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Comparison of Parental In-Person Visitation and Webcam Usage Patterns at a Single-Center Neonatal Intensive Care Unit

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Purpose	Barriers to parents visiting the neonatal intensive care unit (NICU) in person for infant bonding include socioeconomic status, distance from NICU, and having children at home. Use of NICU bedside webcam can increase access to parent-infant interaction. This study aimed to describe the pattern of webcam logins by parents, relationship of logins to in-person visitation, and maternal factors affecting usage.
Methods	In this retrospective cohort study, data pertaining to parental webcam logins and in-person visitation, maternal screening for depression, anxiety, and stress, and family sociodemographics were collected from medical records. Relationships between chart variables and webcam or in-person visitation were measured using Pearson's correlation coefficient and Mann-Whitney <i>U</i> test, as applicable. Login data were obtained from weeks 2 through 5 of NICU stay of the infant, while depression, anxiety, and stress scores were obtained in the second week as standard procedure by a dedicated NICU social worker.
Results	A total of 59 mother-baby dyads were included. Percentage of days visited and webcam logins decreased from week 2 to week 5. A higher rate of webcam login was documented for all parents on days they did not visit in person. Parents who lived ≥ 15 miles away ($P=0.004$) and those with government insurance ($P=0.01$) visited in person significantly less, although webcam logins showed no difference between groups. One negative correlation was found between percentage of in-person visits and DASS-21 depression score ($P=0.03$), but no such correlation was seen with webcam logins.
Conclusions	Parents utilized NICU webcams to connect with their infants when unable to be at the bedside. Webcam use reduced visitation disparities known to be exacerbated by insurance status, home-to-hospital distance, and psychological distress. (<i>J Patient Cent Res Rev.</i> 2023;10:31-37.)
Keywords	neonate; webcam; mental distress; neonatal intensive care unit; NICU visitation

Parent(s) of infants admitted into the neonatal intensive care unit (NICU) often experience psychological distress.^{1,2} Separation from their infant gives rise to feelings of being an outsider, being excluded, lack of control, despair, and disappointment.^{3,4} Parents face several barriers to visiting the NICU in person to bond with their infant, including socioeconomic status, home distance from the NICU, and having children at home to care for.^{1,5}

The use of technology in the NICU has improved interaction between parents and their infants, potentially enhancing mother-infant bonding.⁶ One such technology,

the bedside webcam, has been perceived to reduce stress and anxiety in the NICU.⁷ In 2015, Rhoads et al showed that although parents preferred in-person visits, a bedside webcam was an alternative means of connection as evidenced by a reduction in parental stress and anxiety.⁸ Parents using webcam technology also were found to have lower stress levels arising from being separated from their infants in a 2020 study by Guttman et al.⁵

However, the major question of whether webcam use minimizes the effects of family visitation-preventing factors such as insurance type, number of other children at home, distance from the hospital, and psychological distress encountered by parents during in-person visitation remains unanswered. The objective of this study was to determine the relationship of in-person visitation and webcam usage by parents during their infant's NICU stay (patterns) and answer the aforementioned question by assessing the effects of the

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barriers of in-person visitation and comparing them to webcam usage by parents.

METHODS

This retrospective cohort study, approved by the Cleveland Clinic institutional review board (#20-751), was conducted from September 2019 to August 2020. The study team from the level 3 NICU at Fairview Hospital of Cleveland Clinic extracted information on parental webcam login timestamps, frequency of parental visits to the NICU from medical record review, and the webcam vendor's software system. Infants of any gestation and birth weight who stayed in the NICU for the first 3 weeks of life, or more, and whose parents logged in to the bedside webcam system at least once within the first 7 days of admission of the infant fulfilled the criteria for inclusion in the study. Infants who did not fulfill the above criteria were excluded. Data relating to gestational age, birth weight, length of stay, Apgar scores at 1 and 5 minutes, gravida, number of living children, gender, and type of delivery were collected by chart review.

Data Collection

The descriptive part of the study was to determine the rate of in-person visitation and webcam login over the first 5 weeks of NICU stay and their correlation (excluding the first week). The primary outcome was insurance type (private vs public). Distance of parental home from the hospital, number of siblings/other children in the home, and maternal mental distress (depression, anxiety, and stress) were secondary outcomes. The username obtained from vendor data was linked to the infant's chart. Data related to parental visits to the NICU, as documented by nursing, and maternal Depression, Anxiety and Stress Scale – 21 Items (DASS-21) screening scores, as assessed by the NICU social workers as part of standard procedure, were obtained from the chart. In-person visitation and login data were collected weekly and presented as the percentage of days visited and logged in during each week.

