Birth Hospital Length of Stay and Rehospitalization During COVID-19

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abstract

OBJECTIVES: To determine if birth hospitalization length of stay (LOS) and infant rehospitalization changed during the coronavirus disease 2019 (COVID-19) era among healthy, term infants.

METHODS: Retrospective cohort study using Epic's Cosmos data from 35 health systems of term infants discharged ≤5 days of birth. Short birth hospitalization LOS (vaginal birth <2 midnights; cesarean birth <3 midnights) and, secondarily, infant rehospitalization ≤7 days after birth hospitalization discharge were compared between the COVID-19 (March 1 to August 31, 2020) and prepandemic eras (March 1 to August 31, 2017, 2018, 2019). Mixed-effects models were used to estimate adjusted odds ratios (aORs) comparing the eras.

RESULTS: Among 202 385 infants (57 110 from the COVID-19 era), short birth hospitalization LOS increased from 28.5% to 43.0% for all births (vaginal: 25.6% to 39.3%, cesarean: 40.1% to 61.0%) during the pandemic and persisted after multivariable adjustment (all: aOR 2.30, 95% confidence interval [CI] 2.25–2.36; vaginal: aOR 2.12, 95% CI 2.06–2.18; cesarean: aOR 3.01, 95% CI 2.87–3.15). Despite shorter LOS, infant rehospitalizations decreased slightly during the pandemic (1.2% to 1.1%); results were similar in adjusted analysis (all: aOR 0.83, 95% CI 0.76–0.92; vaginal: aOR 0.82, 95% CI 0.74–0.91; cesarean: aOR 0.87, 95% CI 0.69–1.10). There was no change in the proportion of rehospitalization diagnoses between eras.

CONCLUSIONS: Short infant LOS was 51% more common in the COVID-19 era, yet infant rehospitalization within a week did not increase. This natural experiment suggests shorter birth hospitalization LOS among family- and clinician-selected, healthy term infants may be safe with respect to infant rehospitalization, although examination of additional outcomes is needed.

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WHAT'S KNOWN ON THIS SUBJECT: Randomized trials and epidemiological studies of early discharge after birth among healthy term infants have inconsistent findings. The implications of disruptions in health care delivery from the COVID-19 pandemic on infant birth hospitalization length of stay and rehospitalization are unknown.

WHAT THIS STUDY ADDS: In the context of the natural experiment created by the COVID-19 pandemic, this study illustrates that self- and clinician-selected healthy, term infants were discharged from the hospital earlier without a detectable increase in infant rehospitalization.

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The coronavirus disease 2019 (COVID-19) pandemic has affected many aspects of life and health care delivery, including childbirth. To limit transmission of the virus, hospitals implemented screening protocols; minimized hospital contact; modified visitation policies, including limiting to one or no support people during labor and delivery; expedited discharge planning; and increased telehealth encounters.[1–3] The impact of these policies on infant outcomes is unknown.

One unforeseen potential change in the care of infants during the COVID-19 pandemic is earlier discharges among healthy, term infants, although the impact of such changes is unclear. Researchers have evaluated effects of legislation requiring at least 48-hour postpartum stays and early postnatal discharge protocols, findings of which have been inconsistent regarding infant rehospitalization.[4–9] Authors of a recent Cochrane review found that early postnatal discharge slightly increases infant readmission within 28 days, although after removing randomized controlled trials (RCTs) with high levels of missing data, there was no effect.[10] The American Academy of Pediatrics discharge recommendations for healthy, term infants are not based on time but on individual characteristics, including maternal and infant health, home support systems, and access to follow-up care,[11] which may have been differentially assessed during the COVID-19 pandemic. However, data showing the degree to which duration of infant birth hospitalizations changed during the pandemic and downstream effects on rehospitalization are unknown.

Thus, we had 2 objectives in this study: (1) to determine if birth hospitalization length of stay (LOS) among healthy, term infants differed during COVID-19 and prepandemic eras (analogous months, 3 previous years); and (2) to determine if the frequency of infant rehospitalization within 7 days of birth hospitalization discharge changed during COVID-19. Beyond exploring how the pandemic affected infant hospital care, this study provides a contemporary assessment of infants selected by families and clinicians for earlier discharge and contributes to discussions surrounding hospital discharge policies, which may influence birth hospitalization costs and personalization of mother-infant care.

