TITLE

Asynchronous video messaging promotes family involvement and mitigate separation in neonatal care

AUTHORS

Sandy Kirolos[1], Lynsey Sutcliffe[2], Maria Giatsi Clausen[3], Carolyn Abernethy[1], Shanthi Shanmugalingam[4], Nicole Bauwens[5], Judith Orme[6], Kirsty Thompson[7], Rosemary Grattan[7], Neil Patel[2]

1 Department of Neonatology, Princess Royal Maternity Hospital, Glasgow

2 Department of Neonatology, Royal Hospital for Children, Glasgow

3 School of Health Sciences, Queen Margaret University, Edinburgh

4 Starlight Neonatal Unit, Barnet Hospital, Royal Free London NHS Foundation Trust

5 Department of Neonatology, Aberdeen Maternity Hospital, Aberdeen

6 Department of Neonatology, Simpson Centre for Reproductive Health, Royal Infirmary of Edinburgh

7 Department of Neonatology, Forth Valley Royal Hospital

Corresponding Author: Sandy Kirolos

Address: Department of Neonatology, Princess Royal Maternity, 16 Alexandra Parade, Glasgow, G31 2ER

Phone: 0141 211 4000

Email: sandy.kirolos@nhs.net

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ABSTRACT

Objective: To evaluate the parent and staff experience of a secure video messaging service as a component of neonatal care.

Design: Multi-centre evaluation incorporating quantitative and qualitative items.

Setting: Level II and Level III UK neonatal units.

Population: Families of neonatal inpatients and neonatal staff.

Intervention: Use of a secure, cloud-based asynchronous video messaging service to send short messages from neonatal staff to families. Evaluation undertaken July to November 2019.

Main Outcome measures: Parental experience, including anxiety, involvement in care, relationships between parents and staff, and breastmilk expression.

Results: In pre-implementation surveys (n=41), families reported high levels of stress and anxiety and were receptive to use of the service. In post-implementation surveys (n=42), 88% perceived a benefit of the service to their neonatal experience. Families rated a positive impact of the service on anxiety, sleep, family involvement and relationships with staff. Qualitative responses indicated enhanced emotional closeness, increased involvement in care, and positive impacts on breastmilk expression. Seventy-seven post-implementation staff surveys were also collected. Staff rated the service as easy to use, with minimal impact on workload. Fifty-five (71%) felt the service had a positive effect on relationships with families. Staff identified the need to manage parental expectations in relation to the number of videos that could be sent.

Conclusions:

Asynchronous video messaging improves parental experience, emotional closeness to their baby, and builds supportive relationships between families and staff. Asynchronous video supports models of family integrated care and can mitigate family separation, which could be particularly relevant during the COVID-19 pandemic.

INTRODUCTION

There is growing appreciation of models of neonatal care designed to engage and empower families as primary care-givers [1–4]. These models of Family Integrated Care (FiCare) are associated with improved outcomes for patients, their families and service providers [5,6].

Unrestricted family access is a key component of FiCare[7,8]. Ordinarily families may be physically separated from their newborn due to work, to care for other family members, or because of lack of money, transport, or on-site accommodation[9].

Coronavirus Disease 2019 (COVID-19) has brought new and unprecedented challenges in clinical care, including the delivery of FiCare. Strict infection control measures have created new barriers to family involvement in care, restricting the duration and number of family members who can visit, and excluding those at risk of having COVID-19 infection [10,11].

Innovative solutions are required to mitigate family separation[12]. Live video technologies are available, but have practical limitations and potential unintended negative consequences [13]. Asynchronous, recorded or "store-and-forward" video, may offer greater convenience and support relationships between families and staff. The vCreate asynchronous video service has been widely implemented in over 60 neonatal units in the UK. During the COVID-19 global pandemic this digital service has been extended to additional neonatal, paediatric, and adult critical care settings.

AIM

To evaluate the impact of a secure video messaging service on parent and staff experience of neonatal care.

