.[7] Unfortunately, this study did not capture more specific illness severity indicators, visit diagnoses, proportion of preventable and nonurgent visits, nor financial or geographic barriers to primary care.

In our study, Asian infants were less likely to be seen frequently in acute care settings as demonstrated previously.[13] We hesitate to draw conclusions for this ethnically heterogeneous group with heterogeneous HCU patterns. Future studies should include ethnic subgroups to better characterize patterns in HCU.

A notable limitation related to the OSHPD dataset is that acute care visits and emergency visits are indistinguishable. Information regarding frequency of ED visits versus acute care visits and timing of visits would be more specific and informative. Our findings did not change after adjusting for our covariates, suggesting our covariates did not contribute significantly to detected disparities. We suspect structural racism and social determinants of health factors that impact health and access to health care contribute to disparities in HCU but were not available in our dataset. For example, community level poverty has been associated with increased infant HCU.[14]

In a diverse population of infants born preterm, we found disparities in acute care utilization including ED visits. Black and Hispanic infants were more likely to be seen frequently in acute care settings compared to White infants. Future work should further identify etiologies and interventions to reduce disparate outcomes.

ACKNOWLEDGEMENTS

This study was funded by the California Preterm Birth Initiative (PPTBi-CA). M.S.P. is also supported by an AHRQ career development grant (K12HS026383), and National Center for Advancing Translational Sciences grant (KL2TR001870).

AUTHOR CONTRIBUTIONS

K.L.K. conceptualized and designed the study, drafted the initial manuscript, and revised the manuscript. M.S.P. supervised the design and review process as well as edited the manuscript. R.J.B. analyzed the data and edited the manuscript. E.E.R., M.A.S., and L.L.J.-P. substantially contributed to the study conception and design and edited the manuscript. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

ADDITIONAL INFORMATION

Competing interests: The authors declare no competing interests.

Consent statement: Patient consent was not required for this retrospective study with de-identified data, confirmed by the UCSF IRB.

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