Interaction Behaviors Effects on Nursing Care Quality of Older Adults in the ICU

by

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Nurse and Patient Communication Interaction Behaviors and their Effect on Nursing Care Quality of Older Adults in the ICU

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Background: Approximately 2.8 million people require mechanical ventilation (MV) in intensive care units (ICU) each year and, therefore, are unable to communicate using vocal speech. ICU nurses are positioned to mitigate the detrimental effects of communication difficulties during care interactions.

Objectives: The specific aims included: **1a)** identify and describe communication interaction behaviors that nurses and nonspeaking, critically ill older adults use during communication interactions; **1b)** describe the frequency of augmentative and alternative communication (AAC) use with critically ill older adults; **1c)** evaluate the relationship between individual interaction behaviors and individual AAC strategies; **2)** explore the association between interaction behaviors and nursing care quality indicators (NCQI), and **3)** psychometrically evaluate an interaction behavior instrument derived from prior observational research in ICU.

Methods: The sample included patients $\geq$ 60 years of age (N=38) and their nurses (N=24) who participated in the *Study of Patient-Nurse Effectiveness with Communication Strategies* (SPEACS) (R01-HD043988). Interaction behaviors were measured by rating videotaped interactions. Participant characteristics and NCQI were obtained from the SPEACS dataset and medical chart review. Descriptive statistics were used to describe the nurse and patient interaction behaviors and AAC use. Group comparative statistics were used to examine the differences between interaction behaviors and use of AAC. The association between interaction behaviors and NCQI was explored through repeated measures analysis. Reliability and validity of the instrument were determined by inter-rater agreement, and expert review.

Results: All positive behaviors were observed, whereas negative behaviors were rare. Significant (p<.05) associations were observed between: 1) positive nurse and patient behaviors, 2) patient unaided communication strategies and positive nurse behaviors, 3) individual unaided strategies and individual nurse positive behaviors and 4) nurse and patient behaviors and pain management and sedation level, respectively. Using the revised instrument, percent agreements were better for nurse behaviors (73-100%) than patient behaviors (68-100%). Kappa coefficients ranged from 0.13-1.00; lower coefficients occurred for patient behaviors.

Conclusion: Findings provide evidence that nurse behaviors affect communication tone and suggest an association between nurse-patient interaction behaviors and NCQI. Preliminary results suggest that the revised interaction behavior instrument has good reliability and face validity in MV, non-speaking older adult patients.

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PREFACE

The study was supported through funding from the National Institutes of Health (NINR F31 NR012856-02) and the Szeming Sze Scholarship, through the University of Pittsburgh, School of Nursing, provided support for a second coder. The John A. Hartford Building Academic Geriatric Nursing Capacity Scholarship provided funding support for the preliminary work on duration of nurse talk. In addition, I would like to recognize the funding sources for the *Study of Patient-Nurse Effectiveness with Communication Strategies* (R01-HD043988, K24-NR010244 PI: M. Happ). I would like to acknowledge the individual contributions of my dissertation chair, co-chair, and committee; the SPEACS study team, and Rebecca Nock, SN. Finally, I would like to thank my family and friends for their patience and support.

1.0 PROPOSAL INTRODUCTION

In the United States, approximately 2.8 million people require mechanical ventilation in an intensive care unit (ICU) each year (Angus et al., 2000; Angus et al., 2006) and, as a consequence, are unable to communicate using natural speech. Over half of all ICU days are devoted to the care of older adults (Angus et al., 2000) who are at a greater risk for impaired communication and prolonged critical illness than their younger counterparts (Chelluri, Grenvik, & Silverman, 1995; Ebert & Heckerling, 1998; Gates, Cooper, Kannel, & Miller, 1990). During an extended period of critical illness, it is essential for patients to be able to communicate needs, symptoms, and emotions and participate in decision-making with their family and healthcare team members.

The inability to speak, due to mechanical ventilation, can elicit feelings of distress, anger, fear and isolation (Belitz, 1983; Bergbom-Engberg & Haljamae, 1989; Carroll, 2007; Cooper, 1993; Fitch, 1989; Frace, 1982; Gries & Fernsler, 1988; Happ, 2000a; Jablonski, 1994; Menzel, 1997, 1998; Patak, Gawlinski, Fung, Doering, & Berg, 2004; Rier, 2000; Riggio, Singer, Hartman, & Sneider, 1982; Robillard, 1994; Rotondi et al., 2002; Wunderlich, Perry, Lavin, & Katz, 1999). Even when nonvocal strategies, including lip-reading and gesturing, are used, patients and families continue to report frustration and confusion (Menzel, 1998; Patak et al., 2004). Several studies have evaluated the use of “Low tech” augmentative and alternative communication (AAC) strategies and more sophisticated electronic AAC devices in improving communication between nurses and mechanically ventilated adults but the majority of these studies have small sample sizes and a lack comparison group (Calculator & Luchko, 1983; Dowden, Beukelman, & Lossing, 1986; Etchels et al., 2003; Fried-Oken, Howard, & Stewart, 1991; MacAulay et al., 2002; Miglietta, Bochicchio, & Scalea, 2004; Patak et al., 2004; Stovsky, Rudy, & Dragonette, 1988). Previous studies have not evaluated the influence AAC use has on interaction behaviors between nurses and critically ill, older adults.

In addition to emotional distress, patients in acute care settings who have communication problems are three times more likely to experience preventable adverse events. Preventable adverse events also occurred more often in patients over the age of 65 years when compared to younger patients (Bartlett, Blais, Tamblyn, Clermont, & MacGibbon, 2008). Critical care nurses are uniquely positioned to mitigate the detrimental effects of communication impairment during caring interactions with their older adult patients (Happ, Baumann, et al., 2010; Happ, Sereika, Garrett, et al., 2010). Previous studies have shown that nurse behaviors, which include both positive and negative actions, can influence the tone and quality of the interpersonal interaction between the nurse and critically ill patient (de los Ríos Castillo & Sánchez-Sosa, 2002; Salyer & Stuart, 1985). However, the association between nurse-patient interaction behaviors and nursing care quality has not been explored.

While there is a growing recognition that improved communication is essential to improving healthcare quality and safety, little attention has been focused on how patient communication plays a role. The majority of research has focused on team communication (Despins, 2009; Krimsky et al., 2009; Rothschild et al., 2005; Wilson, Burke, Priest, & Salas, 2005). The proposed study will provide evidence on how relational communication behaviors between nurses and critically ill older adults are associated with nursing care quality.

1.1 PURPOSE AND SPECIFIC AIMS

The purposes of this study are to 1) measure and describe nurse and patient interaction behaviors and factors that may impact communication between nurses and nonspeaking critically ill older adults in the ICU and 2) explore the association between nurse and patient interaction behaviors and nursing care quality indicators.

The specific aims are to: 1a) identify and describe interaction behaviors that nurses and nonspeaking critically ill older adults use during communication interactions in the ICU; 1b) describe the frequency of augmentative and alternative communication use with critically ill older adults and descriptively compare the interaction behaviors with respect to AAC use; 2) explore the association between interaction behaviors and nursing care quality indicators, including sedation use, sedation level, physical restraint use, pain management, and unplanned device disruption, during a two-day observation period; and 3) psychometrically evaluate an interaction behavior instrument derived from prior observational research in the ICU setting (de los Ríos Castillo & Sánchez-Sosa, 2002; Hall, 1996a; Salyer & Stuart, 1985).

The research questions are: 1a) What interaction behaviors are used during communication between nurses and mechanically ventilated, critically ill older adults? 1b) Are there differences in interaction behaviors when AAC strategies are used? 2) Is there an association between interaction behaviors and nursing quality care indicators (sedation use and level, physical restraint use, pain management and unplanned device removal), during a two-day observation period? 3) Does the interaction behavior instrument meet expected standards in regards to reliability and validity when used to measure interaction behaviors?

1.2 BACKGROUND AND SIGNIFICANCE

1.2.1 Mechanical Ventilation and Older Adults

Acute respiratory failure is the primary reason for admission into the Intensive Care Unit (Angus et al., 2001). Acute respiratory failure (ARF) increases 10 fold for adults between the ages of 65 and 85 years (Behrendt, 2000). Mechanical ventilation is a well-established therapy for pulmonary support during ARF and critical illness; its use in older adults has rapidly increased since the late 1980's (Lubitz, Greenberg, Gorina, Wartzman, & Gibson, 2001). By the year 2020, the annual number of older adults requiring prolonged acute mechanical ventilation (> 96 hours) is expected to reach over 330,000 cases (Zilberberg, de Wit, Pirone, & Shorr, 2008).

Age has been evaluated as a prognostic indicator for the following medical recovery outcomes in mechanically ventilated, critically ill adults: mortality, length of hospital and ICU stay, need for prolongation of therapy, and successful ventilator weaning. While several prospective cohort studies found age to be independently associated with hospital mortality (Behrendt, 2000; Esteban et al., 2002; Esteban et al., 2004; Kollef, O'Brien, & Silver, 1997; Luhr et al., 1999; Zilberberg & Epstein, 1998), others found no statistically significant association (Ely, Evans, & Haponik, 1999; Rodriguez-Reganon et al., 2006). When age was evaluated as a predictor for ICU or hospital lengths of stay, days on mechanical ventilation, and weaning success, findings varied between studies (Ely et al., 1999; Esteban et al., 2004). Although Esteban et al found advanced age (>70 years of age) to be independently associated with hospital survival in 5,183 patients from 361 ICUs in 20 countries, age was not a significant predictor of prolonged need for ventilation, weaning success, or length of stay in either the ICU or hospital (Esteban et al., 2004). Conversely, a prospective matched cohort study found that patients 70 years of age and older had longer lengths of stay in the ICU and required more days on the ventilator than younger patients but with no significant difference in mortality (Rodriguez-Reganon et al., 2006).

The interaction of age with other clinical factors and co-morbidities may provide a more accurate prediction of medical recovery outcomes when compared to evaluating patients based on age alone. Esteban et al found that critically ill adults over the age of 70 had a higher mortality when clinical factors, including acute renal failure, shock, and limited functional status, were present (Esteban et al., 2004). The presence of delirium has also been shown to increase the risk of ICU and hospital mortality, prolonged need for mechanical ventilation, longer hospital and ICU stay in mechanically ventilated, critically ill adults (Ely et al., 2004; Lat et al., 2009; Lin et al., 2008; Lin et al., 2004; Ouimet, Kavanagh, Gottfried, & Skrobik, 2007; Salluh et al., 2010; Shehabi et al., 2010). While results are mixed (Aldemir et al., 2001; Dubois, Bergeron, Dumont, Dial, & Skrobik, 2001; Salluh et al., 2010), advanced age has been shown to be a risk factor for delirium (Elie, Cole, Primeau, & Bellavance, 1998; Litaker, Locala, Franco, Bronson, & Tannous, 2001; Marcantonio et al., 1994; Pisani, Murphy, Araujo, & Van Ness, 2010; Pisani, Murphy, Van Ness, Araujo, & Inouye, 2007; Schor et al., 1992). In older adults, delirium has been associated with longer hospital stays, more complications, functional decline, increase risk for dementia, increased morality, lower quality of life, and increase likelihood that the patient will be discharge to a place other then home (Balas, Happ, Yang, Chelluri, & Richmond, 2009; Marcantonio et al., 1994; McCusker, Cole, Abrahamowicz, Primeau, & Belzile, 2002; O'Keeffe & Lavan, 1997; Pisani et al., 2009; Robinson et al., 2009; Rockwood et al., 1999; Van Rompaey et al., 2009). Moreover, researchers suggest that the proportion of older adults with delirium will increase as the older population grows to 70.2 million by 2030 (Inouye, Schlesinger, & Lydon, 1999).