The first 7 days from admission was designated as the time needed for the parent(s) to access the system and gain familiarity with the technology. Therefore, login data from week 1 was excluded but obtained for weeks 2 through 5 of the NICU stay of the infant. In addition, beginning in the second week of admission, psychological stress and adjustment scores were obtained by administering DASS-21, a validated screening tool.¹⁰ In-person visitation and DASS-21 data were also obtained for weeks 2 through 5 of NICU stay. It is worth mentioning that there were in-person NICU visitation policy changes during the pandemic starting March 2020 until the end of the study. Estimating the effects of the restrictions imposed by the state or the hospital was beyond the scope of this study.

Statistical Analyses

Pearson's correlation coefficient was applied as a statistical method to establish the correlation between continuous variables. Mann-Whitney *U* test was applied to measure differences between groups with dichotomous variables (insurance type, race, residential distance of ≥ 15 miles). An alpha level of $P < 0.05$ was considered significant for coefficient of correlation (CoC) as well as Mann-Whitney comparisons. SPSS Statistics 27 software (IBM Corporation) was used for statistical analyses.

RESULTS

Out of 540 admissions to the NICU in the study period, 62 infant-mother dyads met the first inclusion criterion. This included 13 pairs of twins, but each pair was considered as a single subject. Three of these 62 dyads were excluded because the parent did not log in to the system within the first 7 days, leaving 59 infant-mother dyads in the study. Study population demographics are described in Table 1. Overall, the average number of days the parents visited their infants in person during weeks 2–5 was 84.0%, while the average number of days logged into webcams during the same duration was 79.0%.

The percentage of days visited decreased from 87.6% in week 2 to 80.1% in week 5. The rate of days logged in also reduced from 84.2% in week 2 to 73.8% in week 5, a steeper drop than days visited (10.3% vs 7.5%; Figure 1). The percentage of days the mother logged in when not visiting the NICU was always higher than the percentage of days the mother in-person visited the NICU, indicating that parents logged in to the webcam more when they were not able to visit their infant in the NICU (Figure 2). There was a statistically nonsignificant negative correlation between the percentage of days visited and the percentage of days logged in during all 4 weeks, which increased from week 2 (-0.1) to week 5 (-0.3).

More than half of the mothers had government insurance, the rest had private insurance. No parents included in the study were uninsured. Average visits for parents with private insurance in all 4 weeks assessed was 89.9% vs 79.5% for parents with government insurance, a significant gap of 10.4% ($P = 0.01$). However, the average login for parents with private insurance was 81.4% vs 77.7% for parents with government insurance, the reduced difference of 3.7% that was not statistically significant ($P = 0.50$).

There was a nonsignificant negative correlation between the percentage of weekly in-person NICU visitations and the number of siblings the hospitalized infant had at home. Conversely, the nonsignificant correlation between the number of children at home and the percentage of days

Table 1. Characteristics of the Study Population (n=59, except where noted*)

Characteristic	Median or proportion	25 th percentile	75 th percentile
Gestational age at birth of infant	30 weeks	27 weeks	32 weeks
Birth weight	1430 grams	1090 grams	1910 grams
Length of stay of the infant	41 days	30 days	78 days
1-minute Apgar score	6	4	8
5-minute Apgar score	8	7	8
Gravida number	2	1	3
Number of living children to care for at home	1	0	2
Infant gender (male)	50.8%		
Cesarean section delivery	67.8%		
Distance of home from hospital	12.5 miles	5.9 miles	20.5 miles
Maternal insurance (private)	47.5% [†]		
Maternal depression score*	2	0	8
Maternal anxiety score*	2	0	8
Maternal stress score*	8	4	18
Maternal depression diagnosis*	22.2%		
Maternal anxiety diagnosis*	33.3%		
Maternal stress diagnosis*	29.6%		

*n=27

[†]The remaining 52.5% all had government insurance.

logged in via webcam was positive for all 4 weeks, with the maximum correlation observed in week 5 (P=0.06).

A nonsignificant negative correlation was found between the distance from the hospital and percentage in-person visitation all through the 4 weeks, with an increasing trend from week 2 to week 5 (-0.1 in week 2 to -0.2 in week 5). No correlation was found between distance from the hospital and webcam login. When the distance between the NICU and home was 15 miles or more, a significantly lower percentage of in-person visitation was observed than parents with homes less than 15 miles away (76.2% vs 89.3%; P<0.01), but there was no significant difference in webcam login percentages (83% for ≥15 miles vs 77.3% for <15 miles, P=0.38).

