



Examining technology use and mental health among parents with newborns in the intensive care unit during the COVID-19 pandemic: A cross-sectional study

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ABSTRACT

Objectives: To investigate the relationship between pandemic-related stressors, mental health, and technology use among parents of hospitalized infants during the COVID-19 pandemic.

Methods: A cross-sectional study of 47 participants who had an infant in the Neonatal Intensive Care Unit (NICU) during the pandemic was completed. Participants ranked several statements on a Likert scale to assess mental health, technology use, and COVID-19-related stress during their infant's stay in the NICU.

Results: Mental health wellness scores were negatively associated with COVID-19-related stress ($r_s = -0.40, p = .015$). The most prevalent stressor was hospital visitation restriction. Higher COVID-19-related stress was associated with greater use of text and video chat [$(r_s 0.35, p = 0.016)$ and $(r_s 0.33, p = .025)$]. Enjoyment of technology use and access to technology were positively associated with higher mental health wellness scores [$(r_s 0.42, p = .003)$ and $(r_s 0.38, p = .009)$].

Conclusions: Social uses of technology were valuable in a cohort of parents with infants hospitalized during the COVID-19 pandemic.

Innovation: Technology is a tool that can help parents cope with the stress of having a hospitalized infant. Digital literacy and technology access should be promoted in the post-pandemic landscape to help parents of infants in the NICU attain more benefit from these resources.

1. Introduction

Hospitalization of a newborn in the neonatal intensive care unit (NICU) can have detrimental health implications for both the infant and their parents, as it limits the formation of attachment between parents and their infants. This can interfere with the infant's physical, cognitive, and socioemotional development as well as with the parents' role adjustment to their new identity as parents [1,2]. Consequently, an estimated 15% to 63% of parents report symptoms of anxiety, depression, acute stress disorder, or posttraumatic stress disorder during their infants' hospitalization. [1]. Social support from friends, family, and other parents of NICU infants has been reported as a source of stress relief [2]. Additionally, the presence of a spouse in the NICU has been found to reduce maternal post-partum depression [3].

During the COVID-19 pandemic, social restrictions such as quarantine, hospital visitation restrictions, and travel restrictions limited the

availability of social and emotional support [4]. For some time, hospital visitation restrictions allowed only one parent to visit their child in the NICU at a time [5]. This limited the spousal and familial support that has been demonstrated to help improve parental mental health. Significant reductions in therapy and social work services also occurred in many NICUs during the pandemic, which limited the availability of these resources for parents in the NICU [6]. In combination with such reductions in mental health services, there was also a steep rise in mental health issues during the COVID-19 pandemic due to factors such as loss of a loved one, fear of getting sick, financial stress, parental stress, and loneliness [7]. Among NICU mothers, specifically, worry surrounding COVID-19 health risks is associated with increased symptoms of depression, anxiety, and loneliness [8].

Technology offers several tools that may be able to address these issues among NICU parents by improving access to mental health support and facilitating remote participation in the NICU. Smart phones

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offer various social tools including video calling, photo sharing services, and virtual support groups. They also allow access to mental health tools such as wellness apps and counseling services [9]. Further, many mental health providers began offering appointments via phone or computer during the pandemic, and telemedicine has since become well integrated into clinical practice [7]. Hospital-specific technologies such as bedside cameras have also been introduced with favorable results [10]. Despite the hypothesized benefits of technology on mental health, the use of technology may be limited by awareness of resources, personal preferences, digital literacy, and access considerations [9]. Although the use of technology is increasing, the prevalence of specific technologies and their associated mental health benefits among parents with infants in the NICU during the COVID-19 pandemic has not been clearly described.

In this study, we aim to describe the types of technology used during the COVID-19 pandemic and their relationship with perceived mental wellness and COVID-related stress among NICU parents.

