

ICU-Talk: The development of a computerised communication aid for patients in ICU

Etchels Maria C., MacAulay Fiona, Judson Andrew, Ashraf Saqib, Ricketts Ian W.,
Waller Annalu, Alm Norman, Warden Audrey, Gordon Brian, Brodie Jan, Shearer
Alfred J.

Mrs Maria Etchels
Qualifications: RGN, BN
Professional address: Intensive Care Unit, NHS Tayside, Ninewells Hospital &
Medical School, Dundee, DD1 9SY, Scotland

Mrs Fiona MacAulay
Qualifications: BSc (Honours) MPhil
Professional address: Department of Speech & Language Therapy, Tayside Primary
Care Trust, Ninewells Hospital & Medical School, Dundee, DD1 9SY, Scotland

Mr. Andrew Judson
Qualifications: BSc (Honours) Applied Computing
Professional address: Department of Applied Computing, University of Dundee,
Dundee, DD1 4HN Scotland

Mr. Saqib Ashraf
Qualifications: BSc (Honours) Applied Computing
Professional address: Department of Applied Computing, University of Dundee,
Dundee, DD1 4HN Scotland

Professor Ian W Ricketts
Qualifications: BSc (Honours) Electrical Engineering & Economics, PhD (Computer
Science)
Professional Qualifications: MIEE, MIEEE, AMBCS
Other: FRSA
Professional address: Department of Applied Computing, University of Dundee,
Dundee, DD1 4HN Scotland

Dr. Annalu Waller
Qualifications: BSc (Honours), MSc (Med.),
PhD in Computer Science
Professional address: Department of Applied Computing, University of Dundee,
Dundee, DD1 4HN Scotland

Dr. Norman Alm

Qualifications: B.A. (English), PhD (Computer Science)

Professional address: Department of Applied Computing, University of Dundee,
Dundee, DD1 4HN Scotland

Mrs Audrey Warden

Qualifications: RGN, DANS, BN

Professional address: Intensive Care Unit, NHS Tayside, Ninewells Hospital &
Medical School, Dundee, DD1 9SY, Scotland

Mr Brian Gordon

Qualifications: MMSc, Dip. Nursing (Clinical Teaching), RGN, RNT

Professional address: School of Nursing and Midwifery, University of Dundee,
Dundee, DD1 4HN Scotland

Mrs Jan Brodie

Qualifications: B.Ed Speech and Language Pathology and Therapeutics

Qualification: Reg Member Royal College of Speech and Language Therapists

Professional address: Department of Speech & Language Therapy, Tayside Primary
Care Trust, Ninewells Hospital & Medical School, Dundee, DD1 9SY, Scotland

Dr Alfred J. Shearer

Qualifications: M.B., Ch.B., F.F.A.R.C.S.

Professional address: Intensive Care Unit and Department of Anaesthesia, Ninewells
Hospital & Medical School, Dundee, DD1 9SY, Scotland

As ventilators are becoming more highly developed, it is becoming easier to wean patients from sedation. This means that patients are more awake at a time when they can feel most stressed. Communication can be extremely difficult for this group of alert yet still intubated patients. ICU-Talk is a unique communication aid that has been developed specifically for use at this time. This paper describes the collaborative development of this computerised communication aid.

Keywords: alternative communication, collaboration, endotracheal intubation, intensive care

Introduction

Intensive care is a harsh and stressful process for patients. Many aspects of their wellbeing can be adversely affected, some for a long time afterwards. The difficulty in communicating which they experience can be a major factor. Most medical and nursing staff assume that communication problems only affect the patient during the intubation period but there is evidence that, even after discharge from hospital, sequelae can affect the psychological wellbeing of many patients (1,2,3,4,5).

Many users of augmentative and alternative communication (AAC) devices are long term users and can develop a database of words and sentences which can often be stored within the device (6). This means they are able to choose what they would like to express using their AAC device. Intubated patients in ICU do not have the time to do this. They wake from their sedated state to find they can no longer communicate using speech. Many patients are frightened of the ICU environment (7) and frustrated that they cannot 'speak' (8). Their lack of effective communication means it is difficult to tell anyone about their anxiety during this period of intubation (4).

Previous research into communication with intubated patients in ICU reveals that alternative methods of communication such as alphabet boards, pen and paper, or mouthing words are time consuming and frustrating for both patients and nurses (9,10,11). Many patients describe feelings of disempowerment and social isolation whilst intubated (2,3,12). Nurses find it difficult to communicate with someone who cannot 'speak' back (13,14) and the patient cannot accurately express how they feel (4). Through questioning of the patient, nurses can sometimes establish which subject the patient is trying to 'talk' about, but this can take several minutes. Frequently the patient gives up and is deterred from making further attempts depending on the reaction and help from the nurse (15). The patient is not the sole person disempowered by the lack of communication. Their relatives also experience a degree of anxiety due to ineffective communication by their loved one (16). Patients recovering from a critical illness tire easily and can have cognitive impairment due to their illness (7) and residual effects from the analgesia and sedation that they have received (16). Concentration is often poor and short term memory impaired (9). Many patients are also physically compromised by various invasive catheters (17) and by generalised weakness.

