CE 1.5 ANCC CONTACT HOURS

The Use of Communication Technology to Affect Patient Outcomes in the Intensive Care Unit

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Effective two-way patient-provider communication is challenging and is even more difficult when patients are communication vulnerable. The results of being unheard and unacknowledged can contribute to negative feelings and may manifest as symptoms of anxiety and depression. Researchers explored symptoms of anxiety and depression when using a team-developed, patient-centered, and nurse-led intervention called Speak for Myself—Voice (formerly published as Speak for Myself) in five intensive care units at a Magnet status, university-affiliated medical center in East Tennessee. This was an equivalent control group design. The data were analyzed with a mixed-effect analysis of variance (between and within groups) with repeated measures to see if the treatment group changed differently than the control group across time (48 hours). This study report adds information about anxiety and depression in patients who are communication vulnerable and using communication technology.

KEY WORDS: Communication technology, Communication vulnerable, Depressive symptoms, Intensive care unit, SFM-V, Speak for Myself—Voice, Symptoms of anxiety, Technology

Effective two-way patient-provider communication is very difficult for individuals who are communication vulnerable (unable to articulate needs or preferences).[1–4] Reasons for being communication vulnerable include mechanical ventilation, tracheostomy, head and neck cancer surgical procedures, obstruction (tumor or swelling), and trauma as well as deafness. The results of being unheard and unacknowledged in one of the most critical times of a patient's life can contribute to negative feelings and can manifest as symptoms of anxiety and depression.[5]

Missed communication in the acute care setting often leads to misunderstanding and confusion for patients and providers. Lack of clarity may result in care that is not centered on personalized patient needs and preferences and may actually result in adverse events (eg, falls, medication errors).[3] The Joint Commission[6] mandates that communication methods must be available for patients and that the communication solution should be effective and appropriate.

Communication apps represent a viable solution at the bedside point of care when patients are unable to traditionally communicate. While this particular communication app, Speak for Myself—Voice (SFM-V; formerly published as Speak for Myself), was informed through a population of patients with disabilities who live in community dwellings, it became clear that patients could use SFM-V when hospitalized in critical or intensive care units (ICUs). We further recognized that the expanded population *included* patients who *have disabilities*. The first prepilot study informed us that participants felt less voice handicapped,[5] which is defined as the influence of voice problems on quality of life and measured by the Voice Handicap Index (VHI).[7] Specifically, the decrease in mean of VHI detected in the seminal study could support the premise that participants were less (1) anxious, (2) irritated, (3) frustrated, (4) upset, (5) annoyed, (6) embarrassed, and (7) ashamed. It was also clear that many patients reported pain more often when they used SFM-V and, furthermore, that patients would like to communicate personalized advanced care planning (ACP). We deduced that the next logical step was a small randomized controlled trial (RCT) of SFM-V in ICUs that include patients who have disabilities. Because the qualitative information in the prepilot study measured decreased frustration and fear and the quantitative data supported improved pain reporting and decreased feelings of voice handicap, patient outcomes were identified in the small RCT as measurement of anxiety and

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depression. The length of intervention was extended from 24 to 48 hours because patients who used SFM-V in the prepilot often did not want to end participation after only 24 hours.

The aims of this study were to pilot test the use of SFM-V with patients in ICUs who are communication vulnerable and to examine the effect of SFM-V on patient outcomes of anxiety and depression. Based on the rationale that enhanced communication affects health outcomes, it was hypothesized that using a team-developed, patient-centered communication computer app would decrease symptoms of anxiety and depression in patients who are communication vulnerable and who are being cared for in various ICUs as compared to a control group using hospital-provided communication boards.

REVIEW OF LITERATURE

It is now more common to encounter patients who are lightly or not sedated in ICUs.[8] In past years, patients who were intubated and receiving mechanical ventilation in ICUs were more heavily sedated and, consequently, less aware. Awake and aware patients often require alternative strategies for communication, most often directed by nurses who care for patients. In fact, a recent estimate of patients who may qualify for the basic criteria for communication, including being awake and aware, is at least 53.9%.[9] There are numerous computer apps and devices currently available commercially. Notably, work conducted by researchers[10] has contributed to the nursing literature about effective communication with patients who are communication vulnerable, while others approach the problem from a speech language pathology (SLP) perspective.[11–16] Regardless of the disciplinary approach, the problem is that patients who are unheard tend to experience anxiety and frustration[8] and may actually suffer from posthospitalization traumatic memories.[17] Nurses are uniquely positioned at the bedside and closely engaged within the patient environment and represent the first lines of communication in these settings. It is estimated that at least half of patients[9] could communicate their needs with effective communication technology tools and assistance from nurses and other healthcare professionals.