METHODS

A multi-centre service evaluation was performed in five UK neonatal care units (four level III, one level II) between July and November 2019. The vCreate Neonatal Video Diary service (vCreate, Windsor, UK) was developed in collaboration with neonatal patient families and the clinical team at the Royal Hospital for Children, Glasgow.

Families consented and registered to use of the service. Neonatal staff recorded short videos (1-3 minutes duration) on a tablet device (Apple iPad, Apple, CA) and used the vCreate web-app to assign these to pre-registered parent accounts. Videos are stored in a secure cloud (Microsoft Azure, Microsoft, WA). Families downloaded, viewed and shared their videos using their personal login on any internet-enabled device. Guidance on creating video content was available in each unit. Specifically, videos were used to provide generic updates, not specific clinical information, and to capture significant moments in a baby's life that the parents might otherwise have missed e.g. first feeds, successful extubation, first time dressed.

The vCreate service is funded in individual units from local hospital or neonatal charities, with no additional costs to the health service provider (UK National Health Service, NHS) or to families. The service received Information Governance and IT security approval in each centre and is an NHS Digital Library Trusted App.

Pre and post-implementation surveys were designed for staff and families. Staff pre-implementation surveys were distributed in two centres where the service was not yet in use. Parent pre and post-implementation surveys were distributed in three centres where the system was already in use as a component of standard clinical care. Surveys contained quantitative (9-point Likert scale, or closed-ended yes/no responses), and qualitative items (open comment boxes). Factors evaluated were

parental stress and anxiety, breast milk expression, involvement in care (parents and extended family), emotional closeness, sleep, visiting and phoning, relationship with staff, staff workload, ease-of-use of the service, barriers and concerns relating to the service.

Surveys were distributed in paper format by evaluation team members at each site to all eligible participant families and were returned by respondents anonymously to collection boxes. Only families who did not consent to use of vCreate were excluded. The sample size represents a convenience sample of parents and staff using the service and available to respond to the survey during the study period.

Quantitative data were analysed using Graphpad Prism V8.4.2 and summarised as median, range and percentage. The impact of patient and video-service related variables on parental outcomes were assessed (length of use of video service, number of videos received at time of evaluation, frequency of receiving videos, and gestation of infant), using Mann-Whitney analysis to compare dichotomous groups. A p-value of <0.05 was considered significant.

Qualitative data were analysed using nVivo v.11 (nVivo, QSR, UK). Relevant themes and concepts were identified by content analysis of the free-text survey responses. A coding dictionary was created and individual survey responses of all respondents were coded accordingly. Coded responses were aggregated to report themes from both parent and staff surveys.

RESULTS

Parent responses

Forty-one pre-implementation surveys were returned by families. Respondent's infants had a median (range) gestation at birth of 33 (24-41) weeks. Parents reported high levels of satisfaction with

family-staff relationships, but also high levels of stress related to separation, concern for their child's health, and fear of the unknown (Table 1). Families felt that future use of the video messaging service would reduce stress (68%), improve their involvement in care (61%), and enhance emotional closeness (61%). All families (n=41, 100%) had access to a suitable internet-enabled device. Parental concerns related to security of the service and staff workload.

Table 1: Pre-implementation parent responses

Theme	Parent comments
Parent stressors	
Separation	"I don't want to leave him" "Being apart from your newborn and not being there 24hr is stressful"
Worry about baby's health	"Worried about my baby's health - I thought she might die" "My baby's health and constant ups and downs, worries about getting him better"
Feeling afraid, sad, helpless	"I'm afraid" "As a new father for the first time it takes its toll, you feel helpless" "Not being able to stay with my baby or see him caused me great stress and sadness"
Fear of unknown	"Not knowing how she is when not here" "Fear of unknown"
Siblings	"Feeling like bad parents having to leave other kids to come to hospital"
Money and work	"Cost of going to and from hospital" "Still running a business because they came so early"
Feelings about future use of video service	
Stress and anxiety	"I would have loved to have a video of her so I could be reassured she was comfortable and not in pain. It would reduce my stress a lot"
Emotional closeness	"It would help to feel closer to her and I can see how she is all the time" "It would make me feel like we weren't apart"
Relationship with staff	"It would build more trust and faith in how well they care for her" "Feel more at ease with who's looking after your child"
Security	"Only concern is security and data protection" "Who would access the videos, when would they be deleted"
Staff distraction	"I might be a bit more concerned if the nurses had to spend more time than is necessary taking video recordings rather than attending to the babies"

