

REGULAR ARTICLE

Using telemedicine in the care of newborn infants after discharge from a neonatal intensive care unit reduced the need of hospital visits

Charlotta Robinson¹, Anna Gund², Bengt-Arne Sjöqvist², Kristina Bry (kristina.bry@pediat.gu.se)^{3,4}

1.Norra Älvsborg Regional Hospital, Trollhättan, Sweden

2.Chalmers University of Technology, Gothenburg, Sweden

3.Department of Paediatrics, Division of Clinical Sciences, Gothenburg University, Gothenburg, Sweden

4.Division of Neonatology, Sahlgrenska University Hospital, Gothenburg, Sweden

Keywords

Home health care, Newborn, Preterm infant, Telemedicine

Correspondence

K. Bry, Department of Paediatrics, The Queen Silvia Children's Hospital, 41685 Gothenburg, Sweden.

Tel: +46 31 3434630 |

Email: kristina.bry@pediat.gu.se

Received

16 November 2015; revised 5 February 2016;

accepted 14 March 2016.

DOI:10.1111/apa.13407

BACKGROUND

Telemedicine applications can enhance the involvement of patients in their own care, provide monitoring of their symptoms and help the healthcare provider identify signs of deterioration in the patient's condition early and respond to these in a timely manner. Telemedicine has mostly been used in the management of adult patients with chronic conditions, such as congestive heart failure, stroke or chronic obstructive pulmonary disease (1). Recently, telemedicine applications have also been used in the home care of children with chronic illnesses. A randomised trial of a remote home support programme for infants with major congenital heart disease showed that the use of video conferences compared with telephone consultations made clinicians feel more confident in making medical decisions (2). Parents were more satisfied with videoconferencing support than with telephone calls. The risk of hospitalisation was also lower in the videoconferencing group (2). Videoconferencing has also been shown to be feasible in the

ABSTRACT

Aim: This study examined the use of telemedicine as a means to follow up infants discharged from a Swedish neonatal intensive care unit to home health care.

Methods: Families were randomised to either a control group receiving standard home health care ($n = 42$ families) or a telemedicine group receiving home health care with telemedicine support ($n = 47$ families) after discharge from the hospital. Both groups had follow-up hospital appointments with the neonatal nurse. In the telemedicine group, appointments were supplemented by the use of a specially designed web page and video calls.

Results: The use of the web page and video calls decreased the number of emergency visits to the hospital ($p = 0.047$). In the telemedicine group, 26% of the families felt they had more scheduled appointments than necessary, whereas only 6% of the families in the control group thought so ($p = 0.037$). The parents were highly satisfied with the use of telemedicine. Although the nurses were favourable to using telemedicine, the rigid organisation of the home healthcare programme and the nurses' schedules and work routines prevented its optimal use.

Conclusion: The use of telemedicine decreased the need of hospital visits. Organisational adaptations would be necessary to make the best use of telemedicine.

management of children on home ventilator support (3) as well as for paediatric palliative care at home (4).

An area where the use of telemedicine is being developed is the home health care of newborn infants. Due to prematurity or illness, many newborn infants need hospital care after birth. When the infants are sufficiently mature and physiologically stable, the infants can be discharged from the NICU to home health care in which neonatal staff support parents in the care of their infants. In a previous study, we compared the use of either a web application or

Key notes

- This randomized study examined the usefulness of video calls and a specially designed web page in hospital-supported home health care of newborn infants after hospital discharge.
- The use of telemedicine decreased the need for scheduled follow-up visits and the number of emergency visits to the hospital.
- For the optimal use of telemedicine applications, a reorganisation of the home healthcare programme and the nurses' schedules would have been needed.

Abbreviation

NICU, Neonatal intensive care unit.

video calls with traditional telephone calls in the home health care of preterm infants after discharge from a large neonatal intensive care unit (NICU) of a university hospital. Under this hospital's home healthcare programme, neonatal nurses made home visits to the family until the visits were no longer necessary (5). The randomised pilot study showed that parents felt that the use of telemedicine helped them cope with the care of their infant at home (5).

