

## ARTICLE



# Sociodemographic factors and family use of remote infant viewing in neonatal intensive care

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**OBJECTIVE:** We aimed to determine whether the use of remote infant viewing (RIV) in a neonatal intensive care unit (NICU) differed based on maternal sociodemographic factors.

**METHODS:** The number of RIV camera views and view duration were obtained for NICU patients between 10/01/2019 and 3/31/2021 and standardized relative to patient days. Maternal sociodemographic and neonatal characteristics were obtained from institutional databases.

**RESULTS:** Families in which mothers were unmarried (aOR 1.42, 95% CI 1.03–1.95), did not require an interpreter (aOR 2.86, 95% CI 1.54–5.32), were multiparous (aOR 1.56, 95% CI 1.16–2.10), delivered prior to 37 weeks' gestation (aOR 1.57, 95% CI 1.17–2.12), or resided  $\geq 50$  miles from the NICU (aOR 1.38, 95% CI 1.02–1.87) were significantly more likely to use RIV.

**CONCLUSION:** Family use of RIV in the NICU varied by multiple sociodemographic factors. Further investigation to understand and to address potential equity gaps revealed or created by RIV are warranted.

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## INTRODUCTION

Remote infant viewing (RIV) is a technology that enables families to observe their child in the neonatal intensive care unit (NICU) through a livestream camera. Despite being introduced in 1997, RIV is a relatively new technology in many NICUs and is not available uniformly [1, 2]. RIV systems have beneficial effects for families including reduced parental stress [1, 3, 4] as well as increased parental bonding [5], familial involvement in patient care [6], and parental satisfaction in the NICU environment [7].

Like many telehealth programs, RIV requires an internet connection. However, nearly a quarter of households in the United States lack a broadband connection at home [8]. Sociodemographic factors, including age, race, education level, insurance status, primary language, and income, are associated with patients' likelihood to utilize technology and virtual options for their health care [9–11]. Greater use of technology and telehealth, as was observed during the COVID-19 pandemic [12–14], could increase health disparities based on social determinants of health (SDH). In addition to technology accessibility, SDH affect perinatal care and outcomes [15]. For example, low-income level, public insurance, unmarried status, and black race (due to systemic racism in the United States) have been associated with higher risk for preterm birth [16]. In addition, primary language affects communication between healthcare teams and families, which indirectly impacts newborn care [17].

To provide equitable care to all patients, there is a need to understand the potential association of sociodemographic factors with

care delivery and family engagement in the NICU, including the use of RIV. As new forms of telehealth are developed and implemented, it is important to understand whether sociodemographic factors influence access to and utilization of these services. In this study, we hypothesized that RIV use, including standardized viewing frequency and view duration, would differ based on maternal sociodemographic factors.