2. Methods

We conducted a cross-sectional study at a large, not-for-profit, academic institution in Albany, New York with a 60-bed NICU. The study sample included 47 participants who completed our survey. To recruit this sample, we distributed our survey to parents visiting their infants in the NICU as well as postpartum patients with infants in the NICU between March 15, 2020 and July 23, 2021. To allow for participation by those with limited technology access, the survey was made available both through a paper copy and through a QR code link to complete the survey virtually. Envelopes were provided with the paper surveys to allow participants to return their responses anonymously. Survey participation was voluntary, and responses were anonymous. This study was granted IRB exemption.

The survey consisted of a brief demographics section, a mental health section, and a technology use section. To keep the survey short and avoid non-completion, the demographics section was narrowed down to age, gender identity, and distance from the hospital. The mental health section assessed stress relating to the COVID-19 pandemic as well as perceived general mental health. We based the structure of this section on the validated PSS-NICU scale, which is a 52-item assessment in which parents rank their stress related to each item on a Likert scale [10]. Similar to the PSS-NICU assessment, we assessed pandemic-related stress by asking participants to rank a series of stressors posed by the pandemic on a 6-point Likert scale ranging from “not at all stressful” to “extremely stressful”. However, we produced a modified and abbreviated version of this tool to focus more on pandemic-related stressors. To assess perceived mental health, we asked participants to rank the extent to which they agree with a series of statements on a 6-point Likert scale

ranging from “strongly disagree” to “strongly agree”, as shown in Fig. 1. Next, the technology section listed a series of technologies that participants may use for telehealth, social support, and infant monitoring. Participants were asked to rank how often they used each technology for these purposes during their baby’s NICU stay on a 4-point Likert scale ranging from “never” to “constantly”. To better assess participant relationships with technology, participants also ranked the extent to which they agree with a series of statements assessing their feelings about technology on a 6-point Likert scale ranging from “strongly disagree” to “strongly agree”.

Based on survey responses, participants were assigned a mental health score, a COVID-19-related stress score, and an overall technology use score. These scores were determined by calculating the average ranking that the participant assigned to items in the corresponding survey section. In addition to overall technology use scores, the frequency of use for each individual type of technology was also recorded for cross-sectional analysis. Using these scores, two-tailed Spearman rank coefficients were calculated to measure the strength and direction of associations between mental health and COVID-19-related stress, between mental health and technology use, and between COVID-19-related stress and technology use. These relationships were measured using overall technology scores as well as frequency scores for each individual type of technology. A *p*-value of <0.05 was considered statistically significant.

Table 1
Participant demographics.

	Number
Age (years)	
<20	0
20–29	16
30–39	31
40–49	0
50+	0
Gender Identity	
Male	11
Female	36
Non-binary / third gender	0
Distance from AMC	
Lives in Albany	5
Within 30 min	14
30–60 min	18
Over an hour	9
Over 2 h	1

	0	1	2	3	4	5
I feel an overall sense of wellness	0	0	0	0	0	0
I feel that I have a social support network	0	0	0	0	0	0
I am grateful for what I have in life	0	0	0	0	0	0
I have a sense of control over my day-to-day life	0	0	0	0	0	0
I feel that my anxieties and fears are manageable	0	0	0	0	0	0
When I feel anxious or sad I know how to cope or manage these feelings	0	0	0	0	0	0

Fig. 1. Survey items assessing participant mental health. Participants were asked to rank the extent to which they agree with each statement at present on a scale of 0–5, with 0 being “strongly disagree” and 5 being “strongly agree”.

3. Results

Demographic information is shown in Table 1. Our study consisted of 47 participants total, including 36 females and 11 males based on self-reported gender identity. The age range includes 16 participants between the ages of 20–29 and 31 participants between the ages of 30–39.

Fig. 2 shows the frequency of use of each form of technology among participants. The most utilized technologies were text messages for social support and photo/video sharing of the baby. 72% of participants ranked their text message use as “always”, and 66% ranked their photo/video sharing as “always”. The least utilized technologies were live bedside cameras, virtual support groups, and virtual therapy visits. 87% of participants said they never used live bedside cameras, 74% said they never used virtual support groups, and 68% said they never used virtual appointments with a therapist.