METHODS

Study Population

We performed a retrospective cohort study using Epic Systems Corporation's Cosmos research platform. Cosmos is an Epic application that provides a framework to aggregate electronic health record (EHR) data submitted voluntarily by health systems for research. At the time of this study there were 100 health systems participating in Cosmos, contributing >50 million patients. Patients with records at multiple, different Cosmos-participating health care organizations are deduplicated. The term "health system" indicates an entity that shares a single EHR, and often encompasses a variety of hospitals and departments.

Health systems send a Health Insurance Portability and Accountability Act–defined limited data set from their EHR to Cosmos containing discrete data elements such as demographic information, International Classification of Diseases codes, Current Procedural Terminology codes, medications, and laboratory values. After a health system joins Cosmos, current and future data are included in the research platform and previous data can be backfilled.

We included 41 health systems with 3 years of prepandemic data (2017–2019) as of the October 20, 2020, data break. Within each health system, infant records were identified, and variables of interest were assessed for missingness. Health systems with rates of missing maternal data greater than fifth percentile (>41.5%) were excluded, because these health systems likely employed retrospective documentation workflows and did not directly document birth encounters in Epic. We excluded 6 health systems because they lacked a department with at least 100 births. Included infants were term (37–44 weeks' gestation), healthy (discharged ≤5 days of birth), singletons who were born between March 1 and August 31 of 2017, 2018, 2019, and 2020, to control for seasonal differences. The institutional review board of the Children's Hospital of Philadelphia deemed this study nonhuman subjects research (IRB 21-018576).

Outcomes and Variables

The primary outcome was short birth hospitalizations, defined as <2 midnights for vaginal deliveries and <3 midnights for cesarean deliveries. Because time of birth is redacted in the Cosmos research platform to reduce re-identifiability of patients, LOS in midnights was extracted as an integer. The secondary outcome was all-cause infant rehospitalization ≤7 days after birth hospitalization discharge captured within the Cosmos research platform.

Included maternal characteristics were age, race and ethnicity, insurance (for the birth hospitalization encounter), smoking status, first trimester BMI, COVID-19 status based on previous COVID-19 diagnosis or positive severe acute respiratory syndrome coronavirus 2 nucleic acid amplification test during the birth hospitalization, and mode of delivery. First trimester BMI was recorded as the earliest BMI during the first trimester; when not available, it was calculated by subtracting the recommended weight gain during pregnancy[12] from the earliest weight. *International Classification of Diseases, Tenth Revision, Clinical Modification* (ICD-10-CM) codes were used to identify patients with hypertension (chronic hypertension and hypertensive disorders of pregnancy) and diabetes (preexisting and gestational) (ICD-10-CM codes in Supplemental Table 3). Infant variables were gestational age, sex, small for gestational age (SGA) or large for gestational age (LGA) (defined as <10th percentile [SGA] and >90th percentile for gestational age [LGA], respectively[13]), percentage weight loss at discharge (calculated as [birth weight − weight at discharge]/birth weight), age at rehospitalization, and rehospitalization LOS. ICD-10-CM codes were used to identify infant birth hospitalization diagnoses (hypoglycemia and jaundice) and rehospitalization diagnoses (dehydration, hypothermia, infection, jaundice, tachypnea, and other) (ICD-10-CM codes in Supplemental Table 3).

Area-level variables included urbanicity, census region, ZIP code, and the overall social vulnerability index (SVI).[14] We used the SVI from patient's home ZIP code as a proxy for social context. The SVI includes indicators of socioeconomic status, household composition and disability, minority status, and language. For each ZIP code, the census ZIP code tabulation areas were employed to create a weighted average of the composite SVI scores across all census tracts overlapping the ZIP code on the basis of relative population. Mapping of ZIP codes to rural–urban commuting area codes was obtained from the United States Department of Agriculture.[15] Rural–urban commuting area codes 1 to 3 were considered urban.

Statistical Analysis

Patient characteristics between the prepandemic (2017–2019) and COVID-19 (2020) eras were compared in bivariate analysis by using two-sample *t* tests for continuous variables and χ^2 tests for categorical variables. We chose to additionally quantify dissimilarities between eras using standardized differences, which compares the proportions (formulated as a series of one-versus-rest comparisons for categorical variables) in units of the pooled standard deviation.[16] A standardized difference of >0.1 indicates imbalance between groups.[17] Although small dissimilarities between populations may result in statistical significance (small *P* values) when using *t* tests and χ^2 tests with large sample sizes, standardized differences are not influenced by sample size and have been used to assess baseline differences between groups in cohort large studies.[18–22] Nonetheless, for comparability with the literature, we also present *P* values. Given preexisting LOS differences after vaginal and cesarean deliveries, descriptive analyses were completed for the whole cohort and stratified by mode of delivery.