Nurses often develop coping strategies such as submerging themselves in other aspects of the patient's care for example by constantly monitoring and recording vital signs, handling and administering drugs or updating nursing documentation to compensate for ineffective communication attempts (18,19). Education about the importance of communicating with patients as well as how best to facilitate communication for patients is a serious consideration for many nursing colleges (1,19,20).

A three year collaboration between the Department of Applied Computing and the School of Nursing and Midwifery at Dundee University, along with the Department of Speech and Language Therapy and the Intensive Care Unit at Ninewells Hospital, Dundee, the ICU-Talk research project has examined the co-existing problems for these patients and the staff. A computerised AAC device called ICU-Talk was designed that is simple and intuitive to use and requires minimal training. This paper outlines the development of the ICU-Talk device.

Development of the ICU-Talk device

For the patient to communicate using ICU-Talk a phrase or question from a pre-stored database is selected and is then voiced by a speech synthesizer.

The concept of choosing a pre-stored phrase, sentence or question from a database was used in previous collaborative research between the Applied Computing Department at Dundee University and the Speech & Language Therapy Department at Ninewells Hospital, Dundee. This research developed a computer-based device for patients with dysphasia following a cerebral vascular accident (21). A modified version of this device was trialled with a patient in ICU and found to be effective. The principles underlying the development of this AAC device were therefore felt to be appropriate for physically limited but alert intubated ICU patients.

Database development

The vocabulary for the ICU-Talk database was collected in two stages. The first stage involved asking nursing staff from ICU to give examples of communication attempts

made by intubated patients. Thirty four nurses from a possible forty four gave over 200 examples. For the second stage an observation tool was developed using the examples given by the nurses. These were used to compare actual communication attempts by intubated patients with those recalled by the nursing staff. Twelve patients were observed for a total of 30 hours. Fifty three percent of patients' communication attempts were examples that the nursing staff had suggested. The remainder of the communication attempts were patient specific. This finding suggested that the database for each patient should be individualised.

The results from stages one and two were collated and a total of 190 phrases and questions were found to represent the majority of communication attempts by ICU patients. The phrases were organised under eight different conversation topics and formed the core database for the ICU-Talk device. All patients who used ICU-Talk received the same core database. To individualise this database for each patient, a computer based interview was developed. The interview was designed to be completed by a close friend or relative, as the best source of information about the patient (6). The information obtained was used to form personalised phrases or questions. There were 13 questions which, depending on the replies can automatically generate 80 patient specific phrases and questions. These can then be added to the patient's core database.

Interface design

The core database was presented to the patient using two different interfaces. This gave the patient a choice of styles.

< INSERT PICTURE OF INTERFACES – figure1.jpeg >

Both styles had a main page where eight topics were displayed. The topics and their related phrases and questions were colour coded to assist the patient with navigation through the system. Each topic contained a number of different phrases and questions. With the Boxes design up to ten phrases or questions could be displayed on the screen at any time and with the Bubbles design only six could be displayed. The patient navigated through a topic to find the phrase or question they required.

The two styles support the use of the touch screen, mouse emulation (trackball or joystick) and single switch scanning. These different access methods ensured that patients at different stages in recovery and those with severe physical impairment could still access the ICU-Talk device.

Hardware solutions

The hardware was required to be waterproof for cleaning between and during use to reduce the risk of cross infection. It also had to be rugged to withstand the possibility of accidental damage and easily manoeuvrable to avoid interfering with the delivery of care (6).

< INSERT PICTURE OF FIRST PROTOTYPE – figure2.jpeg >

Figure 2 - The first ICU-Talk prototype: a rugged 8 kg Shark touch screen monitor, a metal mounting frame and an IBM compatible personal computer.

The large frame size of the first ICU-Talk prototype shown in Figure 2 was necessary because of the weight of the monitor. It weighed 8kg and was completely waterproof and able to withstand chemical disinfectant. It was securely mounted to ensure the safety of the patient at all times. The monitor could be positioned above the patient if

they were lying flat, or in front of the patient if they were sitting up, so that the patient could reach the touch screen in either of these positions. Storage and manoeuvrability proved difficult with this prototype. These issues were addressed in the design of the second prototype.