Forty-two post-implementation parental surveys were returned, by families whose infants were median (range) gestation at birth 30 (23-41) weeks. Thirty-seven respondents (88%) were mothers. Sixty-nine percent of families had been on the neonatal unit for more than two weeks and 67% (n=28) of respondents had been using the service for more than two weeks. At the time of survey, the number of videos received per family were: 19 (45%) had received < 5 videos; 9 (21%) had received 5 to 10 videos; 10 (24%) had received 11-15 videos; 3 (7%) had received >15 videos, one non-response. Nineteen families (45%) would have liked to have received more video messages.

Thirty-eight (90%) reported an overall positive impact of video messaging on their neonatal experience, three (7%) were unsure, one respondent reported no overall benefit. Median parental ratings of impact (ranging from 1 = greatest negative impact to 10 = greatest positive impact) were, for sleep 7 (range 5-10), anxiety 8 (range 5-10), breastmilk expression 5 (range 5-10), extended family involvement 7 (range 5-10), and relationship with staff 9 (range 5-10), Figure 1.

Qualitative parental responses highlighted key themes of reduced stress and anxiety, and increased feelings of reassurance particularly at times when parents had to leave their baby. Parents also indicated that use of the service made them feel more involved in their child's care in the neonatal unit, by giving them a sense of inclusion when they could not be physically present and ensuring they did not miss out on significant moments. Parents also reported that visualising and seeing their child in the videos, when they could not be present, led to greater emotional closeness and stronger bonding, Table 2.

Table 2: Post-implementation parent responses

Theme	Parent comments
Parent experience	
Anxiety and stress	"It has reduced my stress levels, especially at night when I have left the neonatal unit" "I see my baby is safe, so my stress levels are reduced"
Reassurance	"It is reassuring to see she is being cared for when I'm not present" "It gives me peace of mind" "Being able to see my baby when I'm at home is overwhelming but reassuring that he is ok" "It helps if he's been having a bad day to see that things have calmed down after we've left"
Involvement in care	"You feel included by being sent the videos and photos as you are being included in stuff that's happening when you're not there" "It helps us feel more included and that the staff are thinking of us" "Seeing moments we would maybe normally miss"
Emotional closeness	"It helps with the feeling of bonding as we see more of him" "Despite distance, getting to see him makes us feel closer to him" "This makes me see how well my baby has come along and gives me a strong bond"
Breastmilk expression	"The very first one was hugely emotional and actually helped with my breastmilk!" "It really helps! One was entitled "ready for feeding" so the next day we tried her on the breast"
Extended Family	"We sent to family which helped them too as at that point they hadn't even seen her"
Relationships with staff	
Appreciation	"We love and appreciate the time the two nurses who did the videos have taken - meant a lot to us!" "I appreciate how busy the staff are and how hard they work, the fact they take the time to send a little video is kind" "I feel they care not only for my baby, but also for my mental comfort"

Communication	"It allows me to form a bond with staff by talking about the impact of the videos" "More confident in asking questions" "Makes me appreciate the staff and the job they do. Can talk openly to staff in the unit. Makes you feel more comfortable" "It is a very personal touch and helps build rapport"
Trust	"They often speak on the videos this builds a trust" "It has given me more trust and confidence with the staff in the neonatal unit"
Concerns and technical aspects	
Inconsistent frequency of videos	"Sadly we received videos the first 2 nights but then none the following 2 so that made us more anxious wondering why and what was wrong" "I wish I would have gotten videos more frequently"
Technical issues	"Can't save the video on phone" "Only able to share with family for 24hr"
Security concerns	"Risk of my baby's photos being sent to another parent"

Parent-reported measures of the impact of the video service were compared based on length of service use (< or ≥ 4 weeks), number of videos received (< or ≥ 10), frequency of receiving videos (< or ≥ every 2 days), and infant gestation (< or ≥ 32 weeks). No significant differences were observed for any of these variables, Table 3.