To assess associations of the COVID-19 era with short birth hospitalization LOS and infant rehospitalization, we used generalized linear mixed-effects models adjusting for maternal age, race and ethnicity, first trimester BMI, insurance, smoking status, hypertension, diabetes, infant gestational age, infant sex, SGA and LGA, hyperbilirubinemia and hypoglycemia during the birth hospitalization, percent weight loss at discharge, and ZIP code–associated SVI; models included hospital system as a random intercept. The infant rehospitalization model also included short birth hospitalization LOS. Race and ethnicity were included in the models on the basis of previous research showing differences in rehospitalization by race and ethnicity.[6,23] We explored whether the effect of short birth hospitalization LOS and rehospitalization differed between eras with an interaction term. In a more granular, secondary analysis, adjusting for the covariates in the primary model as well as era, we analyzed birth hospitalization LOS using the number of midnights before discharge and associations with infant rehospitalization. Models were run on the entire cohort and stratified by mode of delivery. To evaluate if indications for rehospitalization changed in the COVID-19 era, we compared the proportion of rehospitalization diagnoses between eras.

We completed 2 sensitivity analyses: (1) assessing the primary and secondary outcomes by calculating birth hospitalization LOS using hours after birth, which was determined by using the proxy of vitamin K or erythromycin administration for time of birth and time of discharge, which is a discrete variable in Cosmos and available for a subset of patients; and (2) examining the secondary outcome of infant rehospitalization within 14 days of birth.

Analysis was completed by using Python v.3.8.5 (numpy v.1.19.1, pandas v.1.0.5, scipy v.1.5.0) (Python Software Foundation) and R 3.6.3 using the tidyverse and lme4 packages.[24–26]

RESULTS

Included infants were born across 35 health systems, with a median of

2 departments per health system (range 1–11) and departmental median of 700 births per year (range 104–4901). During the study period, 202 385 infants met inclusion criteria, of which 145 275 (71.8%) were born in the prepandemic era and 57 110 (28.2%) in the COVID-19 era (Fig 1). In bivariate analysis, patient characteristics did not differ substantially (standardized differences <0.1), except for percent weight loss at discharge, which was less in the COVID-19 era, and the proportion with short LOS, which increased (Table 1). In Supplemental Tables 4 and 5 we report patient characteristics stratified by mode of delivery. Infants rehospitalized in the COVID-19 era differed from the prepandemic era with respect to a few characteristics: infants had a lower average percentage weight loss at discharge; a lower proportion lived in the western region; and a higher proportion were non-Hispanic Black, diagnosed with jaundice during the birth hospitalization, and had a short birth hospitalization LOS (Table 2). In the COVID-19 era, 1.6% (n = 886) of birth parents were COVID-19 positive at the time of delivery.

There was a substantial increase in short birth hospitalization LOS from 28.5% to 43.0% for all births (standardized difference = 0.306), 25.6% to 39.3% for vaginal (standardized difference = 0.297), and 40.1% to 61.0% for cesarean (standardized difference = 0.428). This difference reflects an increase in vaginal births discharged with a LOS of 1 midnight between eras (25.4% to 39.2%) and decline in 2 midnight LOS. Similarly, there was a 19% increase in 2 midnight LOS for cesarean deliveries and reductions of 3 and 4 midnight LOS stays (Supplemental Table 6). Association between the COVID-19 era and short birth hospitalization LOS persisted after multivariable adjustment for all (adjusted odds ratio [aOR] 2.30, 95% confidence interval [CI] 2.25–2.36), vaginal (aOR 2.12, 95% CI 2.06–2.18), and cesarean births (aOR 3.01, 95% CI 2.87–3.15) (Fig 2A).