Spearman rank coefficients reflecting the associations of each form of technology with mental health and COVID-19-related stress can be seen in Table 2. Greater COVID-19-related stress was associated with more frequent use of text messages ($r_s = 0.35$, $p = .016$) and video chat ($r_s = 0.33$, $p = .025$). None of the other specific technologies had any significant associations with mental health wellness or COVID-19-related stress. There was no association between overall technology use and mental health wellness or COVID-19-related stress.

Table 2 also shows participant feelings about technology. Greater perceived access to technology ($r_s = 0.38$, $p = .009$), greater enjoyment using technology ($r_s = 0.42$, $p = .003$), and greater feeling that technology was helpful during the infant's time in the NICU ($r_s = 0.41$, $p = .005$) were all associated with higher mental health wellness.

Of note, the most prevalent COVID-19-related stressor was hospital visitation restrictions, which 32% of participants ranked as “extremely stressful”. Table 3 shows the distribution of stress rankings for each COVID-19-related stressor assessed.

4. Discussion and conclusion

4.1. Discussion

Mental health issues continue to be a major problem among parents with infants in the NICU, yet a clear solution has not been described. Other studies have demonstrated increased use of technologies such as videoconferencing for communication with NICU staff during the pandemic [5], which adds context to our finding of increased texting and video-chatting among parents who were more stressed about pandemic-related factors. Given that the most prominent stressor was visitation restriction, perhaps those who were more stressed about their limited NICU presence used these technologies more frequently to communicate with NICU staff. This emphasizes the need for remote approaches to improve family integrated care for NICU parents with limited ability to visit their infant in-person.

Our finding of higher mental health wellness scores among parents with positive feelings about technology and greater perceived access to technology suggests potential clinical benefits of technology. However, several of the technologies we examined were not highly utilized among participants, making it difficult to adequately assess their relationship with mental health. Other studies have demonstrated clinical benefits of technologies that were underutilized, such as live bedside cameras and virtual support groups [1,10,11]. While these technologies have the potential to improve mental health among NICU parents, our finding of low utilization in conjunction with existing literature on technology-use barriers suggests that a lack of awareness or access to these technologies may be limiting their use [9]. To better understand the underutilization of these resources, future studies should collect feedback on this topic directly from NICU parents. Of note, while the NICU in this study did not have any specific protocols in place that may have limited use of these technologies, it also did not have live bedside cameras available, so participants would have needed to bring their own equipment to utilize this resource.