Table 3. Parent-reported outcomes of use of asynchronous video service and variables related to patient characteristics and service use

		Parent-reported outcomes, Likert score 1-10, median (range)							
		Stress	**Involvement in care**	**Emotional closeness**	**Parent-staff relationship**	**Sleep**	**Anxiety**	**Breastmilk expression**	**Extended Family Involvement**
Length of use	**< 4 weeks** (n=29)	8 (5-10)	8 (4-10)	8.5 (5-10)	9 (5-10)	7 (5-10)	8 (5-10)	5 (5-10)	6 (5-10)
	≥ 4 weeks (n=13)	8 (5-10)	7 (5-10)	8 (4-10)	9 (5-10)	5 (4-10)	6 (5-10)	5 (1-10)	7 (4-10)
	P	0.77	0.26	0.47	0.28	0.83	0.26	0.43	0.85
Number of videos received	**< 10** (n=29)	8 (5-10)	8 (4-10)	8 (5-10)	10 (5-10)	6.5 (5-10)	8 (5-10)	6 (5-10)	6.5 (5-10)
	≥ 10 (n=13)	9 (7-10)	8 (5-10)	8 (5-10)	8 (5-10)	7 (5-10)	8 (5-10)	5 (1-10)	7 (4-10)
	P	0.10	0.96	0.69	0.41	0.74	0.95	0.15	0.84
Frequency of videos received	**< 2 days** (n-22)	8 (5-10)	8.5 (5-10)	9 (5-10)	9 (5-10)	7 (5-10)	7 (5-10)	5 (5-10)	6.5 (5-10)
	> 2 days (n=20)	8 (5-10)	7 (4-10)	8 (4-10)	9 (5-10)	6.5 (5-10)	8 (5-10)	5 (1-10)	7 (4-10)
	P	0.33	0.22	0.54	0.95	0.78	0.28	0.82	0.56
Gestation of infant	**< 32 weeks** (n=24)	8 (5-10)	8 (4-10)	8 (5-10)	9.5 (5-10)	7 (5-10)	8 (5-10)	6 (1-10)	7.5 (4-10)
	≥ 32 weeks (n=18)	8 (5-10)	8.5 (5-10)	8.5 (4-10)	8 (5-10)	5 (5-10)	6.5 (5-10)	5 (5-10)	5.5 (5-10)
	P	0.91	0.69	0.89	0.30	0.13	0.10	0.21	0.22

Families reported that receiving video updates did not affect the number of times they visited the neonatal unit, but that use of the service led them to make fewer phone calls to the neonatal unit.

Staff responses

Twenty-six staff pre-implementation surveys were completed, by 15 nursing staff, one occupational therapist, and 10 medical staff. Thirteen (50%) felt the service could potentially be implemented alongside current workload, three (12%) said no, and 10 (38%) were unsure. Fourteen (54%) felt it would positively impact relationships with families. 18 (70%) were interested in future use of the service.

Seventy-seven staff completed post-implementation surveys, all were nursing staff. Median number of videos sent per respondent was 3 videos per week (range 1–10). Forty-one (54%) reported that they would like to send videos more frequently.

Median (range) staff ratings were, for ease of use 3 (range 1-10: 1=extremely easy, 10= extremely difficult) and for workload 4 (range 1-8; 1=increased workload, 10 = reduced workload). Fifty-five (71%) felt that the service had a beneficial impact on their relationship with families, 12 (16%) were unsure, and 10 (13%) felt it had no effect.