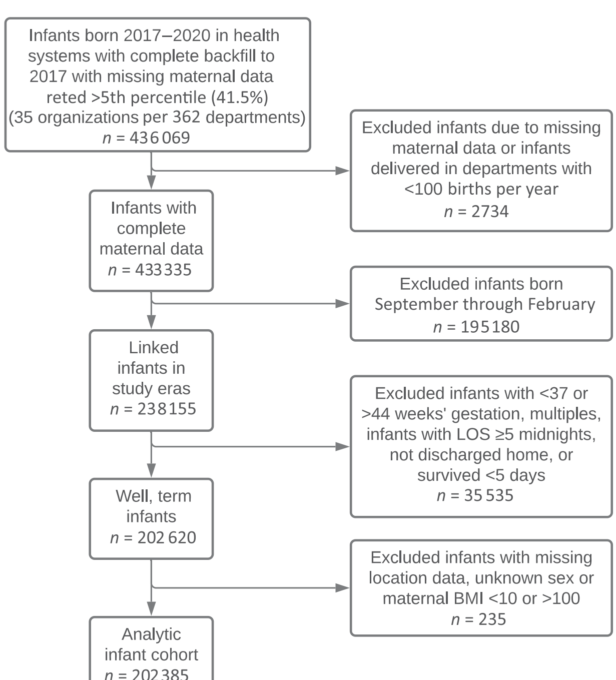

FIGURE 1
Cohort identification flow diagram.

Despite shorter LOS, frequency of infant rehospitalization within 7 days of discharge did not increase during the pandemic (1.2% to 1.1%, standardized difference = −0.016). Results were similar in adjusted analysis (all births aOR 0.83, 95% CI 0.76–0.92; vaginal births aOR 0.82, 95% CI 0.74–0.91; cesarean births, aOR 0.87, 95% CI 0.69–1.10) (Fig 2B). The association between short birth hospitalization LOS and infant rehospitalization did not differ significantly between eras (interaction P value for all births, P = .13; vaginal births, P = .14; cesarean births, P = .51). There was no change in the relative proportion of rehospitalization diagnoses between eras (Fig 3). In secondary analysis, regardless of mode of delivery, compared with infants with LOS of 2 midnights, the adjusted odds of rehospitalization were higher among all infants (regardless of era) with a birth hospitalization LOS of 0 midnights (n = 13; aOR 3.89, 95% CI 2.23–6.77), and among infants born via cesarean with a birth hospitalization of 1 midnight (n = 33; aOR 6.34, 95% CI 4.19–9.59) (Supplemental Table 7). Study findings were unchanged in the sensitivity analyses.

DISCUSSION

In this large, contemporary observational study during the natural experiment created by the COVID-19 pandemic, we found a substantial increase in short birth hospitalization LOS among healthy, term infants, with no associated increase in rehospitalization within 7 days of birth hospitalization discharge. The LOS changes were driven by the increase in infants born vaginally discharged after 1 midnight and those born via cesarean discharged after 2 midnights. These findings suggest that shared decision-making between families and