The communication difficulties posed by mechanical ventilation, which prevents natural speech, may contribute to an exacerbation of negative emotions and acute confusion among critically ill older adults. In a study of 158 patients retrospectively interviewed about their experience during mechanical ventilation, 47% reported feelings of anxiety and fear, which were mainly attributed to their inability to talk or communicate (Bergbom-Engberg & Haljamae, 1989). Several qualitative studies and personal accounts of mechanical ventilation during critical illness have described patients' feelings of helplessness, frustration, and feelings of death along with profound communication difficulties (Bergbom-Engberg & Haljamae, 1989; Carroll, 2004, 2007; Fitch, 1989; Frace, 1982; Gries & Fernsler, 1988; Happ, 2000a; Hupcey, 2000; Jablonski, 1994; Menzel, 1997, 1998; Patak et al., 2004; Pennock, Crawshaw, Maher, Price, & Kaplan, 1994; Rier, 2000; Riggio et al., 1982; Robillard, 1994). Older adults are at an increased risk for communication difficulties because cognition, vision, speech, and hearing impairments occur with greater frequency in this population (Ebert & Heckerling, 1998).

More than 30 years ago, Pat Ashworth conducted a descriptive, observational study of 39 patients and 112 nurses from 5 different ICUs in the U.K to assess the amount, content, and channels by which nurse-patient communication took place. Patients reported fear/insecurity and frustration in conveying messages to their nurse. Most of the staff-patient communication was informative in content and approximately 76% of the communication lasted less than 1 minute (Ashworth, 1980). Frustration with communication continues to be a problem for this population (Carroll, 2007; Patak et al., 2004; Patak et al., 2006; Rodriguez & VanCott, 2005).

Patients in acute care settings who have communication problems are also three times more likely to experience preventable adverse events. Preventable adverse events occurred more often in patients over the age of 65 years when compared to younger patients (Bartlett et al., 2008). Critical care nurses are uniquely positioned to mitigate the detrimental effects of communication impairment during caring interactions with their older adult patients (Happ, Baumann, et al., 2010). Patient communication impairment could be a missing link between age and care outcomes in the intensive care unit.

1.2.2 Interaction Behaviors

Previous studies of interaction behaviors have shown that nurse behaviors, which include both positive and negative actions, can influence tone and quality of the interpersonal interaction between the nurse and critically ill patient (de los Ríos Castillo & Sánchez-Sosa, 2002; Salyer & Stuart, 1985). Patient and nurse characteristics can also influence the interpersonal interactions between the nurse and nonspeaking patient. Salyer and Stuart observed 20 mechanically ventilated patients and found that positive nurse actions yielded positive patient reactions. The majority of observed interactions (183 of 217 interactions), were initiated by the nurse (1985). A cross-sectional study of 30 ICU nurses found a significant correlation between nurse's perception of patient's responsiveness and the number of positive and negative interactions with the patient. Higher Glasgow Coma Scale scores were associated with more positive interactions and fewer negative interactions from the nurse to the patient (Hall, 1996a).

de los Ríos Castillo and Sánchez-Sosa (2002) found significant improvements in patient recovery and well-being in an experimental group, in which nurses attended a specialized 8-week intensive training program focused on interpersonal communication skills (e.g., eye contact, tone and touch). Patients in the experimental group perceived significantly less pain, more interest from the nurse, and had greater ability to engage in activities than those in the control group. A difference in length of stay was also noted between the groups with the experimental group having a cumulative total of 212 days compared to 419 days in the comparison group (de los Ríos Castillo & Sánchez-Sosa, 2002). Unfortunately, descriptive statistics including mean, median, standard deviation, and range, were not reported by the researchers making critical appraisal of the results difficult. In addition, although study participants were required to "need assistance breathing," many of the operational definitions for positive and negative patient behaviors included a possible verbal response (such as "yelling, requests"), so the extent to which this study sample was nonspeaking is questionable While these studies have included all adults in their sample, only one of the studies provided a sample description. de los Rios Castillo and Sanchez-Sosa reported that only 15% of their patient sample was over the age of 60 years (2002). With the increase in older adults utilizing critical care, it is questionable whether these studies are generalizable due to inadequate representation of older adults in the samples. The proposed study would be the first to describe communication interaction behaviors in an exclusively nonspeaking, older adult population.

1.2.3 Nursing Care Quality Indicators

While there is a growing recognition that improved communication is essential to improving healthcare quality and safety, little attention has been focused on how nurse-patient communication plays a role. Research is beginning to show the influence that communication has on adverse events (Bartlett et al., 2008), but the literature is limited. Currently, the majority of research has focused on team communication, and interdisciplinary communication (Despins, 2009; Krimsky et al., 2009; Rothschild et al., 2005; Wilson et al., 2005). However, research with respect to communication between critically ill older adults and their nurses is imperative in order to understand how relational communication affects quality and safety for our most vulnerable patients. Physical restraint use, pain management, sedation use, and unplanned device removal are nursing care quality indicators potentially linked to communication (Alasad & Ahmad, 2005; Happ, 2000c, 2001; Happ, Roesch, & Garrett, 2004; Menzel, 1998; Pennock et al., 1994; Puntillo, 1990; Rotondi et al., 2002; Sullivan-Marx & Strumpf, 1996; Weinert & Calvin, 2007; Wunderlich et al., 1999). To date, no studies have evaluated the association between communication interaction behaviors and nursing care quality.

1.2.3.1 Sedation Use

Sedation levels are likely to affect the critically ill patient's ability to think clearly and communicate effectively. Intravenous sedation has become a central component in the care of critically ill patients. The purpose of sedation is to provide anxiolytic and analgesic effects (Arbour, 2000; Burns & Park, 1992; Weinert, Chlan, & Gross, 2001). Sedation effects can also be linked to quality of care outcomes. Excessive sedation and analgesia can prolong the need for mechanical ventilation and lengths of stay in the ICU (Brook et al., 1999; Kollef et al., 1998; Kress, Pohlman, O'Connor, & Hall, 2000; Shehabi et al., 2012). Critical care nurses typically manage the administration of sedation for mechanically-ventilated patients, often using nurse-implemented algorithms and protocols (Brook et al., 1999; De Jonghe et al., 2005; de Wit, Gennings, Jenvey, & Epstein, 2008; Quenot et al., 2007) for daily sedation interruption, which have been shown to shorten duration of mechanical ventilation, significantly decrease ICU and hospital stay, and the need for tracheostomy (Girard et al., 2008; Jackson, Proudfoot, Cann, & Walsh, 2010; Kress et al., 2000; Schweickert, Gehlbach, Pohlman, Hall, & Kress, 2004).

However, findings are inconsistent (Mehta et al., 2012). Anifantaki et al found no significant benefit to daily sedation interruption in respect to total length of stay in the ICU or hospital (2009). Others reported that light sedation, which allowed the patient to be awake and cooperative, contributed to a reduction of intensive care unit stay and duration of ventilation without negatively affecting subsequent mental health or safety of the patient (Treggiari et al., 2009).

Several factors affect nurses' implementation of sedation protocols, including the families' ability to influence sedation therapy, nurses' beliefs that mechanical ventilation is uncomfortable for the patient, nurses' perception that movement of large muscle groups indicates under-sedation, and nurses' workload (Weinert et al., 2001). In a qualitative study of 28 critical care nurses in Jordan, Alasad and Ahmad found that nurses preferred caring for sedated patients because "they do not initiate communication and they do not give you any significant feedback" (2005, p. 359). In both studies, nurses reported that sedated patients were less demanding because they could not communicate their needs, rather, nurses anticipated what they perceived the patient needed (Alasad & Ahmad, 2005; Weinert et al., 2001). The following nurse quote aptly summarizes the potential impact of sedation on communication with mechanically ventilated patients, "Asking the patient is excellent because sometimes you think they're short of breath or they're in pain and you ask then, and they're not. Which means that every other way we have of assessing is pretty inexact"(Weinert et al., 2001, p. 162). Improved communication with nonspeaking ICU patients should result in more effective and more efficient pain and symptom management (Campbell & Happ, 2010).

1.2.3.2 Physical Restraint Use

Physical restraints are commonly used in conjunction with sedation to control behavior and movement in mechanically ventilated ICU patients to prevent disruption of devices and therapies. The use of physical restraints, specifically wrist restraints, minimizes patients' ability to communicate through gestures and use alternative communication techniques such as picture boards (Happ, 2001; Menzel, 1998). In a retrospective, descriptive study of 50 non-surviving ICU patients who received mechanical ventilation, communication interactions occurred more frequently when restraints were not in use (62.9%) (Happ, Tuite, Dobbin, DiVirgilio-Thomas, & Kitutu, 2004). Although 20% of the data on restraint use for this study were missing, the authors suggest that the trend towards more frequent communication interaction during restraint-free care is important (Happ, Tuite, et al., 2004). In addition to detrimental physical effects (e.g., decreased mobility, nerve damage, injurious falls, entrapment, strangulation and death) (Evans, Wood, & Lambert, 2003), physical restraint use may indirectly hinder communication by contributing to feelings of stress, anxiety, depression, and withdrawal among patients who received mechanical ventilation (Rotondi et al., 2002; Sullivan-Marx & Strumpf, 1996; Wunderlich et al., 1999). Physical restraint use has also been strongly associated with the development of delirium (Inouye & Charpentier, 1996; Micek, Anand, Laible, Shannon, & Kollef, 2005). Mechanically ventilated older adults who develop delirium are at an increased risk for death (Ely et al., 2004), thus the association between physical restraint use and delirium may be more burdensome to them than to their younger counterparts. Finally because physical restraints have the potential to cause physical and psychological harm, The National Quality Forum has identified physical restraint use as one of its Nursing Sensitive Care Outcomes measures targeted for reduction (The Joint Commission, 2009; The National Quality Forum, May 2006).

1.2.3.3 Pain Management

Accurate assessment and management of pain in critically ill adults can play an integral role in medical recovery and quality of care. Verbal communication of pain is, however, not typically possible for mechanically ventilated patients. In a classic study, nurses, social workers, and physicians inferred greater physical pain when presented with verbal cues in simulated cases than when nonverbal cues were presented (Baer, Davitz, & Lieb, 1970). Patients assessed for pain received fewer hypnotics, lower daily doses of midazolam, shorter duration of mechanical ventilation (8 *vs.* 11 days; $p<.01$) and a reduced duration of stay in the ICU (13 *vs.* 18 days; $p<.01$) (Payen et al., 2009). Clinicians often rely on both physiological cues, such as heart rate and blood pressure, and nonverbal behaviors, such as grimace or gestures, to interpret pain in mechanically ventilated adults. A prospective, descriptive study of 22 ICU nurses demonstrated that nurses relied both on behavioral and physiological signs to infer the presence of symptoms including pain (Puntillo, Smith, Arai, & Stotts, 2008). Similarly, critical care nurses were observed using physiological cues more often than verbal interactions to determine pain among critically ill older adults (Happ, 2000a).