DASS-21 scores were available for 27 of 59 mothers. Although screening was offered to all parents, many of them preferred not to complete it. There was a significant negative correlation between the percentage of in-person visits and DASS-21 scores of depression in the second week (CoC: -0.4, 95% CI: -0.68 to -0.04; P=0.03), which meant that higher maternal depression scores were associated with lower in-person visitation in the second week of admission. Weaker negative correlation persisted in the third, fourth and fifth weeks, but those correlations did not prove significant. There was a significant negative correlation between the anxiety screening score and the percentage of days visited in the second, third, and fifth

weeks (CoC of -0.4, -0.4, and -0.4, respectively), which was not seen in the fourth week (P=0.07). A negative correlation between stress screening score and in-person visitation in the second week approached significance (CoC: -0.3, 95% CI: -0.66 to 0.01; P=0.05), but there was no significant correlation between stress scores and the percentage of in-person visitation in weeks 3, 4, and 5 (Table 2). The impact of depression and anxiety symptoms did not lower parental interaction with the infant via webcam as it did for in-person visits.

DISCUSSION

This study illustrates that parents utilized webcams when they were not able to be at the bedside of their NICU-admitted infants. Both webcam login and in-person visitation decreased over the 4-week study period. Parents used the webcam service more on the days they were not able to visit, demonstrating its usefulness. There were significant differences in in-person visitation between private and government insurance holders, between parents who lived close vs far away from the hospital, and between parents evidencing higher psychological distress than those reporting lower distress. Such disparities were not observed in webcam use, thereby suggesting the ability of webcam use in reducing those gaps.

Rhoads and colleagues used a qualitative method to demonstrate that parents preferred in-person visitation compared to utilizing a web camera.⁸ It is well studied

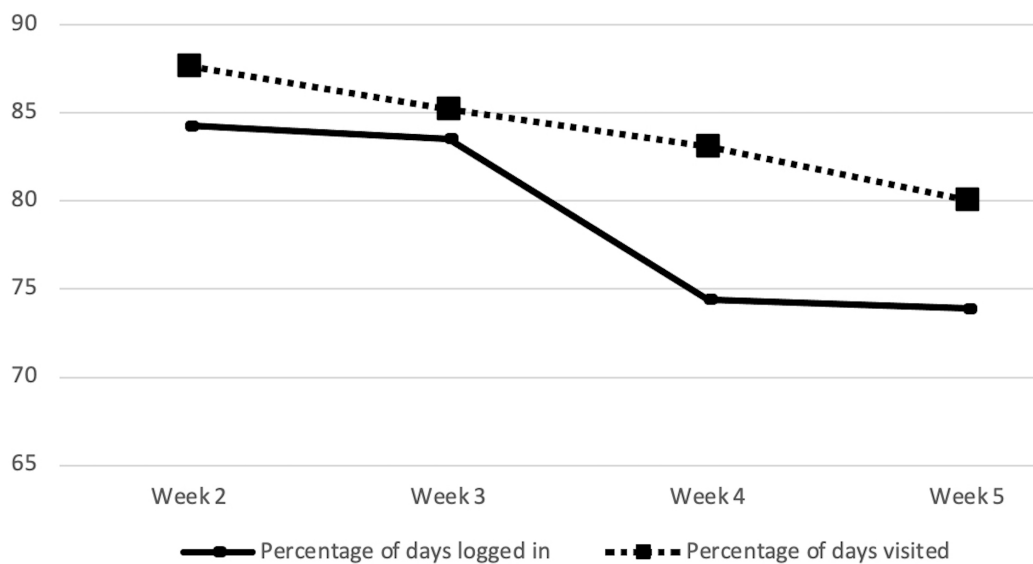


Figure 1. General trends of webcam login and in-person visitation over the 4-week period. Logins dropped more sharply than visitations.