## METHODS

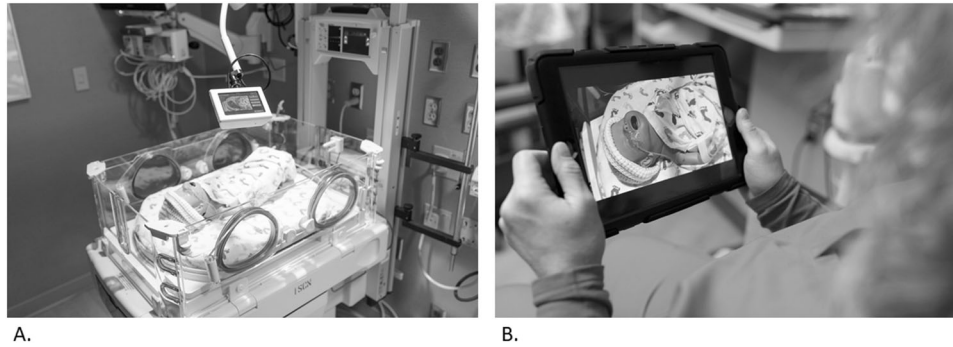
### Study setting

This was a retrospective analysis of infants admitted to neonatal intensive care at Mayo Clinic Hospital NICUs in Rochester, Minnesota, between October 1, 2019, and March 31, 2021. Patients with research authorization at the time of data curation were included in this study. Mayo Clinic Hospital has two NICUs, a 24-bed Level III NICU and a 34-bed Level IV NICU. In September 2019, a RIV system (Angel Eye Health®, Nashville, TN, USA) was implemented in the NICUs, with cameras installed at each patient's bedside. Upon admission, the patient's family was provided the option to use RIV through the voluntary creation of an account with Angel Eye Health® that could be accessed by multiple family members. While consent for RIV was verbal in nature, the RIV account could not be set up unless the patient's family provides an email address for the account. With RIV, a 24/7 livestream view of the patient from the bedside camera was accessible through a Health Insurance Portability and Accountability Act (HIPAA) compliant connection via any device with internet connection (Fig. 1). There was no audio to accompany the video output. The viewer's relationship to the infant was recorded based on the account information. If an individual shared their account information, the viewer's relationship to the infant could be misrepresented.

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**Fig. 1 Remote infant viewing system in a NICU. A** Camera placement in relation to infant bed for remote infant viewing system. **B** Family view on tablet utilized for viewing infant remotely.

### Study design and data collection

For each patient viewed with RIV, Angel Eye Health recorded the number of views and the date, time (hh:mm:ss), and duration of each view. View duration was only available if the application or browser was closed correctly. RIV use data was exported from the Angel Eye Health database for infants in the NICU during the study period.

Maternal sociodemographic characteristics at time of delivery were electronically retrieved from an institutional obstetric database for deliveries at Mayo Clinic Rochester or Mayo Clinic Health System sites and manually abstracted from the infant medical records for deliveries that occurred elsewhere. Maternal data included age, race, ethnicity, marital status, education level, need for interpreter, insurance type, parity, and home address to calculate distance from the NICU. At the time of registration, patients identified their preferred language and whether an interpreter is needed. Infant characteristics were obtained from an institutional ICU database, including birth weight, gestational age at delivery, and the presence of sibling(s) in the NICU. Inborn status was assigned to all infants born at Mayo Clinic Rochester; all other infants were considered outborn. The study statistician merged the data from the above-mentioned databases using the patient's Mayo Clinic medical record number. The study was deemed exempt by the Mayo Clinic Institutional Review Board.

### Statistical analysis

Three primary outcomes were evaluated: a) any use of RIV (yes vs. no), b) standardized viewing frequency (i.e., number of camera views per patient days), and c) standardized view duration (i.e., minutes of camera use per patient days). The latter two outcomes were evaluated among the subset of infants whose families used RIV, and each outcome was standardized to the infant's NICU length of stay (i.e., days). For infants admitted to the NICU prior to the beginning of the study period, the start of their NICU length of stay was recorded as 10/1/2019 00:00. For infants who had not been discharged from the NICU at the time of the study's conclusion, the end of their NICU length of stay was recorded as 3/31/2021 23:59.

Maternal sociodemographic and infant characteristics were evaluated univariately for an association with use (vs. non-use) of RIV based on fitting univariate logistic regression models. Continuously scaled characteristics were each evaluated in univariate logistic regression models using penalized smoothing splines, and the results were graphically summarized to assess the functional form (i.e., linear vs. non-linear) of the relationship with the odds of RIV use (Supplementary Fig. 1). A multivariable logistic regression model was then fit including variables with a  $p$ -value  $< 0.05$  based on univariate analyses (except for low birth weight due to its high degree of collinearity with preterm birth). Associations were summarized by calculating odds ratios (OR) and corresponding 95% confidence intervals (CI).

Given the skewed distributions of the standardized measures for viewing frequency and view duration, the non-parametric Kruskal-Wallis test was used to univariately evaluate relationships of maternal sociodemographic and infant characteristics with each outcome. For each outcome, a multivariable linear regression model was then fit including variables with a  $p$ -value  $< 0.05$  based on univariate analyses. A logarithmic transformation was applied to the outcome measures values to obtain more normally distributed residuals prior to fitting the regression models. The parameter estimates and corresponding standard errors were summarized for each variable in the model.

All calculated  $p$ -values were two-sided, and  $p$ -values less than 0.05 were considered statistically significant. Analyses were performed using SAS version 9.4 software package (SAS Institute, Inc.; Cary, NC) and R Studio version 2021.09.2.