< INSERT PICTURE OF SECOND PROTOTYPE – figure3.jpeg >

Figure 3 - the Fujitsu tablet attached to a bed frame

Some nurses reported that the size of the first prototype deterred them from referring suitable patients to the ICU-Talk project. In response to these comments alternative hardware was identified. The Fujitsu Pen Tablet was selected which was much smaller but not waterproof. This is similar to a laptop, weighs 1.8kg and subsequently takes up very little space. The device can be attached to the cot side of the bed where it is in easy reach of the patient and does not interfere with access to the patient (Figure 3). Simply covering the pen tablet with a plastic bag ensured it was waterproof and did not compromise its operation.

The evaluation of the ICU-Talk device

Following ethical approval, a consent form was developed for completion by the participants in the project. The ICU-Talk prototypes were evaluated in the ICU at Ninewells Hospital, Dundee over a period of one year. A Patient Referral Flowchart (**Figure 4**) was developed to allow nurses to identify and refer suitable patients to the project. The criteria for inclusion were:-

- over 16 years of age

- sedation score of between 1 and 3 using the Ramsay Sedation Scale (22)
- able to consistently respond to a basic command
- attempting to communicate
- able to focus on a communication partner
- literate.

Patients were referred to the ICU-Talk team by nursing staff. After assessment by the team, consent was obtained and the communication device introduced. Patients were encouraged to use ICU-Talk to augment their communication attempts.

Feedback from nurses and relatives was used to assess the communicative effectiveness of ICU-Talk. An important evaluation was how the patient felt at the time that they were using the device. When the patient had made five communication selections using ICU-Talk, a different interface would appear and they were asked to complete an on-screen evaluation tool. This tool consisted of 3 questions:-

- Do you like using ICU-Talk?
- Do you find it easy to use?
- Does it help you to communicate?

The patient could respond by selecting “Yes”, “No” or “Don’t Know”. Their recollection of using the device was also examined after discharge from ICU.

The questionnaires for relatives and nursing staff consisted of:-

1a. ICU-Talk Project Nurse Questionnaire – eight questions with yes/no tick boxes. This was a quick assessment for each nurse who was caring for a patient using ICU-Talk to complete at the end of their 12 hour shift.

2a. ICU-Talk Relative Questionnaire – four questions using Likert Scales and two multiple choice questions for relatives of the patients. There was also a comments section.

3a. ICU-Talk Mid Project Questionnaire – a six point attitude scale which asked the nurse to rate their response from strongly agree to strongly disagree. This was intended for nurses within ICU to obtain their perceptions about the device.

4a. ICU-Talk Questionnaire – a six point attitude scale which asked the nurse to rate their response from strongly agree to strongly disagree. This was completed by nurses who had cared for patients that had used ICU-Talk. Their responses were used as a basis for a structured interview. The comments obtained differed considerably from nurse to nurse and it is beyond the scope of this paper to list and analyse their comments fully.

Results

During the one year evaluation period, 21 suitable patients were selected to use ICU-Talk. The data from the first two patients was excluded as during this time nurses and other staff members had explored ICU-Talk and we were unable to distinguish between use by the patient and use by staff. To overcome this problem a practice mode was developed for other users to explore ICU-Talk. A single key press enables any user to switch between practice mode and patient mode. This meant, for example, that relatives could have ICU-Talk demonstrated to them without the patient's program being interrupted and without corrupting the patient's data.

Details of the remaining 19 patients are given in **Table 1**. The age range of patients was 36 to 76 years, with a mean age of 57 years. Ten patients were female and 9 were male and they used ICU-Talk for up to six days with a mean length of use of two

days. The first 24 hour APACHE scores (23) ranged from 12 to 29 with a mean score of 19. The length of stay varied from 2 to 127 days.

Patient	Age	Gender	Medical diagnosis	Apache II scores	Intubation T-tracheostomy O-oral	Length of stay	No of days ICU-Talk used
1	65	F	Severe burns	12	T	18.3	6
2	39	M	Chest injury	12	T	26.1	2
3	54	M	Aspiration pneumonia	19	O	2.0	2
4	43	F	Septicaemia	15	T	57.9	3
5	69	F	Septicaemia	23	O	24.9	3
6	50	F	Poisoning	23	T	36.2	2
7	52	M	Peritonitis	26	O	127.2	3
8	75	M	Severe Sepsis	29	T	14.8	3
9	76	M	Necrotic cholecystitis	25	T	43.5	1
10	74	M	Cardiogenic shock	26	O	12.6	1
11	76	F	Post cholecystectomy biliary leak and respiratory failure	20	O	17.9	1
12	48	F	Postop colectomy	13	O	15.4	1
13	52	F	Post oesophagectomy tracheo-pharyngeal fistula	13	O	13.3	2
14	68	M	Pneumonia respiratory arrest	16	O	3.7	2
15	75	F	Multiple injuries	20	O	36.9	1
16	74	F	Post resection ischaemic bowel	14	O	14.8	2
17	36	F	Splenectomy	24	O	11.8	1
18	63	M	Postop whipples procedure	14	O	5.1	1
19	65	M	Acute pancreatitis	22	O	7.3	1

Table 1.