TABLE 1 Patient Characteristics in the Prepandemic and COVID-19 Eras

Characteristics	Prepandemic Era, n = 145 275 (71.8%), n (%)	COVID-19 Era, n = 57 110 (28.2%), n (%)	Standardized Difference	P
Maternal characteristics				
Mode of delivery				<.001
Vaginal	102 352 (70.5)	40 133 (70.3)	−0.004	
Cesarean	36 253 (25.0)	13 624 (23.9)	−0.026	
Unknown	6670 (4.6)	3353 (5.9)	0.058	
Maternal race and ethnicity				< .001
Non-Hispanic White	63 480 (43.7)	24 544 (43.0)	−0.015	
Non-Hispanic Black	21 196 (14.6)	8842 (15.5)	0.025	
Hispanic	20 328 (14.0)	8792 (15.4)	0.040	
Other	12 350 (8.5)	4848 (8.5)	0.000	
Unknown	27 921 (19.2)	10 084 (17.7)	−0.040	
Insurance				<.001
Private	105 981 (73.0)	42 896 (75.1)	0.049	
Public	34 893 (24.0)	12 564 (22.0)	−0.048	
Self-pay	4402 (3.0)	1650 (2.9)	0.008	
Maternal BMI				<.001
<18.5	5373 (3.7)	1941 (3.4)	−0.016	
18.5 to <25	62 762 (43.2)	23 530 (41.2)	−0.041	
25 to <30	38 157 (26.3)	15 193 (26.6)	0.008	
30 to <35	18 890 (13.0)	7840 (13.7)	0.021	
>35	13 813 (9.5)	6107 (10.7)	0.039	
Unknown	6281 (4.3)	2499 (4.4)	0.003	
Smoking status				<.001
Never smoker	100 291 (69.0)	41 555 (72.8)	0.082	
Former smoker	22 620 (15.6)	9062 (15.9)	0.008	
Current smoker	10 849 (7.5)	3167 (5.5)	−0.078	
Unknown	11 515 (7.9)	3326 (5.8)	−0.083	
Maternal age, mean (SD), y	28.8 (5.7)	29.0 (5.7)	0.036	<.001
Chronic diabetes	2370 (1.6)	997 (1.7)	0.009	.07
Chronic hypertension	6735 (4.6)	3141 (5.5)	0.039	<.001
Gestational diabetes	11 789 (8.1)	4839 (8.5)	0.013	.008
Gestational hypertension	19 119 (13.2)	8245 (14.4)	0.037	<.001
Preeclampsia, eclampsia	7133 (4.9)	3067 (5.4)	0.021	<.001
HELLP	184 (0.1)	55 (0.1)	−0.009	.09
Previous cesarean delivery	6944 (4.8)	3500 (6.1)	0.059	<.001
Region				<.001
Midwest	39 223 (27.0)	14 588 (25.5)	−0.033	
Northeast	18 605 (12.8)	8366 (14.6)	0.054	
South	47 877 (33.0)	20 206 (35.4)	0.051	
West	39 570 (27.2)	13 950 (24.4)	−0.064	
Urban	129 205 (88.9)	50 622 (88.6)	−0.009	.06
Overall SVI, mean (SD)	0.492 (0.210)	0.499 (0.208)	0.031	.031
Infant characteristics				
Gestational age, mean (SD), wk	39.3 (1.05)	39.3 (1.04)	−0.057	<.001
Birth wt, mean (SD), kg	3.38 (0.45)	3.37 (0.45)	−0.013	.007
Birth wt for gestational age				.03
SGA	9540 (6.6)	3654 (6.4)	−0.007	
LGA	10 517 (7.2)	4305 (7.5)	0.011	
Male	73 999 (50.9)	28 968 (50.7)	−0.004	.39
Jaundice during birth hospitalization	31 418 (21.6)	13 723 (24.0)	0.057	<.001
Hypoglycemia during birth hospitalization	10 715 (7.4)	4953 (8.7)	0.048	<.001
Percentage wt loss at discharge, mean (SD)	4.7 (3.0)	4.4 (2.7)	−0.129	<.001
Short birth hospitalization LOS	41 355 (28.5)	24 530 (43.0)	0.306	<.001

HELLP, hemolysis, elevated liver enzymes, low platelet count syndrome.

clinicians, as was likely the case during COVID-19, resulted in safe earlier discharge with respect to infant hospitalization.

The pandemic changed health care delivery across all settings. In the hospital, COVID-19 may have influenced clinical practices and associated decision-making as well as shifting hospital-based services to the home. For example, literature published before COVID-19 reported

TABLE 2 Patients Characteristics of Infants Rehospitalized Within 7 Days of Birth Hospitalization Discharge