### RESULTS

Among the 980 infants in the NICU during the study period with research authorization, 721 (73.6%) had families who used the RIV system. The viewer's relationship to the infant was the mother for 93.1% of the 232,955 views. Among the 721 patients with RIV use, the median number of camera views per patient was 117 views (IQR, 37–323) and the median length of NICU stay was 9.4 days (IQR, 4.4–19.6), yielding a median standardized number of camera views of 12.5 views per patient days (IQR 5.4, 26.0). Of the 232,955 camera views analyzed, 63% of camera views had a recorded duration. There was a mild correlation between the number of views for a given patient and the percentage of that patient's views that had a recorded duration (Spearman correlation coefficient  $-0.18$ ,  $p < 0.001$ , Supplementary Fig. 2). Among the 721 patients with RIV use, 703 had at least one camera view with a recorded duration with a median of 14.0 min per patient days (IQR, 5.3, 37.7).

Use of RIV (versus non-use) varied based on multiple maternal and infant sociodemographic factors (Table 1). Families in which the mothers were not married (OR 1.45, 95% CI 1.07–1.97), did not require an interpreter (OR 3.10, 95% CI 1.70–5.66), were multiparous (OR 1.37, 95% CI 1.03–1.82), or resided farther ( $\geq 50$  miles) from the NICU (OR 1.48, 95% CI 1.10–1.99) had an increased odds of RIV use on univariate analysis. There were no significant differences in RIV use based on maternal age, race, ethnicity, education level, or insurance type. For infant characteristics, preterm birth ( $< 37$  weeks: OR 1.73, 95% CI 1.30–2.31) and low birth weight ( $< 2500$  g: OR 1.74, 95% CI 1.30–2.33) were associated with an increased odds of RIV use. RIV use did not differ significantly based on the presence of a sibling in the NICU or outborn status. All maternal and infant characteristics that were significant on univariate analysis remained significantly associated with an increased odds of RIV use on multivariable analysis (Table 2).

When evaluating the viewing frequency, i.e., the standardized number of camera views per patient days, families with mothers who were non-Hispanic, did not require an interpreter, or were primiparous viewed infants more frequently on univariate analysis (each  $p < 0.05$ , Table 3). In addition, infants with a sibling concurrently in the NICU had a higher median viewing frequency compared to those who did not (median, 16.8 vs. 11.6 views per patient days;  $p = 0.028$ ). Multivariable analysis revealed that families with mothers who were non-Hispanic or primiparous had significantly higher viewing frequency (Table 4). On average, the viewing frequency was 53.4% higher for infants whose mother