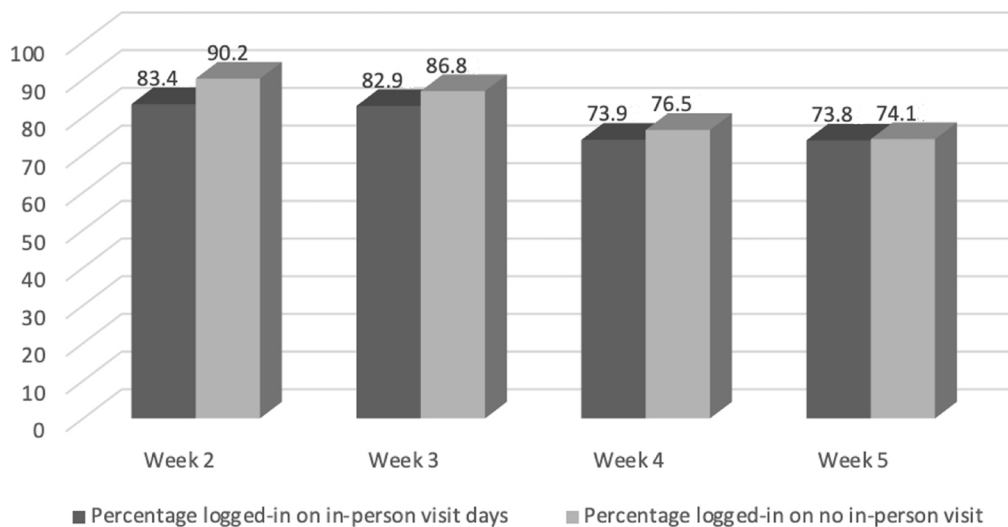


Figure 2. Comparison of percentage of days (Y-axis) parents logged in to webcams on in-person visit days vs days when parents did not visit. Parents always logged in more on the days they did not visit, although the gap decreased from week 2 to week 5. Differences were not significant for any week ($P>0.05$).

that in-person visitation promotes better maternal-infant bonding, breastfeeding, and kangaroo care, which are essential for the growth and development of the infant. This finding was consistent with the results of our study that showed more in-person visitation percentages compared to the use of webcam technology.

Pineda and colleagues reported maternal in-person visitation to the NICU on 4 days per week, while Greene et al found that in-person visitation declined from 70% of the days in the first 2 weeks of life to 67% of the days in the first month of life.^{10,11} A 2014 study by Reynolds et al showed that parental in-person visitation dropped over the first 5 weeks of stay, while baby-holding frequencies

increased throughout the study.¹² In a later publication, average webcam use dropped by more than 50% over 3 weeks post-study enrollment.⁸ These findings are consistent with the results of our study, wherein both in-person visitation and webcam login by parents decreased over time, with a more significant decrease in logins.

The reason behind such a consistent demonstration of decline in family involvement may be twofold. First, parents in the United States have comparatively shorter parental leave (ie, time off) after the birth of a child, which compels them to return to work earlier, leading to decreased engagement in later weeks. Second, Feldman and colleagues demonstrated that in mothers

Table 2. Correlation Between Visitations and Psychological Distress in Mothers*

Maternal psychological factor* per type of NICU visit	Week 2, Pearson's r (P)	Week 3, Pearson's r (P)	Week 4, Pearson's r (P)	Week 5, Pearson's r (P)
Correlation between depression and percentage of weekly visits	-0.4* (0.03*)	-0.2 (0.2)	<0.1 (0.97)	-0.1 (0.62)
Correlation between anxiety and percentage of weekly visits	-0.4* (0.03*)	-0.4* (0.02*)	<0.1 (0.72)	-0.4* (0.03*)
Correlation between stress and percentage of weekly visits	-0.3 (0.054)	-0.1 (0.524)	<0.01 (0.957)	-0.1 (0.773)
Correlation between depression and number of webcam logins	<-0.1 (0.963)	0.1 (0.518)	-0.3 (0.122)	<0.1 (0.896)
Correlation between anxiety and number of webcam logins	0.2 (0.39)	0.2 (0.24)	<-0.1 (0.92)	<0.1 (0.93)
Correlation between stress and number of webcam logins	<0.1 (0.972)	0.1 (0.570)	-0.2 (0.409)	0.2 (0.305)

*As measured using the Pearson correlation coefficient, with $P < 0.05$ the alpha of significance.

experiencing prolonged separation and potential loss of the infant, there were reduced signs of attachment, expressed as lower levels of preoccupation, bonding, and mental representations.¹³ Their study demonstrated a linear decreasing pattern per an increase in the separation of the mother from the infant, which may be the second plausible explanation for decreasing engagement of the parent(s) in terms of in-person visitation and login during the third, fourth, and fifth weeks in our study. We hypothesize that the sharper decline in webcam login by parents in the later weeks (fourth and fifth) might be due to a reduction in anxiety and stress levels, as described by Greene and colleagues, and increased familiarity and confidence with the medical team.^{7,11} The initial (weeks 2 and 3) distress and anxiety appeared to be the reason for increased webcam login when parents were not able to be at the bedside. We further hypothesize, based on the general in-person visitation preference reported by Rhoads et al,⁸ that in the later weeks of NICU stay, if the parents had gotten back to work, that they preferred being at bedside whenever able as opposed to visiting virtually. The gap between the login of parents on days visited vs days not visited decreased from week 2 to week 5, supporting this view.