In western Sweden, the catchment areas of regional hospitals are very large, making home visits time-consuming and therefore costly. At the Norra Älvsborg Regional Hospital, infants who are discharged from the NICU have control visits at the hospital instead of home visits by nurses. Since both parents are on parental leave during the period of hospital-supported home health care, they can be present during the hospital visits. In the present randomised study, we investigated whether the combined use of a web application and video calls would improve the comfort level of parents taking care of their infants at home and decrease the need for scheduled or emergency visits to the hospital.

PATIENTS AND METHODS

Ethical approval

This study was approved by the Institutional Review Board for Human Studies of Gothenburg University.

Patients and study groups

The study was conducted at the NICU of Norra Älvsborg Regional Hospital during the years 2012–2013. The hospital has about 3500 births per year. Due to the regionalisation of neonatal care in western Sweden, this hospital admits only babies born at or above 27 weeks of gestational age. During the years 2012–2013, 1112 babies were admitted to the NICU. Of these, 161 received home health care after discharge from the unit.

Families with newborn infants who were going to be discharged from the NICU to home care were eligible for the present study, except families with insufficient knowledge of the Swedish language to be able to converse on the phone with the nurses or read and write messages written in Swedish, families without a computer and Internet connection at home and families whose infant was expected to need control visits for less than a week.

A total of 139 families fulfilled the inclusion criteria. Of these, 137 families were given both oral and written information about the study during their child's hospitalisation. To ensure that all the families received the same information, one of the authors (CR) informed all the families. As discharge from the unit approached, the families were asked whether they wanted to participate in the study and 89 (65%) consented. After they provided written informed consent, they were randomised into two groups, with 42 families in the control group and 47 families in the study group.

Families in the control group received standard health care after discharge from the hospital. This meant that the

families generally visited the hospital neonatal nurse two to three times per week on Monday, Wednesday or Friday. At each visit, a neonatal nurse met with the family for 30–90 minutes. During the visit, the baby was weighed and his or her length and head circumference were measured. The nurse answered the parents' questions and concerns and provided instructions on how to care their infant. The next visit was usually booked at this time. In addition, the nurse could phone the family as needed. The family could phone the neonatal nurses at the hospital or come to the hospital with their infant at any time, if needed.

The care received by the telemedicine group was similar to that received by the control group except that the hospital visits were complemented with the web application. In addition, the nurses were instructed to use video calls instead of regular phone calls to communicate with the families. As in the control group, the families could telephone the neonatal nurses at the hospital or come to the hospital with their infant at any time.

Prior to discharge from the hospital, the parents in the telemedicine group were shown how to use the web application and were also given written instructions about its use. They were encouraged to answer the ten questions on the web form once a day. They could also write messages to the nurses either through the form or through the internal mail function of the web application. If interested, the families could see their child's data, including his/her growth curve, in graphic form. The home health nurse was instructed to read the parents' answers, give them feedback and answer any questions the parents had written the same day.

In addition to using the web application, the families in the telemedicine group received video calls from the nurse. Each call was scheduled in advance at the time of the previous hospital visit. The video calls took place on Mondays, Wednesdays or Fridays since the nurses worked with home health care only on these days.

Neonatal nurses

Four neonatal nurses at the hospital were involved in the study. They were 38–47 years old and had worked at the NICU for 12–15 years. They received training in the use of the web application and Skype prior to the study.

The web application

The web application contained a form with 10 questions about the child's health and nutrition as well as how the parents were coping with the care of their infant at home. Questions about the infant's general health, activity level, sleeping pattern, nutrition (including tube feeding), spitting up and skin-to-skin care were included. The nursing staff entered the baby's weight and length data on the web page and could view the parents' answers and any questions or comments. The parents could view the child's data in graphic form. The parents and the nurses could also exchange internal messages with each other through the web application.

Video calls using Skype

Skype is a commercially available off-the-shelf programme for video communication over the Internet. The user logs in with a username and a password and can make voice or video calls and send text messages to other Skype users.

For Skype calls, the families were given a bag containing an HD web camera, namely a Logitech QuickCam Pro9000 for PC users and Logitech QuickCam Vision Pro for Mac users (Logitech International S.A., Lausanne, Switzerland), a set of Ace G35 speakers (Ace of Sweden, Mölndal, Sweden) and a compact disc containing the installation programme for Skype version 5.3. The families were given both oral and written instructions for the use of the web camera and Skype.