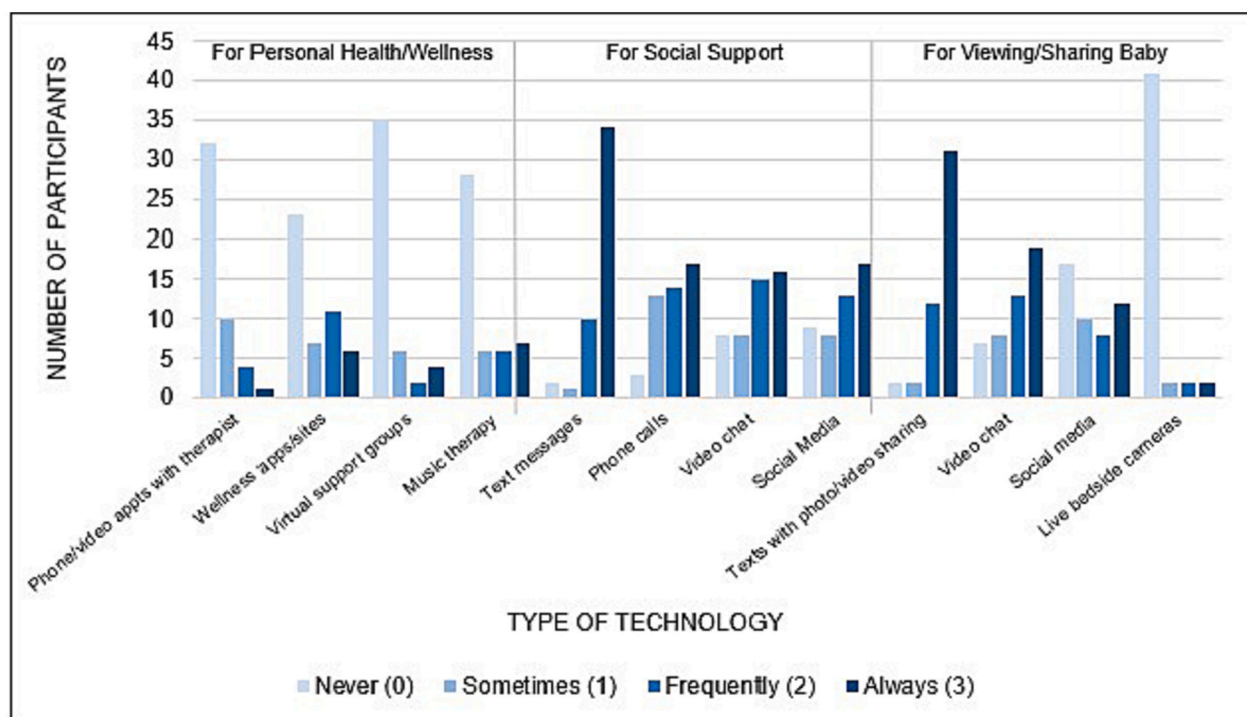


Fig. 2. Prevalence of use of specific technologies among participants.

Table 2

Associations of technology use with mental health and COVID-19-related stress scores. Statistically significant findings are bolded and italicized.

			Spearman Rank Correlations			
			COVID-19-related Stress Scores		Mental Health Scores	
			r_s	p	r_s	p
Feelings about Technology Use		Enjoyment using technology	−0.0879	0.5568	<i>0.4242</i>	<i>0.0030</i>
		Access to technology	−0.0770	0.6070	<i>0.3792</i>	<i>0.0086</i>
		Feeling that technology was helpful during NICU stay	−0.0401	0.7893	<i>0.4056</i>	<i>0.0047</i>
		Phone/video appts with therapist	0.1964	0.1857	0.0801	0.5923
		Wellness apps/sites	0.1351	0.3652	0.2188	0.1395
For Personal Health/Wellness		Virtual support groups	0.2342	0.1132	−0.0600	0.6889
		Music therapy	−0.0828	0.5803	0.2757	0.0607
		Text messages	<i>0.3484</i>	<i>0.0164</i>	−0.1684	0.2578
		Phone calls	0.1718	0.2481	0.0596	0.6906
		Video chat	<i>0.3276</i>	<i>0.0246</i>	−0.1211	0.4176
Frequency of Technology Use	For Social Support	Social Media	0.1603	0.2818	−0.0665	0.6570
		Texts with photo/video sharing	0.1998	0.1782	0.0163	0.9132
		Video chat	0.0933	0.5330	−0.0068	0.9641
		Social media	−0.0486	0.7459	0.0313	0.8347
		Live bedside cameras	−0.0816	0.5857	−0.0830	0.5790
For Viewing/Sharing Baby		Total Technology Use	0.2247	0.1290	0.0267	0.8587

Table 3

COVID-19-related stressors and associated stress severity rankings. Participants were asked to rank each item on a scale of 0–5 in terms of how much stress it caused them during their infant's stay in the NICU, with 0 being “not at all stressful” and 5 being “extremely stressful”. Shown are the numbers and percentages of participants who assigned each severity ranking to each item.