**Table 1.** Univariate analysis of factors evaluated for an association with RIV use.

Characteristic at delivery	RIV use n (%) by row	Univariate logistic regression analysis	
		Odds ratio for odds of RIV use (95% CI)	p-value
<i>Maternal</i>			
<b>Age</b>			0.850
<20 years (n = 35)	27 (77.1%)	1.21 (0.54, 2.71)	
20–34 years (n = 746)	549 (73.6%)	Referent	
≥35 years (n = 197)	143 (72.6%)	0.95 (0.67, 1.35)	
Not recorded (n = 2)	-	-	
<b>Race</b>			0.756
Non-White (n = 167)	127 (76.0%)	1.06 (0.72, 1.57)	
White (n = 777)	582 (74.9%)	Referent	
Not recorded (n = 36)	-	-	
<b>Ethnicity</b>			0.983
Hispanic/Latina (n = 68)	51 (75.0%)	0.99 (0.56, 1.76)	
Not Hispanic (n = 880)	661 (75.1%)	Referent	
Not recorded (n = 32)	-	-	
<b>Marital status</b>			<b>0.018</b>
Married (n = 622)	443 (71.2%)	Referent	
Not married (n = 349)	273 (78.2%)	1.45 (1.07, 1.97)	
Not recorded (n = 9)	-	-	
<b>Education level</b>			0.051
High school degree or less (n = 145)	115 (79.3%)	1.55 (0.97, 2.47)	
Some college (n = 225)	178 (79.1%)	1.53 (1.03, 2.28)	
Bachelor's degree or more (n = 330)	235 (71.2%)	Referent	
Not recorded (n = 280)	-	-	
<b>Need for interpreter</b>			<b>&lt;0.001</b>
Yes (n = 45)	22 (48.9%)	0.32 (0.18, 0.59)	
No (n = 935)	699 (74.8%)	Referent	
<b>Insurance type</b>			0.550
Government (n = 397)	298 (75.1%)	1.15 (0.86, 1.54)	
Non-government (n = 568)	411 (72.4%)	Referent	
Uninsured (n = 15)	12 (80.0%)	1.53 (0.42, 5.48)	
<b>Parity</b>			<b>0.030</b>
Primiparous (n = 428)	300 (70.1%)	0.73 (0.55, 0.97)	
Multiparous (n = 552)	421 (76.3%)	Referent	
<b>Distance from NICU</b>			<b>0.009</b>
< 50 miles (n = 576)	406 (70.5%)	Referent	
≥ 50 miles (n = 404)	315 (78.0%)	1.48 (1.10, 1.99)	
<i>Infant</i>			
<b>Gestational age</b>			<b>&lt;0.001</b>
Preterm (< 37 weeks) (n = 613)	476 (77.7%)	1.73 (1.30, 2.31)	
Term (≥ 37 weeks) (n = 367)	245 (66.8%)	Referent	
<b>Birth weight</b>			<b>&lt;0.001</b>
Low birth weight (< 2500 g) (n = 469)	371 (79.1%)	1.74 (1.30, 2.33)	
Not low birth weight (≥ 2500 g) (n = 511)	350 (68.5%)	Referent	
<b>Sibling in NICU</b>			0.538
Yes (n = 136)	103 (75.7%)	1.14 (0.75, 1.74)	
No (n = 844)	618 (73.2%)	Referent	
<b>Outborn status</b>			0.356
Outborn (n = 248)	188 (75.8%)	1.17 (0.85, 1.63)	
Inborn (n = 732)	533 (72.8%)	Referent	

Bold font was utilized for the variable name to improve the readability of tables with numerous rows. Regular font was used to indicate the possible responses for each bolded variable.

**Table 2.** Multivariable analysis of characteristics at delivery evaluated for an association with RIV use.

Characteristic at delivery <sup>a</sup>	Adjusted OR for odds of RIV use (95% CI)	p-value
<i>Maternal</i>		
<b>Marital status:</b> Not married vs. Married	1.42 (1.03, 1.95)	<b>0.030</b>
<b>Need for interpreter:</b> No vs. Yes	2.86 (1.54, 5.32)	<b>&lt;0.001</b>
<b>Parity:</b> Multiparous vs. Primiparous	1.56 (1.16, 2.10)	<b>0.003</b>
<b>Distance from NICU:</b> ≥ 50 vs. < 50 miles	1.38 (1.02, 1.87)	<b>0.036</b>
<i>Infant</i>		
<b>Preterm birth (&lt; 37 weeks):</b> Yes vs. No	1.57 (1.17, 2.12)	<b>0.003</b>

Bold font was utilized for the variable name to improve the readability of tables with numerous rows. Regular font was used to indicate the possible responses for each bolded variable.

<sup>a</sup>All of the characteristics at delivery that were significantly associated ( $p < 0.05$ ) with an increased odds of RIV use based on the univariate analyses in Table 1 were included in the multivariable model with the exception of birth weight due to its high degree of collinearity with gestational age.

were non-Hispanic (compared to Hispanic) and 41.5% higher for infants whose mothers were primiparous (compared to multiparous). Maternal need for an interpreter and having a sibling in the NICU were no longer associated with a higher viewing frequency on multivariable analysis.

On univariate analysis, the standardized view duration, i.e., view duration (minutes) per patient days, was significantly longer in families with mothers who were primiparous compared to those with mothers who were multiparous. Infants born at term gestation ( $\geq 37$  weeks), with birth weight  $\geq 2500$  g, or who were outborn were viewed for longer durations those born preterm, with low birth weight, or who were inborn, respectively (each  $p < 0.05$ ). On multivariable analysis, only maternal parity remained significant for view duration. Specifically, infants born to primiparous mothers had a 41.4% longer standardized view duration, on average, compared to those born to multiparous mothers (Table 4).