Objective signs have been utilized in several pain assessment tools and analgesia protocols. For example, Robinson et al found that an analgesia-delirium-sedation protocol based on objective measures, including a visual analog scale for pain, reduced ventilator days and hospital length of stay in critically ill trauma patients (2008). Conversely studies have reported that critical care nurses underrated patients' pain when presented with a visual analog scale (Hamill-Ruth & Marohn, 1999; Sloman, Rosen, Rom, & Shir, 2005). It is important to note that pain control alone may not be sufficient to diminish patient distress. In a study of 24 adult intensive care patients, patients reported that not only the presence of pain, but the *communication* of pain and its treatment were also distressing experiences during their ICU stay (Puntillo, 1990). Patient and nurses in the two intervention groups of the SPEACS study had a significantly greater percentage of successful communication exchanges regarding pain than the control group (Happ, Sereika, Garret, et al., 2010). Pain assessment and management is predominantly the role of the nursing staff, therefore they are uniquely positioned to address untreated or unrelieved pain and improve quality of care.

1.2.3.4 Unplanned Device Disruption

Critical illness typically requires several life–saving technological devices, such as endotracheal tubes to maintain an airway and nasogastric tubes to provide nutrition. Although these devices are necessary to promote health and recovery, many patients attempt to manipulate or remove these devices. In the ICU, device removal is common with a prevalence rate estimated to be 22.1 therapy disruption episodes/1000 patient-days resulting in harm in 23% of the episodes of removal and contributing significantly to resource expenditure (Mion, Minnick, Leipzig, Catrambone, & Johnson, 2007). While some studies have shown that older adults are over-represented among the physically restrained on medical units (Minnick, Mion, Johnson, Catrambone, & Leipzig, 2007), older age does not appear to be associated with increased physical restraint use while in the ICU (Minnick et al., 2007; Mion et al., 2007).

Although, the prevention of device disruption is the most common reason for initiating physical restraints in the ICU (Cruz, Abdul-Hamid, & Heater, 1997; Fletcher, 1996; Happ, 2000b), implementation of physical restraints may increase patient's agitation and minimize a patients' ability to communicate through gestures and use alternative communication techniques

(Happ, 2001; Menzel, 1998). Even when restraints are in place, device disruption, including self-extubation, still occurs (Baer, 1998; Balon, 2001; Chang, Wang, & Chao, 2008; Mion et al., 2007). Findings from Happ's grounded theory study of treatment interference among 16 critically ill older adults conceptualized device disruption as a nonverbal communication act (Happ, 2000c). Nurses are uniquely positioned to interpret these nonverbal behaviors in order to develop and implement strategies to minimize device disruption.

1.2.4 Augmentative and Alternative Communication

A variety of strategies have been used to enhance communication with critically ill, mechanically ventilated adults. Nonvocal communication techniques, such as mouthing, gesturing, writing, and head nods, are the most common methods utilized by mechanically ventilated patients when communicating with caregivers and family (Ashworth, 1980; Happ, Tuite, et al., 2004; Jablonski, 1994; Leathart, 1994; Menzel, 1998; Thomas & Rodriguez, 2011). Several studies have investigated the utility of "low tech" augmentative and alternative communication (AAC) strategies, such as communication boards, in critically ill patients (Calculator & Luchko, 1983; Dowden et al., 1986; Fried-Oken et al., 1991; Patak et al., 2004; Rodriguez, Thomas, Bowe, & Koeppel, 2012; Stovsky et al., 1988). So far there has only been one quasi-experimental study the use of communication boards in forty cardiac intensive care unit patients (Stovsky et al., 1988). Patients in the experimental group (n=20) were introduced to a communication board prior to cardiac surgery and utilized the board during the recovery period. Patients in the experimental group had significantly higher satisfaction scores during the early postoperative period than those in the control group (t = 2.09, p = 0.05, n = 35) (Stovsky et al., 1988).

Few studies have examined the benefits of more sophisticated electronic AAC devices in the care of critically ill adults. These were primarily feasibility studies that employed small samples and lacked comparison groups (Dowden et al., 1986; Etchels et al., 2003; Happ, Roesch, et al., 2004; MacAulay et al., 2002; Miglietta et al., 2004; Rodriguez & Rowe, 2010; Rodriguez, Rowe, et al., 2012). ICU patients initiated communication exchanges more often when electronic devices were used suggesting that these devices may change the dynamic of nurse-patient interactions (Happ, Roesch, et al., 2004). Patients vary substantially in their cognitive ability and physical dexterity during critical illness, a circumstance which likely influences their ability to successfully use available AAC strategies (Jones, Griffiths, & Humphris, 2000; Marshall & Soucy, 2003; Pisani, McNicoll, & Inouye, 2003). In a subset analysis of adults who received electronic AAC devices in the ICU, older adults (n=8) utilized the devices in greater proportions when compared to younger adults (N=13) in the sample (Happ, Roesch, Kagan, Garrett, & Farkas, 2007). Although older adults may have functional limitations that are magnified during critical illness, research supports that their ability to communicate should not be disregarded.

1.2.5 Summary

In summary, older adults can successfully recover from critical illness but there is still a need to prevent further potential adverse events, including over-sedation, unplanned extubation, unrecognized or untreated pain, and unnecessary restraint use, in order to optimize the potential for recovery among critically ill older adults. Research is beginning to show the influence that communication has on adverse events (Bartlett et al., 2008), but the literature is limited. To date, the majority of research has focused on team communication and interdisciplinary communication (Despins, 2009; Krimsky et al., 2009; Wilson et al., 2005); however, research with respect to communication between critically ill older adults and their nurses is imperative in order to understand how relational communication effects quality and safety for our most vulnerable patients. Physical restraint use, pain management, sedation use, and unplanned device removal are nursing care quality indicators potentially linked to communication (Alasad & Ahmad, 2005; Happ, 2000c, 2001; Happ, Roesch, et al., 2004; Menzel, 1998, 1999; Pennock et al., 1994; Puntillo, 1990; Rotondi et al., 2002; Sullivan-Marx & Strumpf, 1996; Weinert et al., 2001; Wunderlich et al., 1999), however, no studies have evaluated the association between communication interaction behaviors and nursing care quality. This proposed study has the potential to provide critical evidence regarding how communication interaction behaviors are associated with nursing care quality.

1.3 PRELIMINARY STUDY

During this research project, the article title "Nurse and patient characteristics associated with duration of nurse talk during patient encounters in the ICU" was published in *Heart and Lung* (Appendix A). This article provided rationale for including specific patient covariates (i.e., level of consciousness and days intubated prior to study enrollment) into the dissertation research model.

1.4 PUBLICATIONS AND PRESENTATIONS RELEVANT TO PROPOSED RESEARCH (*DATA-BASED)

Peer Reviewed Journal Articles

***Nilsen, M.L.,** Sereika, S., & Happ, M.B. (2013). Nurse and patient characteristics associated with duration of nurse talk during patient encounters in ICU. *Heart and Lung.* 42(1), 5-12.

Book Chapters

Nilsen, M.L. & Happ, M.B. (2007). Communication enhancement: speech deficit. In B. Ackley, G. Ladwig, B.A. Swan, & S. Tucker (Eds.) **Evidence-Based Nursing Care Guidelines: Medical-Surgical Interventions**. Philadelphia. Mosby. (AJN 2008 book of the year award)

Online Course

Radtke, J., **Nilsen, M**., & Happ, M.B. (2009). Case Study: Mrs Moore- module 7. *Best Practice for Elder Care Course.* American Association of Critical Care Nurses on-line http://www.aacn.org/WD/Practice/Media/eldercare/player/main.html

Published Abstracts

Nilsen, M., Paull, B., Tate, J., Happ, M., Garrett, K., & George, B. (2007). Assessing mechanically ventilated elderly adults in the ICU for augmentative and alternative communication strategies. *The Gerontologist, 47*(Special Issue I), 639

***Nilsen, M.L.,** Happ, M.B., & Sereika, S. (2011) Nurse and Patient Characteristics Associated with Nurse Talk Time in the ICU. *The Gerontologist*, 51(suppl 2): 171.

Presentations

DiVirgilio-Thomas, D., Happ, M.B., **Nilsen, M.**, Tate, J., Garrett, K., & Sereika, S. (2006, October). Coding Clinical Communication Interactions of Nurse-Patient Dyads: Methods, Issues and Implications. (Symposium paper) 2006 National Congress on the State of the Science in Nursing Research: Washington D.C.

***Nilsen, M.L.,** Nock, R., Terhorst, L., Sereika, S., & Happ, M.B. (2012, October) Assessing Reliability and Validity of a Communication Interaction Behavior Instrument in Critically ill, Mechanically Ventilated Adults (Oral Presentation) 2012 State of the Science Congress on Nursing Research: Washington D.C.

Nilsen, M., Paull, B., Tate, J., Happ, M.B., Garrett, K., & George, B. (2008, March) Assessing Mechanically Ventilated Older Adults in the ICU for Augmentative and Alterative Communication Strategies (Poster) 2008 Eastern Nursing Research Society Conference: Philadelphia, PA.

***Nilsen, M.L**. (2010, March) Psychosocial Interaction Behaviors Effect on Nursing Care Quality and Medical Recovery of Nonspeaking, Older ICU Patients (Poster) 2010 Eastern Nursing Research Conference: Providence, RI.

Nilsen, M.L., Paull, B., Tate, J., Happ, M.B., Garrett, K., & George, B. (2007, December) Assessing Mechanically Ventilated Older Adults in the ICU for Augmentative and Alterative Communication Strategies (Poster) 2007 Institute of Aging: Pittsburgh, PA.

Nilsen, M.L. (2009, February) Psychosocial Interaction Behaviors Effect on Nursing Care Quality and Medical Recovery of Nonspeaking, Older ICU Patients (Poster) 2009 Sigma Theta Tau International Eta Chapter 10th Annual Research and Clinical Poster Night: Pittsburgh, PA.

***Nilsen, M.L.,** Happ, M.B., & Sereika, S. (2011, April) Nurse and Patient Characteristics Associated with Nurse Talk Time in the ICU (Poster) 2011 Institute of Aging Research Day: Pittsburgh, PA.

***Nilsen, M.L.,** Happ, M.B., & Sereika, S. (2011, June) Nurse and Patient Characteristics Associated with Nurse Talk Time in the ICU (Poster) Third Annual PhD Research Day: Pittsburgh, PA.

***Nilsen, M.L.,** Nock, R., Terhorst, L., Sereika, S., & Happ, M.B. (2012, June) Assessing Reliability and Validity of a Communication Interaction Behavior Instrument in Critically ill, Mechanically Ventilated Adults (Poster) Fourth Annual PhD Research Day: Pittsburgh, PA.

1.5 RESEARCH METHODS AND DESIGN

The methods outlined in this section are proposed methods for the dissertation. Adjustments or changes made to the proposed methods are detailed in study summary section.

1.5.1 Study Design

The proposed study will employ a descriptive correlational design utilizing data collected on a subset of older adult patients ($\geq$60 years) enrolled in the Study of Patient-Nurse Effectiveness with Communication Strategies (SPEACS) (R01-HD043988; Happ 2003-2008). The proposed study will be conducted in two parts. The first phase will entail the refinement and testing of a tool to assess the presence/absence of the interaction behaviors between nurses and patients. The second phase will be devoted to identifying and describing the interaction behaviors and exploring the association between nurse and patient interaction behaviors and nursing care quality indicators.

1.5.2 Research Model

The research model was adapted from the nurse-patient communication research model used in the SPEACS Study (Happ, Sereika, Garrett, & Tate, 2008) and in subsequent studies (Happ & Barnato, 2009-2011). In the SPEACS research model, the *process* outcomes measured were ease, success, frequency, and quality of communication. For this proposed study, the outcomes will be nursing care quality indicators.