Qualitative staff responses confirmed themes of a modest increase in workload, satisfaction in sending videos for families, improved communication, and trust and appreciation between staff and families. Staff expressed a need to balance parental expectations against clinical workload. Technical issues and need for training were highlighted by a minority of respondents, Table 4.

Table 4: Post-implementation Staff Responses

Theme	Staff comments
Staff experience	
Satisfaction	"I really enjoy sending these videos as much as families love to receive them" "Think it's a great service we can offer to parents/families and I enjoy making the videos individualized to babies" "It is a very nice service for parents and allows the nurses to be creative"
Workload	"It's an extra task to do at the end of your shift but it's a task that I want to do. It doesn't take long" "A little extra but not difficult and rewarding for parents"
Relationship with families	
Parent interaction and experience	"Brilliant. Such an easy way to give memories and some positivity to families" "It's a very positive experience for parents, they always are thankful and talk about how important it has been for them and other siblings" "More positive, they love to chat about the videos" "Positive effect on parents, less fear of making the first phone call of the day"
Communication and trust	"Helps build more of a rapport with parents and gives you something extra to talk about" "Helps to gain the parents trust that you care about them and their baby" "Parents feel more involved and part of the team, which makes our working relationship better"
Appreciation	"They appreciate it and you know you made them feel a bit better seeing their baby is okay" "It's lovely to see how delighted they are with a visual update"
Parent expectation	"Sometimes there's an expectation to receive regular updates which isn't always possible if the unit is busy"
Technical aspects and training	
Technical issues	"If video fails to load, have to repeat again" "Wifi can be an issue resulting in loss of video"
Training	"More training will make me more confident and will make it quicker for me to do"
Equipment	"Sometimes only one iPad available and not always at hand"

DISCUSSION

We evaluated family and staff experience of a secure asynchronous video messaging service in neonatal units.

Families reported that use of the service reduced stress and anxiety, increased involvement in care and emotional closeness, and improved relationships with staff. Staff reported high levels of satisfaction with the service, perceived a benefit for families and improved relationships with them, with only a modest increase in workload.

Need and barriers to implementation

Pre-implementation responses from families highlighted the underlying need for improved support when their newborn is receiving critical care. Families expressed high levels of stress, worry for the future, and fear of the unknown, which are well-recognised in these settings [14]. Families did not report any barriers to using the service; they were technically prepared with universal smartphone ownership and the majority perceived the potential benefits.

Similarly, the majority of staff were receptive to future use of the service. Concerns raised around additional workload and service security highlight these as important factors to address with new users. However, no issues with security were raised by users post-implementation.

Use of the vCreate service required individual information governance and information technology approvals in each participating centre. The absence of a consistent, centralised process for review and approval of new digital services, or for sharing of these across multiple sites, is a potential barrier to clinical implementation and an ongoing inefficiency in health services

Supporting family involvement in care

Families reported consistent benefits from use of the service. Notably, reduced stress and anxiety and feelings of reassurance. Importantly, none expressed a negative impact. These benefits might be particularly relevant for families in critical care during the heightened concerns and mental health challenges associated with COVID-19 [15–17].

Families also reported that the service increased emotional closeness with their child and their sense of involvement in care. Both families and staff felt strongly that the service supported and strengthened their relationships with each other, building communication, appreciation and trust.

These are core elements of FiCare models, indicating a key role for asynchronous video in the practical delivery of this model of care [18,19].

A subset of families additionally reported that video messages supported their breastmilk expression and breastfeeding, potentially contributing indirect benefits of immuno-protection, neurodevelopment, improved preterm outcomes, parent-infant bonding and maternal health [20,21]. Interestingly, the benefits of receiving asynchronous video did not appear to be related to infant gestation, duration of neonatal admission, or the number of videos received. This finding suggests that all families in the neonatal unit may benefit from use of the service.

Staff expressed strong satisfaction with the service as a tool enabling them to support families. This also has particular relevance for models of FiCare in which staff become teachers and mentors to families, reinforcing them as partners at the heart of care[22]. This benefit of the service may be especially important in critically-ill patients where survival is uncertain. In these circumstances, video messages may allow staff to provide an additional support to families, with potential benefits to parent and staff wellbeing [23,24].