For parents, availability and cost of transportation are essential barriers to visiting their infant in the NICU; it has also been shown that mothers with public insurance are less likely to visit their infants.¹¹ These findings were consistent with our study. Mothers with private insurance were significantly more likely to visit their infant in the NICU than mothers with government insurance. However, this difference was not significant when webcam logins were considered. We therefore conclude that webcam use reduced disparities arising

from parents' insurance type. Greene et al also explored the relationship of the total number of children in the family home and in-person visitation by parents and found a negative correlation, meaning, as the number of children in the family decreased, the percentage of in-person visitation increased.¹¹ This was consistent with our study findings. A higher number of children in the family makes it difficult for the parent(s) to visit their infant in the NICU, and those parents tend to use the webcam more (hence the positive correlation). Similarly, distance from the hospital was reported to be a barrier to in-person visits,¹ also consistent with our findings. Since there was no consistent correlation between distance and web login, we assume that the parents who could not visit still logged in to the webcam. Therefore, webcams were able to reduce the visitation disparity caused by distance between parental home and hospital.

The relationship of psychological distress with parental in-person visitation to the NICU is complex. While some studies have shown a decrease in maternal in-person visitation with increasing scores of Parental Stressor Scale, depression, and posttraumatic stress,^{1,14,15} the same and other studies showed improving in-person visitation/skin-to-skin care is associated with increasing maternal anxiety and stress.^{1,16} In addition, webcam use has been associated with improved mood and bonding and positively impacting stress and anxiety.^{8,17,18} Our study showed an increase in maternal distress scores (depression and anxiety) was significantly associated with a decrease in in-person visitation. At the same time, no such relationship existed between webcam logins and parental psychological distress. Our study also concluded that parents logged in more virtually on the days they could not visit their infant. Therefore, we hypothesize

that in the second week of life, parents with psychological distress who could not visit in-person may still have been able to use the bedside webcam technology to connect to their newborn infants, thereby reducing the visitation disparity caused by psychological distress preventing in-person visits to connect with an infant.

Limitations

The study had some significant limitations. Sample size was small, with many variables not powered adequately to establish a significant difference. Less than half of the mothers chose to undergo the DASS-21 mental health screening; this inconsistent participation could have led to bias in the study. Initially eligible subjects excluded due to an inability to sign into the webcam portal may have confounded study results if such individuals tend to have higher psychological distress, lower socioeconomic status, and more systemic barriers to in-person visitation. Lastly, while measuring the impact of COVID-19 policies in effect from March to August 2020 was beyond the study scope, we did passively observe an opposing trend of decreased in-person visitation and increased webcam logins over these later months.

CONCLUSIONS

Parents utilized neonatal intensive care unit bedside webcams to connect with their infants. For parents of infants admitted to the NICU, parental in-person visitation and bedside webcam use decreased over time. Webcam use reduced disparities in in-person visitation arising from differences in the type of insurance, distance of parental home from the hospital, and psychological distress level of the mother.

Patient-Friendly Recap

- Placing a bedside webcam in neonatal intensive care units (NICU) offers parents a remote option for bonding with their infants during a stressful time in their lives.
- Authors studied patterns of both in-person visitation and webcam use to determine if this technology was effectively connecting parents who face common barriers to in-person visitation with their infants.
- Mothers across the board frequently utilized NICU bedside webcams. Although few family characteristics significantly correlated with either means of visitation, the gap between webcam and in-person visits proved greatest for those living 15 miles or more from the hospital and those with government insurance, suggesting that webcams serve to mitigate known NICU visitation disparities.

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Author Contributions

Study design: Mudd, Chuo, Das. Data acquisition or analysis: Goswami, Das. Manuscript drafting: Goswami, Chuo, Das. Critical revision: all authors.

Conflicts of Interest

None.

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