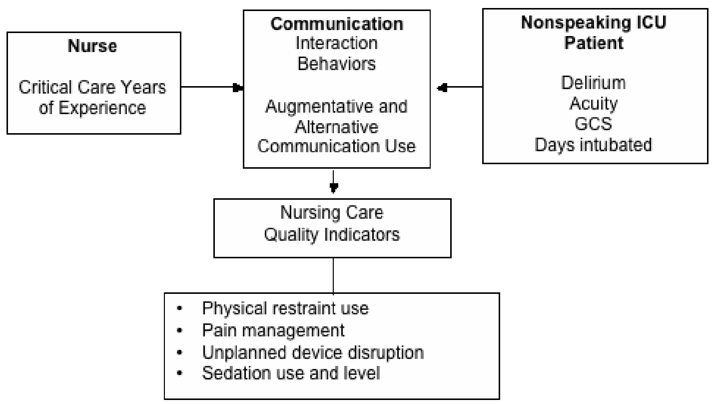

Figure 1: Research Model

1.5.3 Parent Study

The SPEACS study utilized a quasi-experimental three-group sequential cohort design (Happ et al., 2008). The study tested the impact of two interventions on nurse-patient communication compared to a usual nursing care condition. The interventions included: A) basic communication skills training (BCST) for the study nurses, which focused on assessment of the patient's cognitive and motor function, basic interactive communication strategies, and the use of “low tech” communication strategies (e.g., alphabet and picture communication boards, writing tools, etc), and B) basic communication skills training and electronic AAC device education with an individualized speech language pathologist (SLP) consultation, which included assessment of the study patient and development of an individual communication plan (AAC-SLP). Longitudinal assessment was utilized to collect data on two consecutive days, in the morning and afternoon, for a total of four video-recorded observations of nurse-patient interaction.

The study was conducted in the MICU and CT-ICU at the University of Pittsburgh Medical Center (UPMC) Oakland campus. The only AAC strategy used by the usual care group was writing. Patients in the usual care group had access to writing supplies as the only AAC strategy. Low tech communication materials (e.g. alphabet boards, picture boards, writing materials) were available in BCST, and, in addition to low tech materials, AAC-SLP patients were offered high tech (electronic) AAC devices. For the proposed study, groups will be combined as the aim of the study is to evaluate interaction behaviors with respect to AAC use, which can occur in any group. Thirty (30) nurses and 89 ICU patients completed the parent study (n=89 nurse-patient dyads). The parent study measured communication process, specifically ease, quality, frequency and success of communication. Nurse and patient characteristics were collected and used as covariates in the hierarchical regression modeling.

1.5.4 Subjects

Patients were included if they were: (1) nonspeaking due to oral endotracheal tube or tracheostomy, (2) intubated for 48 hours, (3) able to understand English, and (4) scored 13 or above on the Glasgow Coma Scale. Patient participants who were reported by family to have a diagnosed hearing, speech or language disability that could interfere with communication prior to hospitalization were excluded. Nurses were randomly selected for inclusion if they: (1) had at least 1 year of critical care nursing experience, (2) were full-time permanent staff in medical ICU

(MICU) or cardiothoracic ICU (CT-ICU), and (3) were English-speaking. Nurses with a diagnosed hearing or speech impairment or prior SLP-AAC training were excluded.

For the proposed study, the sample will include all adult patients ≥ 60 years of age (n=38) and their nurses (n=24) who participated and completed the parent study. In determining the age range for the proposed study, a literature search revealed a large variation in what is classified as “older adult” in critical care research. Studies varied with lower inclusion ages ranging from 60-75 years (Balas et al., 2007; Ely et al., 1999; Epstein & El-Mokadem, 2002; Esteban et al., 2004). The age 60 years was selected for this study by considering the age classifications in prior research and determining a natural cut-point in the parent study data for patient age.

Patients in the proposed study (N=38) range from 60 to 87 years of age (M±SD =70.3±8.5) with ages fairly evenly distributed among three age subcategories: (1) ≤ 65 years (n= 14), (2) 66-75 years (n=10), and (3) > 75 years (n=14). Patients are predominantly white (90%) and have 8 to 21 years of formal education (M±SD=12.9±2.8). With respect to the parent study sample, the proposed study has a higher percentage of male patients (61%). In the parent study patient participants were almost evenly distributed between males (49%) and females (51%).

The nurses in the proposed study (N=24) range from 22 to 55 years of age (M±SD=35.1±10.4) and are mostly female (79%). The majority of the nurses had their Bachelors degree in nursing (BSN) (83%). Years in nursing practice and in critical care range from 1 to 33 with a mean of 10.0 (SD=10.7) and 7.2 years (SD=9.3), respectively. Nurses in the proposed study sample are reflective of the parent sample except that the parent study nurse sample had a lower proportion of BSNs (80%).

1.5.5 Variables, Measurement and Level of Measurement

1.5.5.1 Interaction behaviors

Interaction behaviors are defined as verbal and nonverbal actions/behaviors communicated by both patients and nurses that can influence the interpersonal care relationship. Nurses and patients can have both positive and negative interaction behaviors during a communication interaction. The interaction behaviors and definitions, originally derived from de los Rios Castillo and Sanchez-Sosa, 2002, have been modified for use with exclusively nonspeaking patients based on prior observational work in the ICU (de los Ríos Castillo & Sánchez-Sosa, 2002; Hall, 1996a; Salyer & Stuart, 1985). There are a total of 24 interaction behaviors divided into the four subscale categories.

Positive Nurse Interaction Behaviors, defined as actions/behaviors by the nurse that communicate interpersonal support and encouragement, include: sharing, praising, visual contact, brief contact, proximity, physical contact, verbal requests, smiling, modeling, and laughing. Operational definitions for nurse interaction behaviors include:

Sharing: Facing the patient, the nurse offers him/her such items as a glass of water, prescribed food, special urinals, the patient's audio cassette player or transistor radio, or some other object used to support the patient's wellbeing or treatment.

Praising: Verbal comments involving approval, recognition or praise to the patient, such as "that was very well done", "you look much better today", and "you are recovering real fast". All comments had to involve clear, audible and a kind tone of voice, and may or may not involve such physical contact as patting the patient's feet, arms, hands or shoulders.

Visual contact: The nurse looks the patient in the eyes for as long as the nurse is at the patient's bedside (unless engaged in incompatible technical procedures), regardless of whether the patient is looking at her/him.

Brief contacts: The nurse stands at a distance no longer than an arm's length from the patient, for a period no shorter than five seconds.

Proximity: As in the previous category but involving contacts longer than five seconds.

Physical contact: The nurse touches, pats or hugs the patient.

Verbal requests: Include clearly audible verbalizations expressing a request, a suggestion or announcement by the nurse. Some examples include "(patient's name), please open your mouth", "please lift your arm", "please turn on your side so that I can raise your headrest", "you are going to feel a mild sting but it will hurt very little", "we are going to give you your sponge bath".

Smiling: Lifting the lips corners while looking the patient in the eyes.

Modeling: Body changes or movements accompanied by the corresponding descriptive verbalization, reproduced by the patient within the following ten seconds ("Please cough like this", "lift your tongue like this").

Laughing: Lifting the lip's corners or congruently opening the mouth while emitting the characteristic voiced laughter sound, with or without an appropriate comment such as "that was funny Mrs/Mr... (patient's name)".

<u>Negative Nurse Interaction Behaviors,</u> defined as actions/behaviors by the nurse that inhibit the interpersonal relationship, include disapproving, yelling, and ignoring. Operational definitions for negative nurse behaviors include:

Disapproving: Verbalizations implicating disagreement, negation, disgust or criticism of the patient. Examples: "No, not like that", "I've already told you how to turn around".

Yelling: Loud verbalizations or utterances containing comments, criticism or disapproval of the patient. Examples: "Hey, that was really bad!", "Don't get out of bed!", "Don't remove that bandage!"

Ignoring the patient: After a question or verbal request by the patient, the nurse does not answer verbally within five seconds in a congruent manner, or does not perform the requested action or does not give an explanation of why it cannot be done, or simply nods (yes or no), without establishing distinct visual contact with the patient

<u>Positive Patient Interaction Behaviors,</u> defined as actions/behaviors that communicate interpersonal engagement, responsiveness and interdependence in the care recipient role, include: acceptance, instruction following, visual contact, physical contact, request, smiling, maintaining attention, laughing, and praise. Operational definitions for positive patient behaviors include:

Acceptance: After the nurse offers or performs a health related or comfort providing function the patient says "yes", "mmhm", thanks the nurse, nods affirmatively with the head, eyes or hand, expressing agreement, acceptance or satisfaction.

Instruction following: Engaging a behavior (within the patient's actual capabilities) in response to an appropriate request or instruction by the nurse, within five seconds of the request. Examples: posture changes, answering questions.

Visual contact: Same definition as the category for nurses.

Physical contact: Same definition as the category for nurses.

Requests: Includes verbal, digital or manual indications (in case of verbal impossibility) expressing a need or request, followed by the corresponding nurse appropriate behavior. Examples: requesting a glass of water, pain medication, etc.

Smiling: Same definition as the category for nurses.

Maintaining attention: The patient keeps sustained eye contact while the nurse provides an explanation, information, instruction or appropriate comment.

Laughing: Same definition as the category for nurses.

Praise: A verbalization or clearly distinguishable gesture expressing gratefulness or approval of an action by the nurse.

<u>Negative Patient Interaction Behaviors,</u> defined as actions/behaviors that are expressions of disapproval or withdrawal from the interpersonal care relationship include: disagreement and ignoring. Operational definitions for negative patient interaction behaviors include:

Disagreement (negativity): Verbalizations expressing opposition to nurse's actions. Examples: "I don't want that medicine", "don't move me", "don't touch me", "I don't want to eat", "leave me alone".

Ignoring: Same definition as the category for nurses in absence of a justifying situation such as being asleep or unconscious.

These interaction behaviors will be obtained by rating each 3-minute session of video-recorded observation of nurse-patient communication for each possible behavior. The 3-minute time unit was selected by the parent study researchers because the literature suggested that typical nurse–patient interactions in the ICU last 1 to 5 minutes in length (Ashworth, 1980; Bergbom-Engberg & Haljamae, 1993; Hall, 1996a; Leathart, 1994; Salyer & Stuart, 1985) and 3 minutes was determined, after viewing videotapes from prior research of gestural communication with nonspeaking ICU patients, to be an adequate amount of time to observe the ICU nurse-patient communication interaction (Happ et al., 2008). Each behavior will be coded as present or absent for each 3-minute session. In addition, a total count will be computed for each individual positive and negative category for nurse and patient behaviors for each session. Some modifications of these behaviors or definitions may occur as a result of instrument testing.

1.5.5.2 Augmentative and Alternative Communication Strategy Usage

AAC strategies, in this context, includes all forms of communication (other than oral speech) that are used to express thoughts, needs, wants, and ideas when an individual has a communication limitation that hinders ability to meet their daily communication needs through natural speech (Beukelman & Mirenda, 2005). These strategies will be categorized as: no technology (gesture, facial expression, head nods), low-technology strategies and high-technology systems (Beukelman, Garrett, & Yorkston, 2007). Use of AAC strategies will be determined by observation of the video recording and analysis of research observer field notes for each session. Use of AAC is a nominally scaled, time-dependent variable and will be measured in terms of whether a strategy/device was used (present or absent) during each session (see Table 1).