While there are no conclusions about standard of care or best practices for communication with patients in this population, there are numerous publications in the literature that discuss specific approaches for each unique communication problem.[11,13,18,19] Communication interventions range from low tech (eg, paper/pencil, dry erase boards) to high tech, which are represented by a range of technologies (apps to sophisticated eye-gaze devices). For the purpose of research, we assumed that paper or laminated alphabet boards represent standard of care. Paper or laminated alphabet boards are less expensive and available to most hospital units and SLP departments within hospitals.

The goal of this study was to test SFM-V in a second site pilot study with the collaboration of SLP, engineering, information science, and biostatistics. The SFM-V was developed to promote communication with persons who are communication vulnerable. In a previous small study, SFM-V was tested with patients who were receiving mechanical ventilation via endotracheal tube or tracheostomy or who were unable to verbally communicate. The study measured pain, frustration, and the feasibility and usability of SFM-V.[20] The investigators learned that when patients used SFM-V, they were more likely to report pain, that frustration was reduced per patient report, and that the app is a feasible and usable method of communication for patients and healthcare professionals.[5,20,21]

ETHICAL CONSIDERATIONS

This study was approved by both the university institutional review board (IRB) and the IRB of the hospital's graduate school of medicine. Also, the primary investigator is the primary developer of SFM-V. However, this app is not currently commercialized. Through grant support, this research group is engaged in team science to affect communication for patients who cannot communicate in the usual way.

METHODS

Design

This was an equivalent control group design. Both groups received a pre- and postintervention assessment using the Hospital Anxiety and Depression Scale (HADS).[22] The data were analyzed using a mixed effects analysis of variance (ANOVA) (between and within groups) with repeated measures to see if the treatment group changed differently than the control group as the study moved across time (48 hours). This second site study occurred in rural East Tennessee over a 15-month period (May 2017 to August 2018) in five units at a university-associated teaching hospital with Magnet status. The power analysis, with a power of 0.8, medium effect at 0.5, and Cronbach's α set to .05 estimated 66 study participants. A total of 80 participants were necessary to ensure equal sampling and to manage attrition. The alpha-priori for power analysis originated from the seminal study.[23] We tested the null hypotheses that, compared to the control group receiving usual care, persons using SFM-V would not experience a reduction in depression and would not experience a reduction in anxiety.

Setting and Sample

The study was conducted at a 608-bed Magnet-status academic medical center in East Tennessee. The medical center maintains six Centers of Excellence, which are brain and spine, cancer, emergency and trauma, heart lung vascular, orthopedics, and women and infants. Units used for recruitment for the study, along with their most common admitting

diagnoses, were a trauma surgical intensive care unit (TSICU) (23-bed unit treating blunt force trauma, including motor vehicle accidents and falls); a neuro critical care (NCC) unit (16-bed unit treating hemorrhagic and ischemic stroke, brain tumor, brain and spinal cord injuries, neurological disease, and seizure); a progressive care unit (PCU) (18-bed unit treating a wide variety of diagnoses of moderately stable patients with a high potential for becoming unstable), a medical intensive care unit (MICU) (30-bed telemetry unit treating a vast variety of diagnoses such as respiratory failure, chronic obstructive pulmonary disease, pneumonia, end-stage renal disease, multisystem organ failure); and a cardiovascular intensive care unit (CVICU) (24-bed unit treating immediate post–open heart, thoracotomy, aortic aneurysm repair, acute myocardial infarction, and postsurgical cardiac conditions requiring intensive hemodynamic monitoring). Inclusion criteria consisted of hospitalization on any of the identified units for any length of time, a Richmond Agitation Sedation Scale (RASS)[24] score between −1 and +1 (awake, aware, and not agitated), able to use SFM-V for 48 hours, able to manipulate a computer tablet, and the ability to read and write English. Exclusion criteria were patients who were hospitalized on units other than those identified for this study, RASS score less than −1 or exceeding +1, unwilling to use SFM-V for 48 hours, unable to manipulate the computer tablet, or unable to read and write English.