Data retrieval and analysis

The infant's gestational age and birth weight as well as the length of initial hospitalisation and of the home healthcare period were recorded. The number of scheduled and emergency visits to the hospital as well as the number of phone and video calls was recorded. The number of times the families or nurses used the web application for communication was also studied.

After discharge from the hospital-supported home health care, the families were asked to fill in a questionnaire on what they thought of the home health care they had received. Thirty-five of 42 families (83%) in the control group and 32 of 47 families (68%) in the telemedicine group completed the questionnaire. The questionnaire for the telemedicine group contained questions specific to this group and was therefore longer than that of the other group. This may in part explain why a lower percentage of parents in the telemedicine group filled in the questionnaire.

The nurses were also given a questionnaire addressing their perceptions of the use of the web-based system and

video calls in neonatal home health care. Three of the four nurses (75%) filled in the questionnaire.

Statistics

The results are given as means \pm SEM. The two-tailed Mann–Whitney *U*-test was used to compare continuous variables between the control and the web group. The relation between categorical variables was analysed using Fisher's exact test. A *p* value of <0.05 was considered significant.

RESULTS

Characteristics of the mothers and infants

Maternal age, the number of older siblings in the family, the gestational age of the infants at birth, their birth weights and the length of their hospitalisation before discharge to home health care did not differ significantly between the groups (Table 1).

The postmenstrual ages and weights of the infants at the beginning and end of home health care were similar in the two groups and so was the duration of home health care (Table 1).

Scheduled and emergency visits to the hospital and hospitalisation episodes during the home healthcare period

Before discharge from the hospital to home health care, the time of the first appointment with the hospital neonatal nurse was scheduled. At each appointment, the subsequent visit was booked. Overall, families in the control and web group had one scheduled hospital visit per 2.6 and 3.0 days of home care, respectively. The number of scheduled appointments to the hospital nurse did not differ between the two groups. However, the frequency of these visits, that is the number of appointments per day of home health care,

Table 1 Characteristics of mothers and infants, of the initial hospitalisation and of the home health care

	Control group, median (range)	Telemedicine group, median (range)	<i>p</i> value
Mothers			
Age	31 (21–45)	30 (21–40)	ns
Siblings			
Number of older siblings	0 (0–4)	0 (0–10)	ns
Infants			
Gestational age, weeks + days	34 wk + 0d (26 wk + 0d – 42 wk + 1d)	34 wk + 2d (23 wk + 0d – 42 wk + 0d)	ns
Birth weight, g	2015 (695–5495)	2243 (590–4750)	ns
Length of hospitalisation, days	14 (2–92)	12 (4–129)	ns
Corrected age when discharged from hospital to home health care, weeks + days	36 wk + 1d (34 wk + 1d – 43 wk + 1d)	36 wk + 2d (35 wk + 0d – 44 wk + 2d)	ns
Weight when discharged from hospital to home health care, g	2305 (1525–5460)	2355 (1570–4780)	ns
Corrected age at discharge from home health care, weeks + days	39 wk + 4d (36 wk + 3d – 46 wk + 6d)	39 wk + 4d (36 wk + 2d – 51 wk + 0d)	ns
Weight at discharge from home health care, g	3030 (2145–5552)	3150 (1955–5550)	ns
Days in home health care	19 (7–71)	21.5 (7–67)	ns

ns, not significant.

Table 2 Number and frequency of scheduled and emergency visits to the hospital during home health care

	Control group, median (range)	Web group, median (range)	p value
Total number of scheduled visits to hospital during home health care	7.7 (2–23)	7.5 (3–20)	ns
Number of scheduled visits to hospital per day of home health care	0.38 (0.17–0.45)	0.33 (0.18–0.57)	0.0053
Total number of emergency visits to hospital during home health care	1 (0–6)	0 (0–7)	0.047
Number of emergency visits per day of home health care	0.05 (0–0.26)	0 (0–0.2)	0.0085

ns, not significant.

was significantly lower in the telemedicine group than in the control group (Table 2).