Table 1: AAC Strategies and Devices

Strategy Classification	Strategies/Devices
No Technology	• Mouthing • Gesture (i.e., waving around the room, pointing, symbolic gestures) • Head nod yes/no or yes/no signal (i.e., thumbs up/down) • Facial expression (I.e., smile, frown) • Nonverbal but communicative act (i.e. purposeful looking or purposeful squeeze) • Audible vocalization or speech
Low Tech	• Drawing • Writing • Point to partner-generated written word choices • Point to partner-generated points on a graphic scale • First letter spelling while mouthing • Point to alphabet board • Point to location on a drawn map • Point to encoded symbol representing a phrase • Indicate a letter in response to partner's auditory/visual scanning of alphabet • Indicate phrase in response to partner's auditory/visual scanning of phrase choice list • Tracheostomy speaking valve • Eye gaze • Prepares message in advance for nurse caregiver
High Tech	• Direct selection- spell • Direct selection- message (i.e., word, picture, phrase) • Scan- word, picture • Scan- spell • Devices o Electrolarynx o Supertalker o TechSpeak o Bluebird II o MiniMos o Dynamyte o E-Talk o Lightwriter o Link Classic

1.5.5.3 Nurse Characteristics as Covariates

Years of critical care experience was measured as a continuous ratio scaled variable denoting the total number of years of experience the study nurse had in a critical care setting. Critical care years of experience were obtained through self-report.

1.5.5.4 Patient Characteristics as Covariates

Nurses' perception of a patient's level of consciousness/responsiveness can affect the amount and type (positive vs. negative) interaction behaviors that occur during a communication session (Hall, 1996a). The following characteristics were identified as possible covariates based on their potential to influence a patient's level of consciousness/responsiveness.

Acuity will be measured by the **Acute Physiology and Chronic Health Evaluation (APACHE III)** scoring system. APACHE III is an acuity measure used in critical care populations to predict an individual's risk of hospital mortality. APACHE III is a sum of three components: an acute physiology score, age score, and chronic health problem score. APACHE III is measured at the approximate interval level with a total score range of 0-299. The Acute Physiology Score component of the earlier version APACHE II tool was shown to be highly reproducible with an intra-class correlation coefficient of .90 and when reanalyzed with the APACHE III tool, results were similar (Knaus et al., 1991). The predictive accuracy of first-day APACHE III scores is high. Within the first ICU day 95% of the patients received a risk estimate of hospital death that was 3% of what was actually observed (r^2 =.41, ROC curve =.90) (Knaus et al., 1991). APACHE III is also commonly used to determine a daily severity of illness measure (Wagner, Knaus, Harrell, Zimmerman, & Watts, 1994). In the parent study, APACHE III scores were obtained on study enrollment and for the two consecutive days of observation.

All APACHE III ratings for the parent study were checked by a second reviewer to achieve > .90 agreement (Happ et al., 2008).

Delirium will be measured as a nominally scaled variable by the **Confusion Assessment Method for ICU (CAM-ICU)** (Ely, Margolin, et al., 2001), which is a delirium screening instrument adapted from the Confusion Assessment Method (CAM) (Inouye et al., 1990) for use with nonverbal ICU patients. The CAM-ICU demonstrated excellent inter-rater reliability (κ= .96, 95% CI, .92 - .99) and high criterion validity with excellent sensitivity, specificity, and accuracy when compared to the reference standard (Ely, Inouye, et al., 2001). In the parent study, inter-rater reliability was checked by an independent rater for 10% of sessions, with > .90% agreement. In the parent study, delirium was the only covariate found to have an association with the communication process measures (success and quality). When patients were delirious, nurse communication acts had a higher quality but were less successful (Happ, Sereika, Garrett, et al., 2010).

Level of Consciousness will be measured as a nominally scaled variable using the **Glasgow Coma Scale (GCS)**. The Glasgow Coma Scale was developed in 1974 as a measurement tool to assess impaired consciousness and coma. It is based on three categories including eye opening, verbal, and motor responsiveness (Teasdale & Jennett, 1974). Scores can range from 3 to 15 with lower scores denoting impaired consciousness and coma. In 290-paired observations by nurses, GCS demonstrated substantial inter-rater reliability (κ=0.64; p=.001) (Ely et al., 2003). In the parent study, the GCS was adapted to provide a verbal score was applied that represented ability to communicate using nonvocal methods. Previous analysis of the SPEACS dataset indicate a lack of variability among GCS levels; therefore, it will be converted to a derived binary categorical variable ($\leq$14, 15)

Days intubated prior to study enrollment will be a ratio scaled variable measured as the total amount of days a patient was intubated during this current admission prior to enrollment in the SPEACS study and was obtained by medical chart review.

1.5.5.5 Nursing Care Quality Indicators

Physical restraint use will be measured as a nominally scaled variable indicating the presence of unilateral or bilateral wrist restraints on the patient by direct observation (presence/absence) during each nurse-patient observation. The data are available in the parent study dataset. Direct observation is an accurate and unobtrusive method of measuring the use of physical restraints (Fogel, Berkman, Merkel, Cranston, & Leipzig, 2009). Inter-rater reliability rates for observation of restraint use range from 94-100% agreement for limb, trunk, and lap restraints (Edwards et al., 2006).

Pain management, a highly ordinal but approximates an interval valued variable, will be determined by a 0-10 pain score with 0 being no pain and 10 representing the worst pain. Pain scores will be obtained through a retrospective chart review. Because multiple pain scores may be recorded, an average score and high will be calculated obtained for each study nurse's shift, which will include 2 observation periods, during two consecutive nurse-patient observation days. Self-report scales have been recommended for assessment of pain in ICU patients and a previous study has shown self-report to be feasible as long as the patient is sufficiently alert (Chanques et al., 2010). Although the concordance between direct report/observation and clinical record documentation is unsatisfactory (Morrison et al., 2006; Saigh, Triola, & Link, 2006), clinical record documentation affords the best proxy for pain management for this study.

Unplanned device disruption of endotracheal tubes, tracheotomies, central line catheter, and nasogastric tubes will be obtained from the clinical record. Unplanned device disruption for each of these therapies will be measured as a nominally scaled variable representing whether or not it occurred during each study nurse shift. The devices identified for this analysis were chosen based on likelihood of occurrence in this cohort, cost associated with disruption, and risk to the patient's health (Mion et al., 2007).

Sedation use will be measured as a ratio scaled variable by calculating a total dose of sedatives and opioids for the observed study nurse's shifts, which is typically a 12-hour shift. These totals will be converted to lorazepam and morphine equivalents using a conversion formula (Cammarano, Drasner, & Katz, 1998; Lacy, Armstrong, Goldman, & Lance, 2004). These conversion formulas have been previously used in several research studies to compare sedation use among patients (de Wit et al., 2008; de Wit et al., 2007; Dubois et al., 2001; Ely et al., 2004; Lat et al., 2009). Medications that are not convertible to lorazepam or morphine equivalents will be excluded from this measure/calculation.

Sedation level will be measured by the **Richmond Agitation and Sedation Scale (RASS)**. The score yielded by the RASS is a interval level variable based on a 10-point scale with four levels of agitation, one level to denote a calm and alert state, and 5 levels of sedation (Sessler et al., 2002). RASS was calculated on study enrollment and for each observation session. In 290 paired observations of critically ill adults admitted to a MICU, nurse inter-rater reliability was very high (κ=.91) (Ely et al., 2003). In an independent cohort of 275 patients receiving mechanical ventilation, the RASS demonstrated excellent criterion, context, and face validity (Ely et al., 2003). In the parent study, inter-rater reliability was checked by independent rater for 10% of sessions, with > .90% agreement. Previous experience with this instrument in this specific population indicates that categories may need to be collapsed into a three-point ordinal-scaled variable. The use of RASS as an outcome variable represents a significant conceptual and methodological difference from the parent study in which sedation level was utilized as a covariate. In addition, sedation level provides important and complementary information to sedation use.

1.5.6 Data Collection, Coding, and Management

Data that have been previously collected in the parent study, including acuity, delirium, physical restraint use, and sedation level, will be accessed and merged into a separate new data file. The data will retain the original parent study subject identification number for identification purposes. Video recordings will be accessed individually for each study patient from the server's password protected hard drive. Each video-recorded session will be analyzed for interaction behaviors. Occurrence of the interaction behaviors will be recorded onto scannable data collection forms developed in Teleform (version 10, Cardiff, Vista, CA), which will be scanned and stored in a separate data table in Oracle relational database (version 10g, Oracle, Redwood Shores, CA).

Reliability of video analysis for interaction behaviors will be checked by having a second coder independently review the video and enter the observation ratings into a separate file. This second coder will be trained using videos from parent study participants that are not included in this analysis. Coders will continue training until 90% agreement is achieved (training competency) and a kappa coefficient > .70 is achieved (Viera & Garrett, 2005). Inter-rater reliability of video-ratings in this study dataset will be tested by conducting independent ratings on 10% of the video-recorded sessions in this sample, in which the two coder files will be compared in terms of percentage of agreement and kappa. These data as well as the data abstracted from the clinical record on sedation usage and unplanned device disruption will be recorded on the scannable forms developed in Teleform and entered directly into the Oracle database for data maintenance and storage on a secured password protected server housed at an offsite 24/7 facility maintained by the Network Operations Center at the University of Pittsburgh. Finally, all the datasets will be imported into statistical software packages and merged by the unique subject identifier in order to perform statistical analysis.

1.6 STATISTICAL ANALYSIS PLAN

Statistical analyses will be conducted using SPSS (version 20.0., IBM, Inc., Chicago, IL), SAS (version 9.3, SAS Institute, Inc. Cary, NC), and Mplus (version 6, Muthén & Muthén, Los Angeles, CA).

1.6.1 Sample Size Justification

As the proposed study is an extension of a completed study, the sample size for the proposed study is fixed. Therefore the sample size justification presented is in terms of precision levels (i.e., margin of error) when estimating point estimates with a confidence coefficient of .95 and effect sizes detectable at the minimum desired statistical power of 80% at a significance level of .05 when testing two-sided hypotheses. Past analyses in the parent study have shown negligible effects for session (fixed) and nurse (random), and it is anticipated that these effects will also be quite modest in the proposed study. With this in mind, for Aim 1a, the expected sample size of 38 patient-nurse dyads (38 nonspeaking patients and their 24 nurses) would achieve a margin of error of no more than 0.329σ (or 0.482σ, if stratified by unit), when estimating mean interaction behaviors at a confidence interval of .95, where σ is the population standard deviation. With respect to Aim 1b**,** a sample size of 38 dyads would achieve a margin of error no more than 0.332 (or 0.467, if stratified by unit) when estimating proportions describing overall AAC use with a confidence level of .95 (conservatively assuming a base proportion of .50). Lastly, for Aim 2 with a sample of 38 dyads we would be able to detect a population correlation between interaction behaviors and nursing care quality indicators as small as $\pm$.436 with 80% power at significance level of .05.

1.6.2 Preliminary Analysis Procedures

Exploratory data analysis will be used to describe the variables of interest and identify data anomalies that may invalidate the planned analysis. For ratio (e.g., counts of interaction behaviors, acuity) and interval (e.g. pain management) data, means and standard deviations will be calculated if the data meet the assumption of normality. If this assumption is not met, medians will be calculated instead of means. Mode and range will be calculated for nominally scaled variables (e.g., individual interaction behaviors, AAC strategy use). For ordinal data (e.g. sedation level), median and inter-quartile range will be calculated.