ICU-Talk Project Nurse Questionnaires (1a) were completed at the end of each 12 hour shift. Summarised findings include:-

- 68% of staff found they needed to remind the patient to use ICU-Talk
- 44% said that patients used ICU-Talk with someone other than themselves

- 12% said that the patient used ICU-Talk as a first means of communication
- 44% said that ICU-Talk assisted with patient care
- 24% said that patients used ICU-Talk to start conversations
- 84% said that ICU-Talk did not obstruct their observation or care of the patient
- 72% said that the patient did stop using ICU-Talk and resort to others forms of communication
- 76% said that it was not harder to understand the patient when they used ICU-Talk.

There was a low response rate to the ICU-Talk Relative Questionnaire (2a) but comments ranged from “my mother found it a little big and a little scary” to “I felt ICU-Talk was wonderful!”

The ICU-Talk Mid Project Questionnaire (3a) was answered by 35 of a possible 38 nursing staff. There were 18 nurses with more than 5 years experience and 17 nurses with experience of three years and less in ICU. Just over half the nursing staff questioned found that manoeuvring the ICU-Talk device was quite difficult and that it did get in their way. Seventy five percent of nurses thought the patients’ well-being was affected by their ability to communicate effectively and that patients could not communicate effectively using mouthing or gesture.

Ninety per cent felt that they should be involved in the ICU-Talk Project and that patients needed a computer based communication aid.

From a total of 19 ICU-Talk users, 3 remembered using it. The patients who remember using ICU-Talk recall that they felt it was good for creating conversations and that it allowed them to ask what had happened to them. One elderly user commented on the use of colours and that he liked the idea of the touchscreen. The

on-screen evaluation tool was found to be confusing due to its sudden appearance on the screen. The patient was allowed to choose if they wanted to answer the tool at this time or not. Most of the patients chose to ignore this tool and others commented “don’t know” to all 3 questions.

Discussion

The ICU-Talk research project produced a prototype communication aid. The software was designed specifically for intubated patients in ICU who are alert and attempting to communicate, but unable to write. The ICU-Talk system contains a database of phrases, some of which are common to all patients and some of which are patient specific. The patient can access the phrases using the touch screen, mouse emulation, or by a switch. The phrases are organised under 8 topic headings. The patient therefore has to explore topics to find a phrase. Although this method of storage is useful once a patient has become familiar with the system, it can be difficult for patients if they have memory problems or only use ICU-Talk for a short period of time. This has become apparent from the users of the system and the nursing staff caring for them.

Providing this communication aid for intubated patients in ICU has demonstrated several important points. Patients would like something to help them communicate. Nurses and medical staff would like something to help patients communicate more effectively and efficiently. The patients who remember using ICU-talk found it useful. Some patients indicated with the onscreen evaluation tool that they liked using ICU-Talk. They did not use it exclusively to communicate but it helped to augment their existing communication. The patients’ relatives found communicating with an

intubated person difficult and felt that there was a need for a communication aid especially designed for intubated patients.

Nursing staff did not find it harder to communicate with patients who used ICU-Talk compared with existing methods used. The existing methods consisted of pen and paper, alphabet boards, mouthing and gesture. The nursing staff were influenced by the size of ICU-Talk and admitted that they were not keen to use the first prototype. From these comments a smaller device was sought and latterly introduced to the patients and nursing staff. Later comments from the nursing staff indicated that they were quite keen to use the smaller device with patients. The staff also admitted that patients could not communicate effectively either by gesture or mouthing. This means that, when the patient is unable to write or use an alphabet board, the existing methods of communication are not adequate and that a new method is required. The single case studies with ICU-Talk suggest that this device can be used by intubated patients to augment their attempts to communicate. The software is such that using the device is straightforward and none of the patient users indicated their fear or uncertainty of using it.

A further evaluation with the smaller ICU-Talk device is required. A randomised control trial is currently being proposed to compare ICU-Talk with existing methods of communication for intubated patients in ICU. This would enable a more comprehensive evaluation of ICU-Talk using explicit tools to measure a number of outcomes which may be influenced by the ability to communicate in the intensive care situation.

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FIGURE 4

Patient Referral Flowchart

If you think a patient may be able to be involved in the ICU-Talk project then please follow this flow chart to check that the patient is suitable.



Please answer the following questions. If the answer to any question is **no** then the patient will not be able to use ICU-Talk and they should be reassessed in 12 – 24 hours time.