Procedures

Participant selection was facilitated by nurse leaders on the ICUs. These nurse leaders identified patients on the designated units who were candidates for this study through direct observation and recommendation from nurses working with the patients. The SLP department was aware of the study and was invited to collaborate.

Contact Procedure

The nurse manager or lead on the unit assessed the RASS score (+1 to −1) and potential participant interest in the study but did not share specific information about SFM-V other than that it could assist with communication. If the potential participant expressed interest, the principal investigator was contacted by one of the identified nurse managers or nurses. The researcher arrived on the unit usually within 2 hours and attempted to gain participant consent. If consent was obtained, the researcher proceeded. If consent was not granted, the researcher exited the room. Any patient who did not consent was not approached again.

Assignment

Assignment to groups was random to either a control or experimental group on each unit, beginning with participant 1 assigned to the experimental group (2 to control, 3 to experimental, and onward in this pattern). Control group participants completed the surveys at the beginning of study hour 1 and at the end of 48 hours. The study was ended at any time the participant indicated that he/she no longer wished to participate. However, data already collected were retained for analysis. The tablets were disinfected at the end of each study period and returned to the principal investigator.

Training Procedures

The researcher attended shift change (huddles) at 6:45 AM and 6:45 PM on each unit on days indicated by nurse managers, and all available personnel were educated about the study and basic use of SFM-V. Additional huddles and private training occurred as needed throughout the duration of the study.

Instrumentation

Data were collected using HADS,[22] a National Institutes of Health (NIH) qualified survey to address hospital-specific depression and anxiety. The HADS is a 14-item scale that requires 3 to 4 minutes for completion. The RASS[24] score used to assess patients in this study to determine inclusion was patient alertness and level of agitation: +1 (restless; anxious, but movements not aggressive; vigorous), 0 (alert and calm), and −1 (not fully alert but has sustained wakening). Patient scores less than −1 or greater than +1 resulted in exclusion from the study. The team also used the NIH qualified demographics allowable via common data elements.

Communication Board (Represented as Standard of Care)

Speech language pathology in the acute care setting often introduces low-tech augmentative and alternative communication strategies such as alphabet boards and picture communication boards. These may be premade communication boards that can be used across patient populations when patients are unable to speak verbally due to medical status.

Speak for Myself—Voice

The SFM-V is a team-developed, patient-centered, and nurse-led communication tablet app. The menu was designed by end-users who are communication vulnerable. The menu was validated (face, context, content)[23] prior to being built into the SFM-V app. An iterative process[25] was used to update SFM-V per the recommendations of patients, family members, and healthcare professionals. An iterative process of design can be described as cyclical. Instead of following rigid steps of development, an iterative process allows for pauses for assessment, update, testing, and evaluation, which then circles back to assessment. The general process can be described as (1) planning and requirements, (2) analysis

and design, (3) implementation, (4) testing, and (5) evaluation. Subsequent iterations should result in improvement of previous designs.

An internal grant was awarded in 2016 to support recommended updates learned in the first feasibility and usability study, including the addition of an ACP menu. Through collaboration with colleagues in the Health Information Technology & Simulation lab, the menus were updated to assist in patient indication of pain. Also added were a male/female body graphic for indication of pain location; a menu about less acute pain; requests for basic needs such as repositioning, water, or a need to void; and requests to see people, including family members, partners, and spiritual advisors. A free-text section allows patients to create their own menu for specific needs, questions, or requests and includes a predictive engine (much like a smartphone). The free-text window remains and is promoted with use so that patients do not need to scroll for or reenter their statements. Although SFM-V is usable on all platforms, this study was conducted on 10 iPads (Apple, Cupertino, CA) technically supported by the College of Nursing Information Technology and the College of Engineering. The ACP menu was provided by a co-principal investigator who is an expert in this area of research.[26]