Between scheduled visits, emergency visits to the hospital occurred because of unexpected concerns or situations in which parents acutely needed help from the nurses. The most common reasons for an emergency visit were suspected illness in the infant or need of reinsertion of the nasogastric tube. Both the total number of emergency visits and their frequency were significantly lower in the telemedicine group than in the control group (Table 2).

Most families in both groups reported that the number of scheduled visits was adequate (Table 3). However, a large percentage (26%) of the families in the telemedicine group felt they had had more visits than they needed, whereas only 6% of the families in the control group thought so ($p = 0.037$, Fisher's exact test).

A total of three planned visits, two in the web group and one in the control group, led to admission to the hospital. The infants in the web group were hospitalised for the evaluation of poor weight gain and for osteopenia of prematurity. The infant in the control group was admitted for increased oxygen requirement and low blood haemoglobin requiring a blood transfusion. The percentages of planned visits leading to hospital admission were 0.6% and 0.3% in the web and the control group, respectively. The difference is not significant ($p > 0.9$, Fisher's exact test).

Seven emergency visits led to hospitalisation, five in the web group and two in the control group. In the web group, one infant was admitted to the hospital twice, once for observation for a suspected infection involving tiredness and poor food intake and once for a viral upper airway infection. The other three infants in the web group were hospitalised for observation because of two episodes of colour change in the infant during sleep, observation because of an episode of apnoea after spitting up, subse-

quently interpreted as a laryngospasm, and a viral upper airway infection. The two infants in the control group were hospitalised for a viral upper airway infection and for observation because of an episode of apnoea after spitting up, later interpreted as a laryngospasm. The reasons for the hospital admissions were of such a kind that they could not have prevented by telemedicine consultation. The percentages of emergency visits leading to hospitalisation were 17% and 4% in the web group and the control group, respectively. There was a trend towards emergency visits being more likely to result in hospital admission in the web group, possibly indicating that telemedicine consultations could prevent unnecessary emergency room visits. The difference between the two groups, however, was not statistically significant ($p = 0.12$, Fisher's exact test).

Use of video calls and the web application in the telemedicine group

To make video calls to the families, the nurses used one stationary computer located in a room outside the NICU, since installation of Skype on the computers in the NICU was not allowed. Video calls were scheduled in advance and took place on Monday, Wednesday or Friday, since the nurses only worked in home health care during these days.

The number of video calls received by families was low, ranging from zero to five. On average, there was one Skype call per 19 days of home care. In the telemedicine group, 13 families (28%) received no video calls at all. Three of these families had problems with their Internet coverage. Three families had a short stay of less than 14 days in the home healthcare programme and paid frequent scheduled visits, three times per week, to the hospital. In these cases, video calls were deemed unnecessary. One family did not want to receive video calls. In one case, video calls were not used because the family visited the hospital nurse frequently due to the infant's illness.

The families in the telemedicine group were asked to answer the questions on the web page every day. The median number of times the families filled in the web form was 10.5, and the range was 1–30. On average, the families completed the web form every other day. The nurses were supposed to check on a daily basis what the parents had written, send a note back to acknowledge having read the entry and answer questions if necessary. However, the nurses only responded to 33% of the parents' entries. In addition, the website contained answers to frequently asked questions about newborn infants and their illnesses.

Table 3 Parents' perceived need of scheduled hospital visits

	We had too few visits (%)	The number of visits was adequate (%)	We had more visits than we needed (%)
Control group	1 (3)	32 (91)	2 (6)
Telemedicine group	0 (0)	23 (74)	8 (26)

$p = 0.037$, Fisher's exact test.