Workload and expectations

Our findings highlight the need to balance staff availability to make and send videos against families' desires to receive more. Parents themselves recognised the potential risk of distracting staff from other clinical duties. In our experience, videos can be made in less than five minutes, though this was not formally assessed in the evaluation. Setting and managing families' expectations of the number and timing of videos is important. In our practice we encourage staff to discuss with families when they would like to receive a video, what content they like to receive, and reassure them not to worry if they do not receive a video.

Importantly, receiving videos did not affect how often families attended the neonatal unit, but did reduce the number of phone calls they made, potentially reducing disruption to care delivery by busy staff.

Alternative video technologies for critical care

This is the first evaluation of an asynchronous neonatal video service, enabling staff to securely share short care videos. Alternative live video services permit families to remotely view their infant for extended periods, but have been associated with challenges [13,25]. Kerr et al reported heightened parental anxiety during use of live neonatal video services, including when live video was unexpectedly discontinued or not switched back on, when a crying infant was not immediately comforted, and the risk of witnessing a procedure they would prefer to have not seen. Kilcullen et al investigated staff perceptions of live videos streams, with reports of anxiety relating to a disruption in workflow due to an increased frequency of phone calls to the unit if the camera was not switched on, and issues relating to use of the hardware and reliable connectivity[26]. The current evaluation did not directly compare these live and recorded (asynchronous) video technologies, but potential differences include a need for more hardware, reliable WiFi connectivity and increased cost of live video services.

Extended use of the asynchronous service during COVID-19

Our evaluation was conducted in the months preceding COVID-19. Unprecedented new restrictions on hospital visiting have now heightened the need for innovative, convenient, solutions to connect patients, families, and staff [27]. The video service has been rapidly extended to additional neonatal, paediatric and adult critical care areas, and is being adapted to support patient-to-clinician outpatient

communication in adult and paediatric services. Further evaluation will be required to understand the impact of the service in these additional settings during this pandemic.

Limitations

Pre-implementation and post-implementation surveys were not administered to the same staff or families. Surveys were distributed to all eligible participants and returned anonymously, therefore we are unable to report specific response rates. Video content was not evaluated, nor was any potential "dose-response" of the number of videos received. Additional potential confounders include nature or severity of the infants' conditions, duration of admission at time of response, staff and family age and previous experiences. We did not evaluate the impact in non-English speaking families, however, use of the system has been explored in centres in non-English speaking countries. Investigators at one evaluation site provided clinical input during development of the video service, introducing a potential bias. Future evaluations could include other staff groups, including allied health care professionals, and sub-group analysis based on additional infant and family characteristics.

CONCLUSION

Asynchronous video messaging from healthcare workers to families in a neonatal care setting supports family involvement in care, parental wellbeing, and strengthens positive relationships with staff. This service could be an important practical component of family-integrated models of care and of particular benefit in mitigating family separation during COVID-19.

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Author contributions

NP, MGC, LS developed the concept and designed evaluation surveys. LS, SS, CA, KT, RG, NB, JO distributed surveys and collated results in their centres. SK and LS combined all survey data and performed analysis, with support from MGC and NP. All authors contributed to authoring the manuscript.

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What is already known on this topic:

- Involving families as primary caregivers in the neonatal team improves outcomes for infants, their parents, and services.
- Parental presence and supportive relationships with staff are key components of family-integrated care models.
- Live video services in neonatal care may be associated with parental and staff anxiety and increased staff workload.

What this study adds:

- This is the first evaluation of asynchronous video to support neonatal care.
- Video messages sent from neonatal staff to families improve parent experience, involvement in care, and relationships with staff.
- Video messages may mitigate the effects of family separation, including during restrictions associated with COVID-19.

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Figure Legend:

Figure 1: Parent-reported impact of video messages
Data presented as median and range. Parent rating; 1= greatest negative impact, 5= no impact, 10 = greatest positive impact