Histograms/normal probability plots and measures of skewness/kurtosis will be used to assess normality. Interdependence and linearity will be evaluated through bivariate scatterplots. Scatterplots and Levene's test will be used to assess homoscedasticity. If this assumption is not met, transformation of the data may be required. Finally, for regression analyses, conditioning indices, variance decomposition proportions, tolerance indices, and variance inflation factors will be used to evaluate for multicollinearity. Data will be screened for univariate and multivariate outliers and assessed for their influence. The occurrence of missing data is expected to be quite minimal. If missing data occurs, the amount and pattern of missing data will be evaluated and appropriate strategies to handle the missing data will be applied. For example, if data are missing completely at random or missing at random, mixed effects modeling will be able to accommodate the missingness. If data are not ignorably missing, multiple imputation methods will be employed.

1.6.3 Data Analysis Procedures

1.6.3.1 Data Analysis Plan for Aim 1a

Descriptive statistics will be used to depict the interaction behaviors (individual and counts of behaviors) between nurses and their nonspeaking older adult patients (overall and by unit, by observation session, and by unit and session combinations). For individual and counts of interaction behaviors of both nurses and patients, frequency distributions will be generated. For counts of interaction behaviors, means and standard deviations (or medians and inter-quartile ranges, if data are not normally distributed) will also be calculated as measures of central tendency and dispersion, respectively. If random nurse effects need to be considered, estimates of central tendency and dispersion estimates will be obtained via mixed effects regression modeling. Confidence intervals (95%) will be computed for all point estimates.

1.6.3.2 Data Analysis Plan for Aim 1b

Descriptive statistics (frequencies and percentages) will be used to depict the use of AAC strategies between nurses and their nonspeaking older adult patients (overall, by unit, by observation session, and by unit and session). Group comparative statistics (e.g., two-sample t-test or the Mann-Whitney U-test, if data are heavily skewed or have outliers) will be utilized to evaluate differences in overall interaction behaviors by AAC use. If random nurse effects are suspected and/or variability in measures over sessions, mixed effects regression modeling will be applied where the AAC use will be treated a time-dependent independent variable (i.e., allowed to vary from session to session) predicting the interaction behaviors at each session. F-tests will be used to investigate AAC use status, session, and their interaction. Regression coefficients with confidence intervals will be used to summarize these associations. Covariates, identified through data screening, will be included in the model secondarily. For each model estimated, model assessment will also be performed (i.e., residual analysis, influence assessment of possible outliers).

1.6.3.3 Data Analysis Plan for Aim 2

The association between interaction behaviors and the outcome of nursing care quality indicators will be examined using appropriate correlational and regression analyses of the variables of interest summarized over observation sessions. If the data permit, these associations will also be explored through repeated measures analysis methods. Both interaction behaviors and nursing care quality indicators will be assessed per three minutes and may vary over the four nurse-patient sessions. Furthermore, nurse quality care indicator variables are both continuous type (sedation use, sedation level, and pain management) as well as binary (physical restraint use and unplanned device disruption). Hence, generalized mixed effects regression modeling will be used to evaluate associations to allow for both normal and binomial error distributions. Regression coefficients with confidence intervals and F- and t-test statistics will be computed to describe and test the associations. All models fitted will be assessed for possible model misspecification, and influence diagnostics will be computed to identify any influential observations. If necessary, the covariates of acuity and delirium will be included as time-dependent covariates in the repeated measures analyses.

1.6.3.4 Data Analysis Plan for Aim 3

Agreement for individual behaviors between and within raters will be determined through the computation of percentage agreement and kappa coefficients. Additionally, intra-class correlation coefficient will be used to assess agreement between and within raters for the counts of interaction behaviors. In order to determine factor structure, the correlation matrices of the patient and nurse behaviors will be evaluated for their appropriateness for factor analysis. Exploratory factor analysis will be performed using Mplus software. Principal components analysis will be utilized for extraction of factors. Orthogonal and oblique rotations will be used to simplify the interpretation of factors assuming the independence of factors and the correlation of factors, respectively. Experts will review the instrument for content validity (i.e. sufficient sampling of behavioral items on the instrument, and wording of the items).

1.7 POTENTIAL LIMITATIONS & ALTERNATIVE APPROACHES

One of the main limitations inherent to secondary analysis are incongruence between primary and secondary research objectives and quality of data (Babbie, 2008; Bibb, 2007). Having worked on the parent study and previewed the dataset, the applicant is aware that the variables obtained will fit the secondary research objectives (Bibb, 2007). As for quality of data, the parent study has achieved good reliability ($r > .90$) in the measures to be used in the proposed study. In addition, the applicant will be performing chart reviews on nursing care quality indicators providing additional data to the pre-existing parent data (Pollack, 1999). With advancements and changes in medication, some sedation medications may not be convertible to midazolam or fentanyl equivalents and therefore will be excluded from the sedation use calculation. This limitation may potentially be offset by the complimentary sedation level (RASS score) variable. Finally, sample size for this proposed study is small and was obtained from one hospital located in Western PA. The sample and outcome variables could be influenced by procedures or policies specific to this institution or region.

1.8 HUMAN SUBJECTS

1.8.1 Human Subjects Involvement and Characteristics and Design

Videotaped nurse-patient interaction sessions will be obtained from the Study of Patient-Nurse Effectiveness with Communication Strategies (SPEACS) (R01-HD043988; Happ 2003-2008, IRB Approval # 00006790, Marci 15, 2010). These video sessions will be analyzed to determine the occurrence of interaction behaviors. In addition to video analysis, data on augmentative and alterative communication strategy use and nursing care quality indicators will be obtained. There will be no further involvement with participants under the proposed research study. A total of 38 adults over the age of 60 and 24 nurses will be included in the proposed study. Participants in this study have met the following inclusion/exclusion criteria for the SPEACS study: nonspeaking due to oral endotracheal tube or tracheostomy, intubated for 48 hours or longer, able to understand English and scored 13 or above on Glasgow Coma Scale (using a modified verbal score). Nurses were included in the study if they had at least 1 year of critical care nursing experience, were permanent staff in MICU or CT-ICU, were English-speaking, and were without hearing or speech disorders.

1.8.2 Source of Materials

The video recordings of patient-nurse interactions and data on augmentative and alternative communication strategies, sedation level, and physical restraint use have previously been collected and are available to the applicant through SPEACS datasets. Data on nursing care quality indicators including, pain management, sedation use, and unplanned device disruption will be obtained through a retrospective clinical record review. As a graduate student researcher for the parent study, the applicant was named as a member of the "investigator" team on consent documents and IRB application. An addendum modification will be sent to the University of Pittsburgh IRB outlining the purpose of this proposed study and the data that will be obtained. All subjects included in this proposed study provided written consent agreement for the use of their data and videotaped session in additional research.

1.8.3 Potential Risks, Benefits, and Protection from Risks:

All subjects to be included in the proposed research have consented to the utilization of their videotaped session and clinical data obtained for the SPEACS study to be available for use in subsequent research studies. Written informed consent was obtained from patients or their decisional surrogates and nurse participants. In order to minimize this risk of a breach of confidentiality, video recordings will be stored on secure external hard drive kept in locked cabinet in locked study office. Back-up DVDs are secured in a locked fire-safe box. All data generated from this proposed study will be stored in a database that will be encrypted and secured on a password-protected computer. Data will be stored in the Dr. Happ's office in a locked file cabinet. In order to maintain confidentiality, patient identifiers will be stored separately. In reference to potential benefits, the results gleaned from this proposed study have the potential to further define and illuminate the relationship that interaction behaviors have on nursing care quality for critically ill older adults.

1.8.4 Data & Safety Monitoring Plan

The videotaped and clinical data will be used solely for the purpose of this proposed study and will be safeguarded by the applicant and her sponsor. All data will be identified by unique numeric identifier that has been assigned the participants under the SPEACS study. Data collected will be entered using the unique identifier via a password-protected computer. The applicant and Dr. Mary Beth Happ will meet weekly to discuss progress on the project and data safety and monitoring, paying special attention to study protocol and protection of subject and data confidentiality.

1.8.5 Inclusion of Women and Minorities

Women and minorities were not excluded from the SPEACS study and are not excluded for the currently proposed study. Female patient participants accounted for 38% of the sample for the proposed study. The gender characteristics of the proposed nurse sample are 79% female and 21% male. The proposed nurse sample is fairly representative of the nursing profession at large, which is predominantly a female profession. While the currently proposed study has to work within the available subjects for the SPEACS study, it is worth noting that African American patients comprise 11% of the proposed study sample, which is fairly representative of the racial makeup of Allegheny County in 2008 (83% white, and 13% African American). In addition to the patient sample, 9% of the nurses in the proposed study are African America.

1.8.6 Inclusion of Children

Children were not included in this study. In the proposed study, the purpose is to focus on the communication between nurses and older adults therefore the sample will target only patients 60 years of age and older.

1.8.7 Target Enrollment

Table 2: Enrollment for Nurse Participants

Total Planned Enrollment: 24 nurses

TARGETED/PLANNED ENROLLMENT: Number of Subjects			
Ethnic Category	**Sex/Gender**		
	Females	**Males**	**Total**
Hispanic or Latino	0	0	0
Not Hispanic or Latino	19	5	24
Ethnic Category: Total of All Subjects *	19	5	24
Racial Categories			
American Indian/Alaska Native	0	0	0
Asian	0	0	0
Native Hawaiian or Other Pacific Islander	0	0	0
Black or African American	2	0	2
White	17	5	22
Racial Categories: Total of All Subjects *	19	5	24

* The “Ethnic Category: Total of All Subjects” must be equal to the “Racial Categories: Total of All Subjects.”

Table 3: Enrollment Patient Participants

Total Planned Enrollment: 38 nonspeaking patients

TARGETED/PLANNED ENROLLMENT: Number of Subjects			
Ethnic Category	**Sex/Gender**		
	Females	**Males**	**Total**
Hispanic or Latino	0	0	0
Not Hispanic or Latino	15	23	38
Ethnic Category: Total of All Subjects *	15	23	38
Racial Categories			
American Indian/Alaska Native	0	0	0
Asian	0	0	0
Native Hawaiian or Other Pacific Islander	0	0	0
Black or African American	3	1	4
White	12	22	34
Racial Categories: Total of All Subjects *	15	23	38

* The “Ethnic Category: Total of All Subjects” must be equal to the “Racial Categories: Total of All Subjects.”

2.0 STUDY SUMMARY

The purpose of this dissertation research was to 1) measure and describe nurse and patient interaction behaviors and factors that may impact communication between nurses and nonspeaking critically ill older adults in the ICU and 2) explore the association between nurse and patient interaction behaviors and nursing care quality indicators. The results of specific aims 1a, 1b, and 2 are presented in the section 3.0 and the results of specific aim 3 are presented in the section 4.0.

2.1 PROPOSAL CHANGES

Throughout the course of this project, several modifications were made to the proposed study methods. These changes, along with the rationale for these changes, are provided below.

2.1.1 Revised Research Model

In the original proposal, we planned to incorporate years of critical care experience as a nurse covariate based on preliminary results of the analysis of nurse-patient characteristics. After performing further analysis, which included unit and the interaction of video observation session by unit into the regression models, years of critical care of experience was no longer a significant predictor of duration of nurse talk, a marker of interaction. Based on these results, we did not include years of critical care experience as a covariate in the analysis of specific aim 2. The revised research model can be seen below.