Table 4 Parents' opinions about the use of video calls

	1	2	3	4	5
How easy was it to use Skype? (%)	0	0	1 (5)	4 (18)	17 (77)
How easy was it to communicate with the nurse via Skype (%)	0	0	2 (8)	1 (4)	22 (88)
How important were the Skype calls for you? (%)	2 (8)	2 (8)	9 (36)	7 (28)	5 (20)
	Yes (%)	No (%)	Neither (%)		
Were the answers or instructions you received from the nurses during the video calls easy to understand?	22 (100)	0	0		
Were the answers and instructions you received from the nurses during the video calls useful for you?	23 (92)	0	2 (8)		
Were video calls better than ordinary phone calls?	17 (74)	6 (26)	0		
Did you use the possibility of showing the infant to the nurse during the video call?	11 (42)	15 (58)	0		
Do you think the use of video calls decreases the need of control visits?	18 (78)	5 (22)	0		

The number of parents is shown with the percentage in parentheses. For the Likert-like scale, 1 = very difficult or completely unimportant; 5 = very easy or very important.

Use of conventional telephone calls

The families could call the nurses at any time to ask questions or take care of practical matters such as rescheduling the next hospital visit. The median number of phone calls in both study groups was quite low, two in the control group and one in the telemedicine group. The number of phone calls from parents ranged from zero to eight in the control group and from zero to 12 in the telemedicine group. There was no difference between the study groups in the number or frequency of telephone calls from the parents to the nurses.

The nurses seldom called the families. The median number of phone calls from the nurses was zero (range 0–9) in the control group and one in the telemedicine group (range 0–7).

Families' opinions about the use of video calls

The families' opinions about the video calls are shown in Table 4. All the families in the telemedicine group felt it was easy to use Skype, except one family that had received no video calls and could not comment. Most families (92%) felt that it was easy to communicate with Skype, whereas the rest (8%) reported problems with their Internet connection. All the parents who had had video calls thought the instructions given over Skype were easy to understand, and 92% felt that these instructions had been useful for them. Many families (76%) thought video calls were better than telephone calls (Table 4). About half of the families had shown their baby to the nurse over Skype. In their freely worded comments, many parents wrote that it was helpful to see the person they were talking to.

Although about half of the families felt the video calls were important for them, 36% were neutral and four (16%) felt that the calls were not important (Table 4). A few families stayed in home health care so briefly that video calls did not seem important. Of the four families who felt that the video calls were unimportant, two families only received one Skype call each, one had not received any

Skype calls and one family felt that their baby was doing so well that Skype calls were unnecessary. On the other hand, frequent visits to the hospital made the video calls redundant for some families.

Seventy-eight percent of the families felt that the use of Skype reduced the need of visits to the hospital (Table 4). One family commented that they would have liked to have a scale at home and felt that weighing the baby themselves and using Skype calls would have spared them many trips to the hospital. Some parents felt that the possibility of calling nurses using Skype during the weekend would have been useful.

Families' opinions about using the web application

All the parents were accustomed to using computers (Table 5). The vast majority of them estimated that their computer experience was very extensive, 84% felt that the web application was good and all of them thought it was easy to use (Table 5).

All the parents thought it was good to see their infant's data on the web form (Table 5). A large majority (86%) had received some feedback from the nurses about what they had written on the web form. 60% of the parents indicated that the use of the web application made them more comfortable with the care of their infant at home. About half the parents thought that the use of the web application decreased the need of control visits to the hospital. A large majority (74%) had received answers to their questions through the information on the web page.

The parents thought it was interesting to be able to see the infant's growth curve and other data in graphic form. They also appreciated the possibility of seeing their own answers to the questions on the web page, as curves as a function of time, and thus see the progress their baby had made. Most of them checked the data several times a week. The families also liked the possibility of exchanging messages with the nurses using the mail function. Some parents wanted to have a mobile phone version of the web application.

Table 5 Parents' opinions about the use of the web application

	1	2	3	4	5
How much computer experience do you have? (%)	0 (0)	0 (0)	3 (10)	6 (19)	22 (71)
How good was the web page? (%)	0 (0)	0 (0)	5 (16.1)	15 (48.4)	11 (35.5)
How easy was it to use the web page? (%)	0 (0)	0 (0)	0 (0)	3 (10)	27 (90)
	Yes (%)	No (%)			
Was it important for you to see your child's data on the web page?	29 (100)	0			
Did you get feedback from the nurses about what you wrote on the web page?	25 (86)	4 (14)			
Did the use of the web application make you feel more comfortable caring for your child at home?	18 (60)	12 (40)			
Do you feel that the use of the web application decreased the need of scheduled visits to the hospital?	14 (47)	16 (53)			
Did you get answers to your questions through the information on the web page (frequently asked questions)	23 (74)	8 (26)			

The number of parents is shown with the percentage in parentheses. For the Likert-like scale, 1 = no experience, very poor or very difficult; 5 = very extensive experience, very good or very easy.