Description of the updated build is as follows: The frontend, which is the client side of the app, was built using a Quasar framework. Quasar is a Massachusetts Institute of Technology–licensed open source framework that enables the developers to build responsive Web site and hybrid mobile apps. The Quasar framework is built on top of the Vue.JS framework, and provides the developers with plug-in and user interface components. The SFM-V was awarded first place at the Institute of Industrial & Systems Engineers Data Analysis & Information Systems Division Mobile App Competition in May 2018.[27]

STATISTICAL METHODS

Frequency and descriptive statistics were used to describe the sample demographic and clinical characteristics. Skewness and kurtosis statistics were used to check for the statistical assumption of normality. If either statistic was above an absolute value of 2.0, then the assumption was violated. The Mauchly test was used to test for the assumption of sphericity. The Greenhouse-Geisser correction was used when the assumption of sphericity was violated. The Levene Test of Equality of Variances was used to assess the statistical assumption of homogeneity of variance. The Box M test was used to check for the assumption of homogeneity of covariance. When all statistical assumptions were met, a mixed effects ANOVA was used to test for significant interaction effects for the between-subjects (treatment vs control) and within-subjects (baseline and postintervention) aspects of the study. Line graphs were constructed to give visual representations of interaction effects. All analyses were conducted using IBM SPSS Statistics Version 25 (IBM Corp, Armonk, NY) and statistical significance was assumed at an α value of .05.

ANALYSES AND RESULTS

Descriptive statistics included a total of 14 control and 22 experimental participants (N = 36; 54%). Ages ranged from 18 to 79 years. The majority of participants were obtained from the TSICU (13), followed by the CVICU (10) and MICU (8). The remainder of the units provided two to three participants per unit. There were no appropriate participants on neuro intensive care.

Reasons for Hospitalization

Most of the cases were related to respiratory failure (12); respiratory infection or sepsis (3); and trauma, including motor vehicle accidents and gunshot wounds (11). Days hospitalized also varied from 2 days to 47 days. Seven (19.4%) of the participants had been hospitalized for only 2 days.

Race and Education

The majority of participants (26; 72.2%) self-identified as white, while six (6.7%) participants self-identified as black or African American. Only one (2.8%) participant self-identified as Asian and one (2.8%) self-identified as Native American. The sample comprised 15 (41%) females and 21 (58%) males. There were 5 (13.9%) participants who reported they had some high school, while 15 (41.7%) participants completed high school, 4 (11.1%) reported having attended some college, and 5 (13.9%) completed college. At least one participant held a doctoral degree. Missing information was detected on the section about race and education on the demographics form.

STATISTICAL RESULTS

The continuous distributions of the baseline and postintervention observations of depression and anxiety met the assumption of normality. Sphericity was violated for the depression and anxiety analyses, so the Greenhouse-Geisser correction was utilized. Equality of variance and covariance matrices were assumed as per the findings of the Levene test and the Box M test. The mixed effects analyses were thus conducted and interpreted.

Marginal means and 95% confidence intervals for the interactions are presented (Table 1). In the case of depression, there was a significant interaction found between the treatment groups across time: $F_{1,\ 25} = 8.95$, $P = .006$, $\eta^2 = 0.26$, power = 0.82. The treatment group experienced a decrease in depression symptoms across time,

Table 1. Marginal Means and 95% Confidence Intervals for Interactions

Outcome	Group	Baseline[a]	Postintervention[a]	*P*
Depression	Treatment	10.53 (8.62–12.44)	8.00 (5.82–10.18)	
	Control	6.40 (3.91–8.89)	9.5 (6.67–12.34)	.006
Anxiety	Treatment	12.55 (10.47–14.63)	8.15 (6.12–10.18)	
	Control	11.10 (8.16–14.04)	10.30 (7.43–13.17)	.072

[a]Marginal mean (95% confidence interval).

while control group participants experienced an increase in depression symptoms (Figure 1).

For the mixed-effects analysis of anxiety, a potential type II error was detected for the interaction effect: $F_{1,\ 28} = 3.49$, $P = .072$, $\eta^2 = 0.11$, power = 0.44. There was a small decrease in anxiety for control group participants, while treatment group participants experienced a much larger decrease in anxiety symptoms from baseline to postintervention. The interaction is depicted visually (Figure 2).