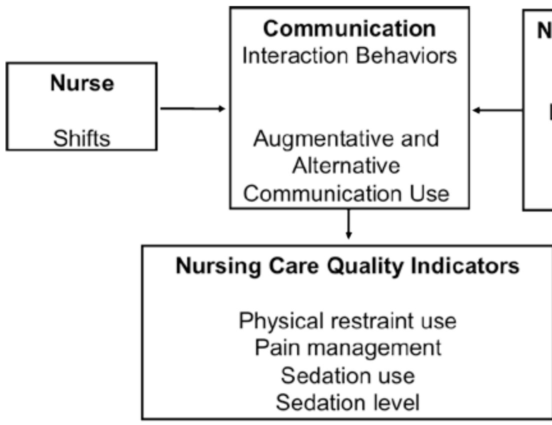

Figure 2: Revised Research Model

2.1.2 Variable measurement of covariates

It was assumed in the original proposal that all study nurses worked 12-hour shifts but during data abstraction, it was noted that a small number of nurses worked only 8-hour shifts. In order to account for this, the variable "nursing shift" was created and included as a covariate during the regression modeling to account for potential interaction exposure. It was measured as a binary variable denoting whether the study nurse worked a (1) 12-hour or a (2) 8-hour shift.

2.1.3 Variable measurement and variable level of Use of AAC Strategies

Initially, this study proposed to evaluate AAC strategy use as a nominally scaled, time-dependent variable to be measured in terms of whether a communication strategy/device was used (present or absent) during each session. Due to limited use of low and high technology strategies, we could not evaluate these strategies individually. In order to include the low and high tech strategies in the group comparative analysis and regression, we computed a sum of all the different low and high technology strategies that occurred during a session, deriving a new composite variable of “any AAC technology” used during a communication interaction.

2.1.4 Variable measurement and variable level of nursing care quality indicators

Pain management was to be measured on a scale of 0-10 with 0 being no pain and 10 representing the worst pain. In addition, we proposed to calculate an average score and highest pain score for each study nurse’s shift during the two consecutive nurse-patient observation days. Because of inconsistencies in pain score reporting, a binary variable was created to denote whether the patient had pain or not. The patient was recorded as ‘having pain” if the nurse provided a pain score, stated the patient had pain but did not provide a score, or if the patient received as needed (PRN) opioid analgesia (i.e. Percocet or Oxycodone).

During data abstraction of the nursing care quality indicators; it became evident that there would not be enough instances of device disruption to perform analysis on this outcome variable. There was only 1 instance of device disruption in the 152 sessions; therefore the outcome variable was dropped.

Finally, sedation level was measured by the RASS, which traditionally has a range of scores from -4 to 4. Due to lack of variability in this sample, we collapsed the categories. We planned to create 3 categories to represent calm, sedated, and agitated but the occurrence of agitation was extremely limited. Therefore we collapsed the RASS into 2 categories: (1) calm and (2) agitated/sedated.

2.1.5 Changes to statistical analysis plan for aim 2

There were not enough occurrences of restraint use to analyze this outcome variable using repeated measures methods. To evaluate the association between nurse and patient positive behaviors and restraint use, nurse positive behaviors, patient positive behaviors, and the covariates (APACHE, CAM-ICU, and GCS) were each aggregated using means over the observation sessions in order to perform binary logistic regression. In addition to the linear mixed effect modeling that was used to evaluate associations between the predictors and continuous outcome variables (sedation use), marginal modeling with generalized estimating equations was employed to evaluate predictors and binary outcomes variables (sedation level and pain management).

2.1.6 Change to statistical analysis plan for aim 3

Intra-class correlations were proposed but not performed for counts of individual interaction behaviors because they were not measured for each observation session. Interaction behaviors were only measured as present or absent for each observation session. Exploratory factor analysis was also proposed in aim 3 for the purpose of conducting more robust psychometric evaluation of the revised communication interaction behavior instrument, but exploratory analysis could not be performed due to a lack of sample adequacy.

2.2 STUDY RESULTS

In addition to the results reported in sections 3.0 and 4.0, we noted several session differences between individual behaviors. While these findings are significant, this could be related to type 1 error due to the conducting of multiple tests. The primary purpose of this portion of analysis was exploratory to evaluate if behaviors differ across the sessions and whether individual behaviors were associated with outcome variables.

2.2.1 Nurse Interaction Behaviors

Nurse smiling was significantly different between units within a session (p=.03). In the CT-ICU, nurse smiling gradually increased from observation session 1 to 2. Nurse smiling remained the same from observation session 2 to 3, but increased again from observation session 3 to 4. In comparison, the occurrence of nurse smiling in the MICU was actually lower in session 4 then in the first observation session (see Figure 3).

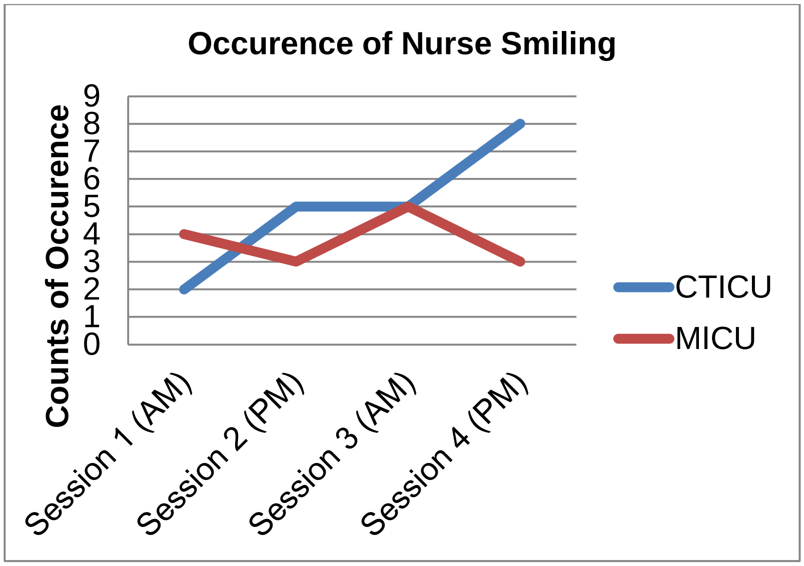

Figure 3: Occurrence of Nursing Smiling for Session by Unit

Finally, nurse augmenting communication behavior was statistically significant by session (p=.04). Session 1 and session 2 had fewer occurrences of nurse augmenting communication than session 4 (22 vs. 33, p=.01 and 26 vs. 33, p=.03, respectively) (see Figure 4).

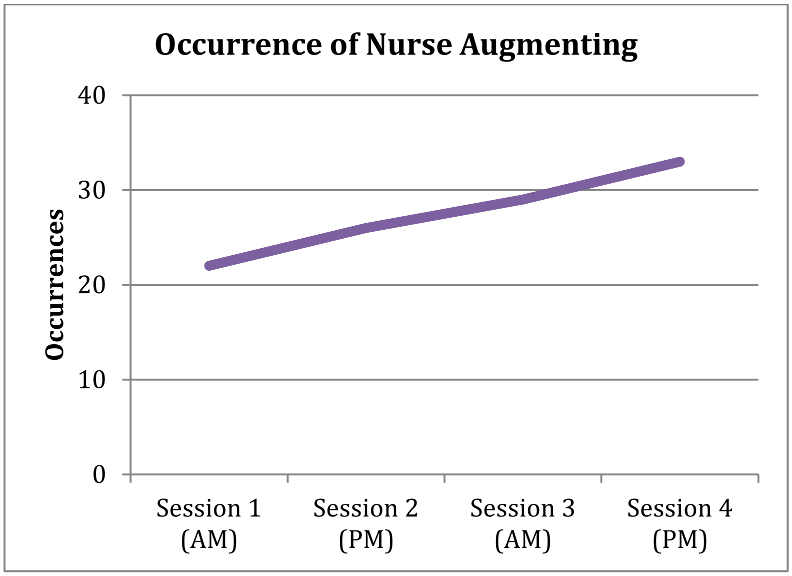

Figure 4: Occurrence of Nursing Augmenting by Session

2.2.2 Patient Interaction Behaviors

The patient negative interaction subscale differed significantly by observation session (p=.02). Observation session 1 had a greater mean sum of negative patient behaviors than session 2 (Mean=0.18 vs. 0.00, p=.005) or observation session 4 (Mean=0.18 vs. 0.03, p=.01)

2.2.3 AAC Use

Heads nods varied significantly across sessions (p=0.04). Head nods initially increased slightly from session 1 to 2 but then gradually decreased in subsequent session (see Figure 5).

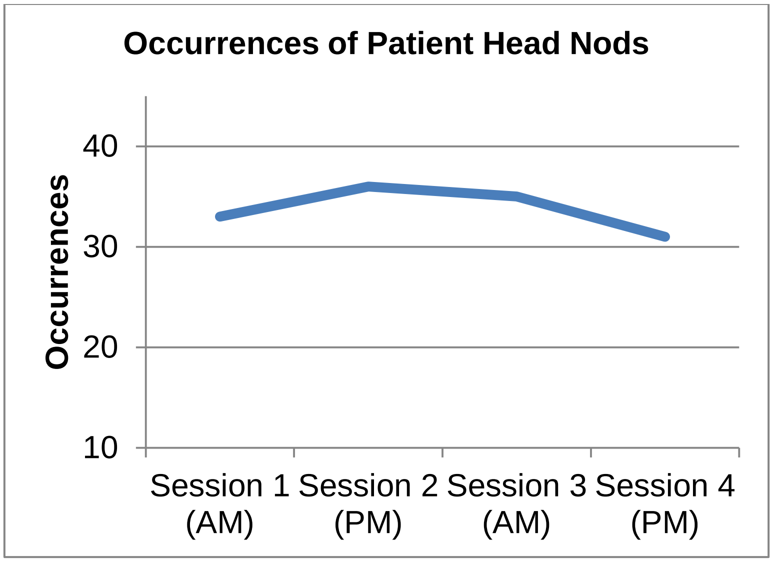

Figure 5: Occurrences of Patient Head Nods by Session

Observation session 3 had a higher sum of unaided communication strategies than observation session 1 (p=.031) (see Figure 6).

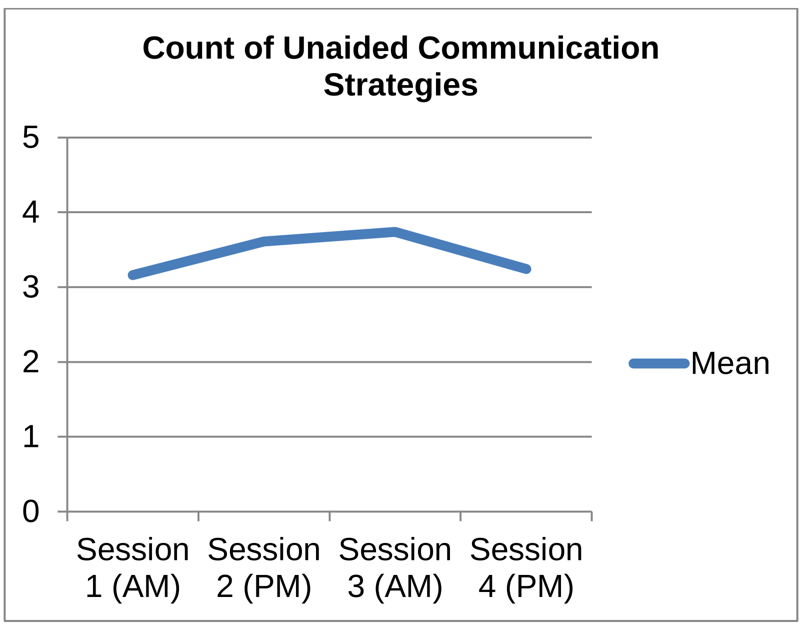

Figure 6: Count of Unaided Communication Strategies by Session

2.2.4 Nursing Care Quality Indicators

Visual contact by the patient was significantly associated with the absence of reported pain after adjusting for all covariates (*p*=.028). No other individual nurse behaviors were associated with any of the nursing care quality indicators. When controlling for the significant covariates of acuity, delirium, and LOC, physical contact by the nurse was positively associated with the probability of the patient being calm (b=0.931, SE=0.459, z-test=2.03, *p*=.043). Finally when adjusting for the significant covariates of acuity, delirium, and LOC, the presence of the following positive patient behaviors, including acceptance, visual contact, request, and maintaining attention, were individually positively associated with the probably of the patient being calm (see Table 4).