## DISCUSSION

RIV allows families to see their infants when they are not at the bedside. In the current study, nearly three fourths of families opted to use RIV during their infant's NICU admission. Families of infants born preterm and families whose mothers were not married, did not need an interpreter, were multiparous, or resided farther from the NICU ( $\geq 50$  miles) were significantly more likely to use RIV. Among families who used RIV, those in which the mother was primiparous had higher viewing frequency and longer view duration compared to families in which the mother was multiparous. Non-Hispanic maternal ethnicity also was associated with higher viewing frequency. In this study, we demonstrated an association between preterm birth and use of RIV, which may reflect families' desire to establish and maintain a connection with their infants in the setting of a prolonged birth admission or increased illness severity. A prolonged hospital admission often results in family-infant separation given the limited duration of parental leave and the interdependence between employment and health insurance in the United States with private insurance accounting for two thirds of health insurance coverage [18]. The median length of stay for infants born very preterm ranges from four months for those born at 24 weeks gestation to one month for those born at 31 weeks' gestation [19]. When parents and other family members are not able to be at an infant's bedside, RIV can be an alternative mechanism for connection and support. There are early reports that RIV may be helpful for establishing or maintaining lactation when there is mother-newborn dyad separation [20].

Our finding of increased RIV use for infants whose mothers did not need an interpreter raises concern that language barriers may negatively impact access to telehealth services. This has been seen in adult primary care and medical subspecialty ambulatory care where non-English speakers had lower rates of telemedicine use [11].

Patients, parents, and their health care teams may experience barriers in communicating through interpreters, particularly if individuals who are not professional medical interpreters are used to facilitate communication [17, 21–23]. The situation can be especially challenging if families' preferred language is a language of lesser diffusion with limited availability of professional medical interpreters. Our observation that mothers who require an interpreter have lower rates of RIV use suggests that they may have had less awareness of, access to, or understanding of the technology. RIV may unintentionally create an inequity in mother-newborn interactions for mothers with limited English proficiency. Awareness of this difference is important so it can be addressed, e.g., through use of RIV education materials in multiple languages. An alternative explanation for discrepant RIV use may be cultural differences. Some cultures may not value RIV as a mechanism to monitor their infant, bond with their infant, or facilitate milk production.

The current study also found that families with mothers who were multiparous, unmarried, or resided 50 miles or more from the NICU were more likely to use RIV. Previous studies have shown that multiparous mothers may have decreased presence in the NICU compared to primiparous mothers who may be able to spend more time at the bedside [24, 25]. RIV may serve as an alternative way for multiparous mothers and their families to bond with their hospitalized infants and feel involved in their care, while potentially spending time with or caring for other children at home. Interestingly, while families of primiparous mothers were less likely to use RIV, those who did use the technology utilized it more frequently and for longer duration. In families with unmarried mothers, the mothers themselves may return to work to provide income or health insurance for the family and utilize RIV more often when unable to be at bedside. Finally, families who reside far from the NICU often have barriers to physical NICU presence due to logistics, such as travel expenses, and may utilize RIV more often as a result.

The primary strength of this study was the early attention to sociodemographic factors in relation to the introduction of a new telehealth technology in the NICU setting. This study had limitations. First, a quarter of families chose not to utilize remote infant viewing, and the reason for non-use was not documented. Non-use could reflect various disparities, including availability of internet access and the method for introducing RIV technology to parents. Second, the study population was largely White race and non-Hispanic ethnicity, which reflects the population of Olmsted County (84% White race, 5% Hispanic ethnicity) [26], where the study occurred. Future studies should evaluate RIV use in a more diverse sample reflective of the racial and ethnic diversity of the United States [27]. Third, there was potential confounding bias in this study based on the patient's room type, which may be associated with RIV use [28]. Some infants were in single patient rooms, some infants were in an open bay environment, and some infants spent time in both single patient rooms and an open bay environment. Finally, the study period overlapped with the

**Table 3.** Univariate analysis of characteristics evaluated for a relationship with the standardized number and duration of camera views.