Characteristics	Prepandemic Era, n = 145 275 (71.8%), n (%)	COVID-19 Era, n = 57 110 (28.2%), n (%)	Standardized Difference	P
Rehospitalized within 7 d of discharge	1811 (1.20)	613 (1.10)	−0.016	.001
Maternal characteristics				
Mode of delivery				.28
Vaginal	1453 (80.2)	476 (77.7)	−0.063	
Cesarean	296 (16.3)	109 (17.8)	0.038	
Unknown	62 (3.4)	28 (4.6)	0.058	
Maternal race and ethnicity				.004
Non-Hispanic White	834 (46.1)	262 (42.7)	−0.067	
Non-Hispanic Black	158 (8.7)	84 (13.7)	0.158	
Hispanic	349 (19.3)	120 (19.6)	0.008	
Other	207 (11.4)	75 (12.2)	0.025	
Unknown	263 (14.5)	72 (11.7)	−0.082	
Insurance				.83
Private	1283 (70.8)	442 (72.1)	0.029	
Public	477 (26.3)	155 (25.3)	−0.024	
Self-pay	51 (2.8)	16 (2.6)	−0.013	
Maternal BMI				.79
<18.5	58 (3.2)	17 (2.8)	−0.025	
18.5 to <25	674 (37.2)	220 (35.9)	−0.028	
25 to <30	490 (27.1)	167 (27.2)	0.004	
30 to <35	281 (15.5)	90 (14.7)	−0.023	
>35	216 (11.9)	86 (14.0)	0.063	
Unknown	92 (5.1)	33 (5.4)	0.014	
Smoking status				.55
Never smoker	1289 (71.2)	445 (72.6)	0.032	
Former smoker	291 (16.1)	99 (16.2)	0.002	
Current smoker	118 (6.5)	39 (4.9)	−0.070	
Unknown	113 (6.2)	39 (6.4)	0.005	
Maternal age, mean (SD), y	28.9 (5.7)	28.9 (5.8)	0.000	.99
Chronic diabetes	57 (3.1)	19 (3.1)	−0.003	.94
Chronic hypertension	110 (6.1)	43 (7.0)	0.038	.46
Gestational diabetes	206 (11.4)	72 (11.7)	0.012	.86
Gestational hypertension	395 (21.8)	131 (21.4)	−0.011	.86
Preeclampsia, eclampsia	176 (9.7)	50 (8.2)	−0.055	.29
HELLP	2 (0.1)	0 (0)	−0.047	.99
Previous cesarean delivery	62 (3.4)	23 (3.8)	0.018	.80
Region				.04
Midwest	482 (26.6)	183 (29.9)	0.072	
Northeast	178 (9.8)	56 (9.1)	−0.024	
South	401 (22.1)	157 (25.6)	0.081	
West	750 (41.4)	217 (35.4)	−0.124	
Urban	1610 (88.9)	557 (90.9)	0.065	.20
Overall SVI, mean (SD)	0.503 (0.204)	0.503 (0.200)	0.001	.98
Infant characteristics				
Gestational age, mean (SD), wk	38.8 (1.14)	38.7 (1.11)	−0.027	.56
Birth wt, mean (SD), kg	3.34 (0.47)	3.35 (0.46)	0.019	.68
Birth wt for gestational age				.69
SGA	103 (5.7)	30 (4.9)	−0.035	
LGA	174 (9.6)	63 (10.3)	0.022	
Male	990 (54.7)	332 (54.2)	−0.010	.86
Jaundice during birth hospitalization	682 (37.7)	281 (45.8)	0.166	<.001
Hypoglycemia during birth hospitalization	212 (11.7)	80 (13.1)	0.041	.42
Percentage wt loss at discharge, mean (SD)	5.03 (3.16)	4.56 (3.15)	−0.150	.001
Short birth hospitalization LOS	479 (26.4)	228 (37.2)	0.232	<.001
Rehospitalization characteristics (among those rehospitalized)				
Age at rehospitalization, days, mean (SD)	4.98 (1.74)	4.85 (1.69)	−0.075	.11
Rehospitalization LOS, days, mean (SD)	1.90 (3.89)	1.55 (4.05)	−0.088	.06

HELLP, hemolysis, elevated liver enzymes, low platelet count syndrome.

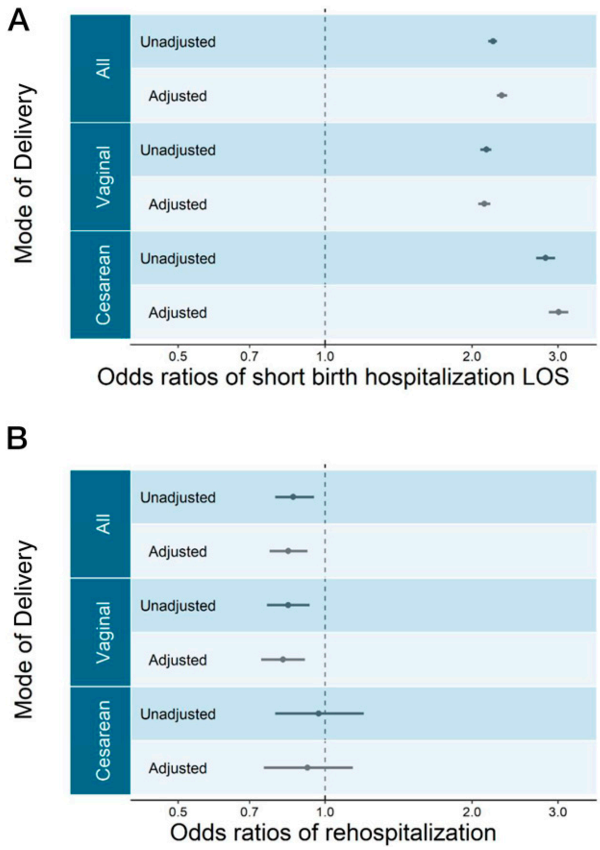

FIGURE 2
Associations between the COVID-19 era and short birth hospitalization LOS (A) and infant rehospitalization within 7 days of birth hospitalization discharge (B).