	0	1	2	3	4	5
Stress surrounding COVID-19 in general	13 (27.7%)	11 (23.4%)	4 (8.5%)	7 (14.9%)	8 (17.0%)	4 (8.5%)
Fear that baby will contract COVID-19 in NICU	25 (53.2%)	13 (27.7%)	4 (8.5%)	1 (2.1%)	1 (2.1%)	3 (6.4%)
Fear I will contract COVID-19 in hospital	25 (53.2%)	12 (25.5%)	4 (8.5%)	4 (8.5%)	0 (0.0%)	2 (4.3%)
Fear I will expose my baby to COVID-19 when visiting	26 (55.3%)	8 (17.0%)	1 (2.1%)	4 (8.5%)	3 (6.4%)	5 (10.6%)
NICU visitation rules	11 (23.4%)	6 (12.8%)	6 (12.8%)	3 (6.4%)	6 (12.8%)	15 (31.9%)
Being able to travel to visit baby in NICU	20 (42.6%)	5 (10.6%)	7 (14.9%)	6 (12.8%)	3 (6.4%)	6 (12.8%)

4.2. Innovation

The limited utilization among participants of potentially beneficial technologies, including live bedside cameras, virtual support groups, and virtual counseling, emphasizes the importance of expanding access and awareness surrounding these resources in order to better understand their mental health benefits.

To better address mental health symptoms for parents coping with the stress of having an infant in the NICU, we recommend that NICUs maintain trained staff members who can set families up with appropriate virtual mental health resources, such as virtual support groups for emotional support or virtual counseling to teach coping strategies. Prior studies suggest that parents need to be offered mental health services upon NICU discharge in order take advantage of them [12,13]. Additionally, families with low digital literacy may need extra support when learning to use these resources [14]. Notably, an existing study has successfully implemented app-based support groups for new parents with depression by familiarizing staff members with the app and keeping them available to parents to answer questions [15]. In a similar fashion, we recommend that all NICUs have trained staff members to educate patient families, especially those with lower digital literacy, on the use of virtual support groups and virtual counseling. This may be an appropriate role for case managers, who can ensure that families are properly set up with these resources upon discharge and that they are capable of continued use at home. Future investigations should explore whether these initiatives increase utilization of virtual counseling and support groups among NICU parents, and if this ultimately has mental health benefits.

Our finding of visitation restrictions as a major stressor suggests that limited NICU presence may contribute to mental health issues. In fact, it has been found that NICU parents felt less involved with shared

decision-making when visitation restrictions were in place, and this was cited as a source of stress [6]. To improve family integrated care, we recommend that more NICUs install live bedside cameras to allow parents to feel more connected to their child, and that NICUs employ virtual family-centered rounds to allow more parents to participate in shared decision-making. Although the social restrictions of the COVID-19 pandemic are no longer in place, several other barriers continue to prevent parents from visiting their hospitalized infants, including employment obligations, childcare responsibilities, long distance to the facility, and lack of transportation [1]. While installation of live bedside cameras may be costly, hospitals may ultimately serve to benefit from these changes through higher customer satisfaction scores, as has been demonstrated in other studies [16,17]. In fact, one study found that by improving satisfaction and perception of quality of care among parents, videoconferencing technology in the NICU actually lowered costs associated with hospital transfers [17]. With regards to virtual family-centered rounds, it has been established that family-centered rounds reduce parental stress while improving outcomes, communication, discharge planning, and satisfaction [6]. Future studies should be conducted to explore the mental health benefits of virtual family-centered rounds for NICU parents.

Ultimately, greater use of technologies that enhance family integrated care in the NICU may provide mental health benefits to NICU parents by increasing their feeling of involvement in their infant's care despite barriers to in-person visitation. Specifically, live bedside cameras may promote a feeling of connectedness through increased viewing of the infant, and virtual family-centered rounds may allow for increased parent participation in shared decision-making. Digital literacy education by NICU staff can empower parents to utilize these resources as well as technologies that facilitate continued psychosocial support.

4.3. Conclusion

Improved technology access and digital literacy are associated with greater mental health wellness among parents coping with the stress of having an infant in the NICU.

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Juliet L. Ross: Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Sarah G. Cagino:** Conceptualization, Data curation, Formal analysis, Methodology. **Cassandra L. Denefrio:** Methodology, Project administration, Supervision, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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