Characteristic at delivery	Standardized number of camera views <sup>a</sup>			Standardized duration (minutes) of views <sup>a</sup>		
	<i>n</i>	Median (IQR)	<i>p</i> -value <sup>b</sup>	<i>n</i>	Median (IQR)	<i>p</i> -value <sup>b</sup>
<i>Maternal</i>						
<b>Age</b>			0.921			0.927
< 20 years	27	11.3 (4.4, 25.8)		26	10.4 (7.4, 25.5)	
20–34 years	549	12.5 (5.4, 26.0)		533	14.0 (5.6, 37.5)	
35 + years	143	13.0 (5.2, 26.3)		142	15.1 (4.4, 39.3)	
<b>Race</b>			0.319			0.898
Non-White	127	11.2 (5.2, 24.1)		121	15.5 (4.7, 40.3)	
White	582	12.7 (5.5, 26.3)		570	13.8 (5.3, 37.0)	
<b>Ethnicity</b>			<b>0.046</b>			0.328
Hispanic/Latina	51	10.5 (2.2, 19.9)		49	13.2 (3.1, 35.6)	
Not Hispanic	661	12.6 (5.5, 26.8)		645	14.0 (5.4, 37.5)	
<b>Marital status</b>			0.827			0.724
Married	443	12.3 (4.9, 27.6)		426	14.2 (4.9, 39.3)	
Not married	273	12.7 (5.6, 25.5)		272	13.6 (5.8, 33.5)	
<b>Education level</b>			0.827			0.571
High school degree or less	115	13.9 (6.5, 24.0)		114	14.7 (7.1, 33.6)	
Some college	178	11.6 (6.2, 28.3)		177	12.0 (6.1, 33.5)	
Bachelor's degree or more	235	13.8 (4.6, 30.0)		225	14.5 (4.1, 40.7)	
<b>Need for interpreter</b>			<b>0.007</b>			0.338
No	669	12.8 (5.5, 26.9)		684	14.1 (5.4, 37.6)	
Yes	22	6.2 (1.8, 11.2)		19	7.9 (2.9, 41.5)	
<b>Insurance type</b>			0.051			0.308
Government	298	11.3 (5.5, 21.8)		294	12.5 (5.3, 33.5)	
Non-government	411	14.3 (5.0, 31.9)		397	15.1 (5.0, 44.9)	
Uninsured	12	7.9 (5.5, 14.7)		12	19.6 (7.4, 28.0)	
<b>Parity</b>			<b>0.002</b>			<b>0.031</b>
Primiparous	300	13.9 (6.5, 32.6)		292	15.8 (6.2, 41.0)	
Multiparous	421	11.3 (4.7, 22.8)		411	13.3 (4.7, 34.9)	
<b>Distance from NICU</b>			0.126			0.058
< 50 miles	406	12.1 (4.7, 25.7)		393	12.9 (4.7, 34.2)	
≥ 50 miles	315	12.9 (6.2, 28.3)		310	15.9 (6.5, 40.3)	
<i>Infant</i>						
<b>Gestational age</b>			0.452			<b>0.010</b>
Preterm (< 37 weeks)	476	12.3 (5.6, 25.1)		466	13.1 (5.0, 31.8)	
Term (≥ 37 weeks)	245	12.7 (4.9, 30.7)		237	18.9 (5.9, 53.3)	
<b>Birth weight</b>			0.963			<b>0.041</b>
Low birth weight (< 2500 g)	371	12.5 (4.9, 27.9)		366	12.3 (4.7, 33.5)	
Not low birth weight (≥ 2500 g)	350	12.5 (5.7, 25.7)		337	16.6 (5.9, 40.7)	
<b>Sibling in NICU</b>			<b>0.028</b>			0.630
No	618	11.6 (4.9, 25.6)		603	14.4 (5.1, 37.8)	
Yes	103	16.8 (7.2, 29.3)		100	12.3 (5.3, 33.6)	
<b>Outborn status</b>			0.590			<b>0.011</b>
Outborn	188	12.7 (5.5, 29.2)		184	19.3 (6.2, 53.1)	
Inborn	533	12.5 (5.2, 25.8)		519	12.9 (5.0, 33.6)	

Bold font was utilized for the variable name to improve the readability of tables with numerous rows. Regular font was used to indicate the possible responses for each bolded variable.