that treating term infants with jaundice before reaching the recommended treatment threshold prevents rehospitalization.[27] Additionally, there is emerging evidence supporting jaundice treatment at home.[28] Increased use of these practices during the pandemic may have facilitated earlier discharge and decreased rehospitalization. Outpatient care also changed with rapid adoption and expansion of telehealth.[29,30] Although it is not known how thresholds to seek care and criteria for admission changed during the pandemic, telehealth may decrease emergency department use and lead to changes in rehospitalization rates.[30]

Shorter hospitalizations may have led to decreased access and support from ancillary services, including lactation support.[31] One Italian study reported lower rates of exclusive breastfeeding during COVID-19,[32] whereas a study from Belgium reported the majority (>90%) of women said the pandemic did not affect breastfeeding.[33] Additional data quantifying how postpartum and postdischarge services for infants and their parents, such as lactation support, changed during COVID-19 era have yet to be published.

Early postnatal discharge of healthy, term infants has been a long-standing area of inquiry. Previous research, including systematic reviews, have reported varied results with respect to early discharge and infant rehospitalization.[10,34–36] A recent meta-analysis, which included RCTs and quasi-experimental studies, and Cochrane review both report an association between early hospital discharge (<48 hours for vaginal and <96 hours for cesarean) and infant readmission within 28 days.[10,36] However, findings from both studies are driven (87.6% and 74% weight, respectively) by a single-center Egyptian RCT.[37] In general, findings from RCTs are limited by the application of highly restrictive criteria for early discharge, inadequate sample sizes to detect clinical effects, and variation in postdischarge services.[10,34] Variation in postdischarge contexts is particularly important and may threaten generalizability given differences in health care coverage, systems, and care delivery between countries and across states.

The American Academy of Pediatrics' Committee on Fetus and Newborn statement on hospital stay for healthy, term newborns highlights 17 discharge criteria, which include assessments of maternal and infant health, home support systems, and access to follow-up care.[11] Discharge decision-making is complex, and determining discharge readiness requires the input of and assessment by multiple stakeholders including the family, pediatric clinician, and obstetric clinician. A large, prospective cohort study reported 17% of mother-infant dyads were unready for discharge on the day of discharge, and the majority of such determinations were based on the maternal assessment.[38] Among those who were not ready, there was higher health care use (eg, calls, visits) after discharge.[39] During COVID-19, it is possible more families felt "ready" for discharge sooner given the desire to minimize COVID-19 exposure. The lack of an association between the increased