DISCUSSION

Therapeutic communication techniques are crucial for the effective care of patients. This study demonstrated that SFM-V used as intervention on five ICUs at a university-affiliated teaching hospital resulted in statistically reduced patient-reported symptoms of depression and clinical significance in reduction of anxiety. These findings are especially important when considering that low emotional support and perceived high life risk are associated with symptoms of posttraumatic stress syndrome following hospitalization in an ICU.[17] Provision of voice, encouragement of patient autonomy through increased communication, and meaningful patient–healthcare provider communication may help mitigate negative outcomes of the ICU experience.

This was a second site study. The researchers learned that SFM-V was not effective for several patients in neurointensive care units. Many of the patients were unable to manipulate the tablet and/or were aphasic. Therefore, the primary investigator introduced nurse leaders and nurse managers to a product that could be helpful for patients who are unable to manipulate alphabet boards or tablets or who are unable to otherwise communicate through writing, lip reading, body language, or other means.

CONCLUSION

The use of communication technology to affect patient outcomes is possible. The study demonstrated that symptoms of depression and anxiety can be affected with communication technology coupled with human interface. It is important to emphasize that technology is not meant to replace human interaction.

Recommendations include a more robust study with a larger sample size to address the probable type II error for symptoms of anxiety and to replicate statistically significant

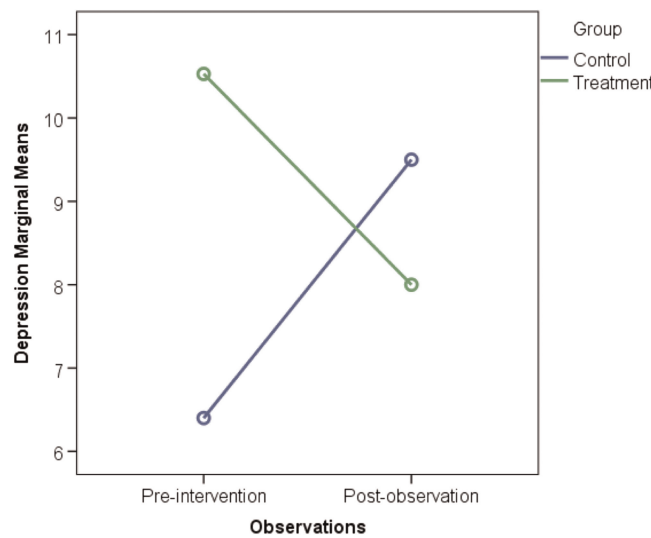

FIGURE 1. Interaction for depression.

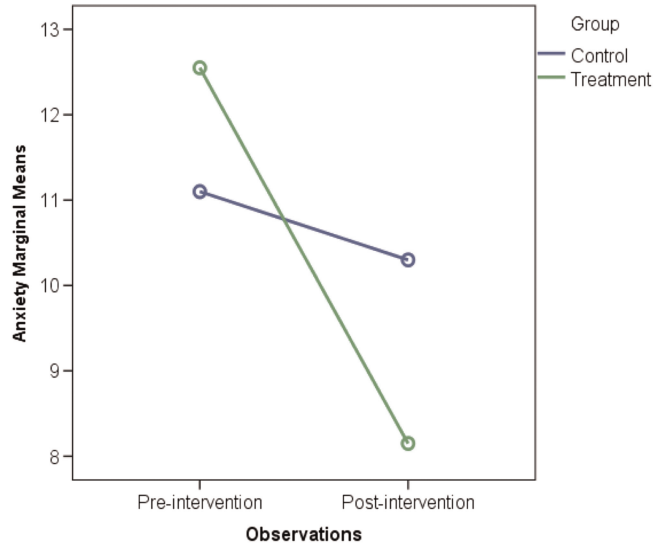

FIGURE 2. Interaction for anxiety.

findings for symptoms of depression. This research is worthy of additional investigation(s). Advanced care planning should continue to be explored in an electronic version.

LIMITATIONS

Threats to internal validity could include that of history, as activities and events between hour 1 and hour 48 are unknown. The study design was rigorous and selection was randomized; however, the study sample yielded 66 participants. There was no attrition as patients who began the study also completed the study. The data for HADS were complete; this is likely due to its being a brief and easily administered instrument. The computer app SFM-V is still investigational.

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