<sup>a</sup>For each patient, the standardized number of camera views was calculated as the number of camera views divided by their length of stay in the NICU (per patient days). Likewise, the standardized duration of camera views was calculated as the total duration of camera views in minutes divided by their length of stay in the NICU. A total of 721 patients were viewed using RIV and at least one camera duration was available for 703 patients.

<sup>b</sup>Univariate analysis based on the non-parametric Kruskal-Wallis test.

**Table 4.** Multivariable analysis of factors evaluated for a relationship with the standardized number and duration of camera views.

Outcome	Characteristic at delivery <sup>a</sup>	Parameter estimate (SE) from model with outcome on a log scale <sup>b</sup>	Average adjusted percent increase in the standardized outcome <sup>b</sup>	p-value
<b>Standardized number of camera views</b>				
<i>Maternal</i>				
	<b>Hispanic ethnicity:</b> No vs. Yes	<b>0.43 (0.22)</b>	<b>53.4%</b>	<b>0.047</b>
	<b>Need for interpreter:</b> No vs. Yes	0.45 (0.32)	56.9%	0.162
	<b>Parity:</b> Primi vs. Multiparous	<b>0.35 (0.11)</b>	<b>41.5%</b>	<b>&lt; 0.001</b>
<i>Infant</i>				
	<b>Sibling in NICU:</b> Yes vs. No	0.22 (0.15)	24.8%	0.139
<b>Standardized duration (minutes) of views</b>				
<i>Maternal</i>				
	<b>Parity:</b> Primi vs. Multiparous	<b>0.35 (0.13)</b>	<b>41.4%</b>	<b>0.006</b>
<i>Infant</i>				
	<b>Term (<math>\geq 37</math> weeks):</b> Yes vs. No	0.25 (0.14)	28.2%	0.067
	<b>Outborn:</b> Yes vs. No	0.21 (0.15)	23.0%	0.156

Bold font was utilized for the variable name to improve the readability of tables with numerous rows. Regular font was used to indicate the possible responses for each bolded variable.

<sup>a</sup>All of the characteristics at delivery that were significantly correlated ( $p < 0.05$ ) with each outcome measure on the univariate analyses in Table 3 were included in the multivariable model for that outcome with the exception of birth weight due to its high degree of collinearity with gestational age.

<sup>b</sup>A logarithmic transformation was applied to the values of the outcome measures to obtain more normally distributed residuals prior to fitting a multivariable linear regression model for each outcome. The average percent increase in the adjusted standardized number of views (or duration) per change in each characteristic (e.g., No vs Yes) was obtained by taking the antilog of each parameter estimate, subtracting 1, and multiplying by 100.

COVID-19 pandemic, which could have variably impacted RIV use based on maternal sociodemographics. Data on the frequency and duration of family presence at bedside was not systematically recorded. Throughout the pandemic, the NICUs allowed two designated adults to be present at bedside following a screening process for COVID-19.

## CONCLUSION

The impact of sociodemographic factors on use of RIV is variable and complex. Some factors associated with RIV use or non-use may not be modifiable, e.g., maternal parity, gestational age at delivery. However other sociodemographic factors associated with less RIV use, such as need for an interpreter, may be amenable to improvement interventions that aim for more equitable utilization of the technology. Given the benefits of RIV use from the family perspective, it is important to further investigate and address potential equity gaps revealed or created by RIV are warranted.

## DATA AVAILABILITY

The datasets generated during and/or analyzed for this study are available from the corresponding author on reasonable request.

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## AUTHOR CONTRIBUTIONS

RKP conducted data collection, drafted the initial manuscript, and reviewed and revised the manuscript. BLK conducted data collection, provided input on study design, and critically reviewed and revised the manuscript. KMM provided input on study design and critically reviewed and revised the manuscript. ALW provided input on the study design, carried out the analyses, and reviewed and revised the manuscript. JLF provided input on study design, conducted, coordinated, and supervised data collection, and reviewed and revised the manuscript. JEB conceptualized and designed the study, conducted, coordinated, and supervised data collection, and reviewed and revised the manuscript. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

## COMPETING INTERESTS

The authors declare no competing interests.

## ADDITIONAL INFORMATION

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