Nurses' opinions about the use of Skype and the web application

The nurses were given a questionnaire about the use of video calls and the web page at the end of the study. Three of the four nurses completed the questionnaire.

All three nurses considered that the use of telemedicine was a promising development in the home health care of newborn infants. All of them used the Internet daily both at work and at home, but none of them had used Skype regularly for private calls. They found Skype easy to use. However, occasional technical problems occurred, such as difficulties logging in or poor picture quality.

The nurses saw video calls as superior to conventional phone calls, because Skype enabled them to see the infant and his or her equipment and talk to both parents at once. They considered video calls a useful complement to hospital visits that could decrease, though not completely obviate, the need for such visits.

The nurses thought that the web application was a useful tool in neonatal home health care. They commented that they needed some time to get used to the new method. The web application helped them understand how the family was coping at home with the care of their infant and how the baby was doing, especially if the parents had answered the questions on the web page regularly.

The nurses used the mail function on the web page and found it helpful. They sent the parents feedback about their answers on the web page, answered their questions and sent information about examinations (such as cardiac ultrasound examination) that the infant was due to have.

However, the nurses sometimes found it difficult to find time to check the parents' answers. Since they were only involved in the home health care for three days of the week, Monday, Wednesday and Friday, and worked in the NICU on the other weekdays, it was difficult for them to give feedback to the families on a daily basis.

DISCUSSION

In this randomised study, we investigated the use of telemedicine in the home health care of newborn infants after discharge from the hospital. The use of telecommunication was appreciated by both parents and nurses. Importantly, it decreased the need of scheduled visits and the number and frequency of emergency visits to the hospital.

For telemedicine to work, it is necessary to have patients and healthcare staff who are able and motivated to use information and communication technology. Some studies have shown that elderly patients may be reluctant to use these new technologies (6). In the present study, most of the parents had extensive computer experience and thought that both video calls and the web page were easy to use. The questions on the web page concerned important aspects of the infant's status, so that answering the questions would help the parents pay attention to what was important in their child's behaviour and thereby recognise changes in the infant that might indicate illness. The web page and video calls could give the families answers to their questions in a timely manner and thereby decrease the need of scheduled and emergency visits to the hospital. The use of telemedicine made them feel more secure in caring for their baby. A large percentage of the parents in the telemedicine group thought that they did not need all their visits to the hospital, whereas few parents in the control group thought so. Similarly, in a randomised trial of a remote home support programme for infants with major congenital heart disease, the use of video calls increased the satisfaction of parents and lowered the risk of hospitalisation and the use of healthcare resources (2).

The parents also had suggestions about how the home health care could be improved. Some parents mentioned that they could have further decreased the number of hospital visits by weighing their infant at home and by using video calls to talk with the nurse about issues that were

usually discussed during hospital visits. Parents also pointed out that having a scale at home to check the infant's weight would have spared visits to the hospital and that a mobile version of the web page would have made it possible to communicate with the nurse from anywhere. The possibility of calling the nurse by Skype during the weekend would also have been appreciated.

In some cases, the parents felt that telecommunication was unnecessary because their infant was doing well. It is understandable that spending time answering questions on a web page or conversing with nurses using video calls was not relevant for these families. Similarly, adult patients with chronic obstructive pulmonary disease did not make use of a self-monitoring device if they were in good health (7). It is important that the use of telecommunication and hospital visits is individualised to meet the variable needs of families in order to avoid unnecessary use of healthcare resources and of parents' and nurses' time.

One strength of the study was that a very high percentage of eligible families (98.6%) received information about the study and that this was given to them all by the same person. This ensured that the same information was given to all the families and probably also contributed to the high percentage of the families (65%) who agreed to participate in the study. A limitation of the study was that the relatively low response rate to the questionnaire (83% in the control group and 68% in the telemedicine group) may have caused a bias in the data based on parents' opinions.