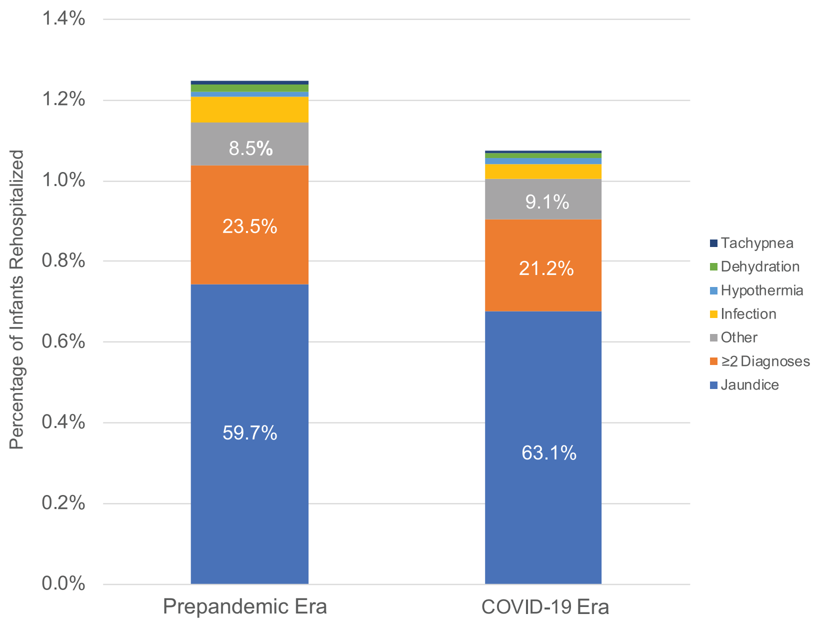

FIGURE 3
Proportion of infants rehospitalized and associated rehospitalization diagnoses. The proportion of infants diagnosed with only infection was 5.1% in the prepandemic era and 3.4% in the COVID-19 era. The proportion of infants diagnosed with only hypothermia was 0.9% in the prepandemic era and 1.5% in the COVID-19 era. The proportion of infants diagnosed with only dehydration was 1.5% in the prepandemic era and 1.1% in the COVID-19 era. The proportion of infants diagnosed with only tachypnea was 0.6% in the prepandemic era and 0.5% in the COVID-19 era. The category ≥2 diagnoses includes any 2 of the named diagnoses (jaundice, infection, hypothermia, dehydration, or tachypnea).

proportion of short birth hospitalization LOS and infant rehospitalization may suggest improved discharge planning (eg, shorter time to first pediatrician appointment, telehealth support) and/or a change in thresholds for rehospitalization.[29] Notably, early discharge was not randomized in this study and our findings likely reflect family self-selection and clinician decision-making and, thus, are unlikely to apply to all hospital births. Additionally, our secondary analysis cautions consideration of discharge on the day of birth or after a one-night stay after cesarean birth. Although early discharge criteria and associated postdischarge services were unknown and likely differed among providers and hospitals, our findings across a large and diverse population suggest that families and clinicians were appropriately assessing discharge readiness based on the outcome of infant rehospitalization.

Although variably defined in pediatrics, readmission is a common measure of health care quality pediatric care.[40,41] However, such quality measures are constrained by reliance on manual abstraction, reporting lag-time, and inadequate standardizations across health systems and have not been available during the pandemic.[42] The Cosmos' HL7 Clinical Document Architecture avoids cumbersome, human-dependent reporting frameworks and overcomes issues of cross health system standardization. Published data show a rehospitalization rate of 1.65% in the first 2 weeks after delivery among healthy, term (37–42 week) infants, suggesting the rates reported in this study over a shorter interval are plausible.[43] Our study findings, from a diverse group of health systems around the country, may suggest that the quality of infant and postdischarge care did not markedly decline in the pandemic's early months.

Limitations related to Cosmos data include incomplete geographic coverage. Health systems in geographic proximity may not equally participate in Cosmos; infants may be born in a participating hospital and readmitted to a nonparticipating hospital, resulting in missed rehospitalizations. Differential rehospitalization practices between eras are unlikely, lowering risk of bias. Furthermore, if infants are born at a participating hospital and rehospitalized at a different participating hospital, the Cosmos research platform deduplicates these patients and combines their data, ensuring these rehospitalizations are captured. Notably, the average total annual number of active departments (≥100 encounters per month) for the 35 included health systems increased by >8% between eras, which could have improved capture of rehospitalizations during the COVID-19 era compared with previous. Birth hospital hospitalization LOS was measured in midnights, not individual hours, because this granular level of data were not available across the cohort, although our sensitivity analysis using a proxy for time of birth produced similar results. While we adjusted for a variety of potential confounders, parity was not available. Experienced parents may be more comfortable with early discharge and could influence findings; however, secular changes in parity would be unexpected. Additionally, although there may be some nondifferential missed hospitalizations between eras, changes in parental preference during the COVID-19 era (eg, hospitals with a perceived lower burden of COVID-19 cases) or in thresholds for hospital admission may have resulted in systematic differences between eras. Finally, examination of other, relevant outcomes such as completion of recommended neonatal screening (eg, newborn, hearing, and congenital heart disease), establishment of breastfeeding, and parental satisfaction were not feasible because these data are not available in Cosmos.

CONCLUSIONS

During the COVID-19 era, short infant birth hospitalization LOS was 51% more common than prepandemic. Yet, counter to our hypothesis, infant rehospitalization within a week of discharge did not increase. Further study of mitigating factors such as home services, telemedicine visits, and other supports that may have changed during the pandemic are warranted. Additionally, investigation of the pandemic's impacts on other infant and maternal outcomes are critical before changing birth hospitalization policy.

ABBREVIATIONS

aOR: adjusted odds ratio
CI: confidence interval
COVID-19: coronavirus disease 2019
EHR: electronic health record
ICD-10-CM: *International Classification of Diseases, Tenth Revision, Clinical Modification*
LOS: length of stay
RCT: randomized controlled trial
SGA: small for gestational age
SVI: social vulnerability index
LGA: large for gestational age

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