Although the nurses were mostly favourable to the use of video calls and the web page, they pointed out that using these technologies required a change in their way of working that they needed motivation and time to get used to. It seems that the nurses did not use telecommunication and home visits as complementary ways of communicating with parents. For example, the next follow-up visit was still routinely scheduled during each visit. The nurses could instead have assessed the need of individual families for an appointment by using information from video calls and from the parents' answers and comments on the web page. This would most likely have resulted in fewer scheduled hospital appointments.

The organisation of the home healthcare programme at the hospital prevented the optimal use of the video calls and web page. The nurses were only involved in home health care on Mondays, Wednesdays and Fridays. During the rest of the week, they worked in inpatient care at the NICU. During that time, they could not make or receive video calls because the computer that was used for the calls was located outside the unit. This may explain why the possibility of using video calls did not decrease the use of ordinary telephone calls in the web group. The nurse could answer the families' comments on the web page while working at the NICU, but only if she happened to have time. This meant that on four days of the week, the nurses hardly used the new technology. It was therefore not surprising to find that the nurses wrote feedback to the families' comments on the web page in only 30% of cases

and that video calls were used infrequently. Organisational factors also limited the possibility of individualising the times of appointments according to the family's needs. Any appointment that was postponed had to be delayed by at least two or (over the weekend) three days. Better organisation of the home healthcare programme would have enabled the nurses to use the telemedicine applications optimally and to adjust the number of hospital visits to meet the families' individual needs. A study examining the impact of a home telemonitoring intervention on the hospital and home health care of patients with elderly chronic obstructive pulmonary disease also concluded that using new technologies requires reorganisation of nurses' care plans (8).

CONCLUSION

This study showed that the use of video calls and a web page in the home health care of newborn infants was well accepted by young computer-proficient parents. However, to optimally use the possibilities of telemedicine, home health care needs to be reorganised to meet the families' needs. Telemedicine in the home health care of newborn infants can lead to more effective use of healthcare resources for this patient population.

ACKNOWLEDGEMENTS

The authors would like to thank the nurses and families who participated in this study.

FUNDING

This study was supported by grants from the Swedish Heart and Lung Foundation, the Frimurare Barnhus Foundation and the Swedish Research Council for Clinical Research in Medicine.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

References

1. Bashshur RL, Shannon GW, Smith BR, Alverson DC, Antoniotti N, Barsan WG, et al. The empirical foundations of telemedicine interventions for chronic disease management. *Telemed J Health* 2014; 20: 769–800.
2. McCrossan B, Morgan G, Grant B, Sands AJ, Craig BG, Doherty NN, et al. A randomised trial of a remote home support programme for infants with major congenital heart disease. *Heart* 2012; 98: 1523–8.
3. Casavant DW, McManus ML, Parsons SK, Zurakowski D, Graham RJ. Trial of telemedicine for patients on home ventilator support: feasibility, confidence in clinical management and use in medical decision-making. *J Telemed Telecare* 2014; 20: 441–9.
4. Bradford NK, Armfield NR, Young J, Smith AC. Paediatric palliative care by video consultation at home: a cost minimisation analysis. *BMC Health Serv Res* 2014; 14: 328.

5. Gund A, Sjoqvist BA, Wigert H, Hentz E, Lindecrantz K, Bry K. A randomized controlled study about the use of eHealth in the home health care of premature infants. *BMC Med Inform Decis Mak* 2013; 13: 22.
6. Van Offenbeek MA, Boonstra A. Does telehomeconsultation lead to substitution of home visits? Analysis and implications of a telehomecare program. *Stud Health Technol Inform* 2010; 157: 148–53.
7. Huniche L, Dinesen B, Nielsen C, Grann O, Toft E. Patients' use of self-monitored readings for managing everyday life with copd: a qualitative study. *Telemed J E Health* 2013; 19: 396–402.
8. Sicotte C, Pare G, Morin S, Potvin J, Moreault MP. Effects of home telemonitoring to support improved care for chronic obstructive pulmonary diseases. *Telemed J E Health* 2011; 17: 95–103.