Table 4: Individual Patient Positive Behaviors Associated with Sedation Level

Positive Behaviors	b	SE	z-test	p-value
Acceptance	1.030	0.386	2.67	.008
Visual Contact	0.922	0.356	2.59	.010
Request	0.926	0.385	2.40	.016
Maintaining Attention	0.889	0.363	2.45	.014

Note: The model was adjusted for the following covariates: acuity, delirium, and level of consciousness.

2.3 DISCUSSION OF RESULTS

This study provides new descriptive and correlational information on nurse and patient interaction behaviors in the ICU setting. It also establishes beginning psychometric evaluation of this behavioral measurement. All of the positive nurse and patient behaviors on the measurement tool were observed at least once, whereas negative behaviors were rare. The most frequently observed positive nurse behavior was “proximity with speech”, while “instruction following” was the most frequently observed positive patient behavior. Some differences were observed in behaviors across session which may be related to continuity of care and familiarity with the nurse; further analysis to evaluate these differences should include adjustments to account for the multiple testing and possibility of inflated type 1 error.

Significant ($p<.05$) associations were observed between: 1) the sum of different positive nurse and the sum of different patient interaction behaviors, 2) patient unaided communication strategies and sum of different positive nurse behaviors, 3) individual unaided strategies (i.e.; Mouthing, gesturing, head nods, facial expressions, and non-verbal but communicative action) and, and individual nurse positive behaviors (i.e.; praising, visual contact, physical contact, preparatory information, smiling, laughing, and augments) and 4) the sum of different positive nurse behaviors and the sum of different positive patient behaviors and pain management and sedation level, respectively. These results provide additional evidence that nurse’s behaviors can significantly impact communication interactions while also recognizing that interaction behaviors are associated with indicators of nursing care quality.

Finally, this study provided preliminary psychometric evaluation for the newly adapted Communication Interaction Behaviors Instrument (CIBI), which included expanded behavior definitions to meet the communication abilities of both speaking and mechanically ventilated, nonspeaking older adults. Using the revised CIBI, percent agreement was better for nurse behaviors (73-100%) than for patient behaviors (68-100%). Kappa coefficients ranged from 0.13-1.00 where lower kappa coefficients tended to occur for patient behaviors. Eight of the 14 positive nurse behaviors had kappa coefficients of 0.60 or greater and 6 out of the 9 positive patients had kappa coefficients of 0.60 or greater for 75% of the sessions. At present, this tool should be applied using dual raters with adjudication of discrepancies.

2.4 STUDY STRENGTHS AND LIMITATIONS

There were several strengths associated with this dissertation study. Our findings support previous research demonstrating that behaviors nurses utilize during communication interactions have the ability to influence the tone of communication (Salyer & Stuart, 1985). Our findings highlight positive interaction behaviors that critical care nurses can incorporate into daily care interactions with mechanically ventilated patients to facilitate communication. Finally, this study provided preliminary psychometric evaluation of the newly adapted Communication Interaction Behavior Instrument in which definitions were revised to allow for use of augmentative and alternative communication strategies by mechanically ventilated, nonspeaking older adults. These findings demonstrate respectable inter-rater reliability on several of the behaviors and outline that currently the most appropriate use of this tool would be to have dual raters observe interaction and adjudicate when discrepancies.

There were several limitations associated with this dissertation study. The secondary nature of this analysis limited the data and sample size for this project. During this study, we had to rely on retrospective chart review to identify nursing care quality indicators such as device disruption. Unfortunately there was only one case of device disruption and therefore, analysis of this variable was not possible. More instances of device disruption may have occurred during this time period but were not charted or were documented in a separate section other than the nurse's notes that were abstracted. In addition, small sample size contributed to lack of sample adequacy, Kaiser-Meyer-Olkin measure <0.6 for individual subscales of nurse positive behaviors and patient positive behaviors, for the psychometric analysis and because of this we could not conduct a more extensive analysis, such as exploratory factor analysis.

2.5 FUTURE STUDIES AND IMPLICATIONS FOR GLOBAL HEALTH AND NURSING

Difficulty communicating during mechanical ventilation is an issue that can affect older adults of all races and ethnicities. Future studies are needed to confirm the results of this study in larger, more diverse samples including different ICU populations, such as neurological ICUs, younger adults, and patients with different ethnic backgrounds. While we have outlined the most commonly used behaviors and AAC strategies for this population, patients in other population, such as neurological ICUs, may have different physical limitation, which could impede their use of behaviors or AAC strategies. While some behaviors may not be universally appropriate across cultures or ethnicities, the incorporation of positive interaction behaviors by the nurse into daily care could help establish a relationship or ease patient’s emotional stress in cases where the patient has additional language barriers (e.g.; they don’t speak the language of the nurse). This is particularly timely as initiatives to address cultural and language disparities have become national priorities in patient-centered care and research initiatives (The Joint Commission, 2010). Nurses have a unique care relationship with critically ill patients and are perfectly positioned to help improve patient outcomes through facilitated communication. Critical care nurses should be encouraged to incorporate the positive interaction behaviors and AAC strategies we have outline into their daily care interactions for mechanically ventilated, older adult patients because they have been shown to enhance communication interaction and could play a part in the reaction and participation of the patient.

3.0 DATA-BASED MANUSCRIPT: NURSE AND PATIENT INTERACTION BEHAVIORS EFFECTS ON NURSING CARE QUALTY FOR MECHANICALLY VENTILTED, OLDER ADULTS IN THE ICU

3.1 ABSTRACT

The study purposes were to 1) measure and describe interaction behaviors and factors that may impact communication and 2) explore associations between interaction behaviors and nursing care quality indicators (NCQI) (restraint use, pain management, sedation use and level) between 38 mechanically ventilated patients ($\geq$60 years) and their ICU nurses (n=24) from the *Study of Patient-Nurse Effectiveness with Communication Strategies* (SPEACS). Behaviors were measured by rating videotaped nurse-patient interactions; other data were obtained from the SPEACS dataset and medical chart review. Positive behaviors were observed at least once, whereas negative behaviors were rare. Significant ($p<.05$) associations were observed between: 1) positive nurse and patient behaviors, 2) patient unaided communication strategies and positive nurse behaviors, 3) individual unaided strategies and individual nurse positive behaviors and 4) nurse and patient behaviors and pain management and sedation level, respectively. Findings provide further evidence that nurse-patient behaviors impact communication and may be associated with NCQI. *Keywords:* mechanical ventilation, critical care, older adults, interaction behaviors, nursing care quality

3.2 INTRODUCTION

The inability to communicate, as a result of mechanical ventilation, is a significant emotional stressor for critically ill patients (Carroll, 2007; Menzel, 1998; Patak et al., 2004). Moreover, communication impairments during hospitalization are a significant risk factor for preventable adverse events, particularly for older adults (Bartlett et al., 2008). Critical care nurses are in an excellent position to lessen the detrimental effects of communication impairment by modifying their behaviors during bedside patient care (Happ, Baumann, et al., 2010).

Interaction behaviors are verbal and nonverbal behaviors communicated by both patients and nurses that can influence the interpersonal relationship. Previous studies of interaction behaviors demonstrated that nurse behaviors can influence the quality of the interpersonal interaction between the nurse and critically ill patient (de los Ríos Castillo & Sánchez-Sosa, 2002; Salyer & Stuart, 1985). However, the association between nurse-patient interaction behaviors and nursing care quality has not been explored. While there is a growing recognition that improved communication is essential to improving healthcare quality and safety, little attention has been focused on the role of patient communication. The purposes of this study were to 1) measure and describe nurse and patient interaction behaviors and factors that may impact communication between nurses and nonspeaking critically ill older adults in the intensive care unit (ICU) and 2) explore the association between nurse and patient interaction behaviors and nursing care quality indicators. Specifically, we aimed to 1a) identify interaction behaviors that nurses and nonspeaking critically ill older adults use during communication interactions in the ICU, 1b) describe the frequency of augmentative and alternative communication (AAC) strategies with critically ill older adults, 1c) evaluate the relationship between individual interaction behaviors and individual AAC strategies and 2) explore the association between interaction behaviors and nursing care quality indicators, including sedation use, sedation level, physical restraint use, pain management, and unplanned device disruption, during a two-day observation period.

3.3 BACKGROUND

Mechanical ventilation (MV) is the primary therapy used to provide pulmonary support for patients in the ICU, with an estimated 2.8 million adult patients receiving this therapy each year (Angus et al., 2000; Angus et al., 2006). MV poses a barrier to communication for critically ill patients because they cannot vocalize. Older adults are at an increased risk for communication difficulties because of cognitive decline and physiological changes in vision, speech, and hearing (Ebert & Heckerling, 1998). These changes may contribute to communication breakdowns or misunderstandings (Yorkston, Bourgeois, & Baylor, 2010). Furthermore, the added communication difficulty posed by MV may exacerbate negative emotions and acute confusion, especially among older adults (Carroll, 2007; Patak et al., 2004; Rier, 2000).

Salyer and Stuart reported that when ICU nurses exhibited positive behaviors, such as praise or explaining a procedure, the patient's reactions was often positive. Negative behaviors by the nurse, such as criticizing, yielded negative reactions by the patient (1985). Similarly, de los Ríos Castillo and Sánchez-Sosa reported that after communication training for ICU nurses, negative actions by the nurse decreased and patient satisfaction with nurse performance improved significantly; however, the intervention and measurement were not targeted specifically to nonspeaking mechanically ventilated patients (de los Ríos Castillo & Sánchez-Sosa, 2002).

Unaided communication strategies, such as mouthing, gesturing, and head nods, are the most common methods utilized by MV patients when communicating with healthcare providers, caregivers and family (Menzel, 1998; Thomas & Rodriguez, 2011). Several studies have investigated the utility of “low tech” AAC strategies, such as writing and communication boards, with critically ill patients. (Patak et al., 2004; Stovsky et al., 1988). Others have examined the benefits of more sophisticated electronic AAC devices in the care of critically ill adults; however, these were primarily feasibility studies that employed small samples and lacked comparison groups (Happ, Roesch, et al., 2004; Happ et al., 2007; Miglietta et al., 2004; Rodriguez & VanCott, 2005). Most importantly, previous studies have not evaluated the influence AAC use has on interaction behaviors between nurses and critically ill, older adults.

Research on the influence that patient communication disability has on adverse events in acute care settings is limited (Bartlett et al., 2008). Research with respect to communication between critically ill older adults and their nurses is needed in order to understand how relational communication affects quality and safety for our most vulnerable patients. Physical restraint use, pain management, sedation use, and unplanned device removal are nursing care quality indicators potentially linked to communication (Alasad & Ahmad, 2005; Happ, 2000c; Happ, Tuite, et al., 2004; Weinert et al., 2001). This is the first study to evaluate the association between patient and nurse interaction behaviors and nursing care quality.

3.4 METHODS

This expanded secondary study employed a descriptive correlational design utilizing data collected on a subset of older adult patients ($\geq$60 years) enrolled in the *Study of Patient-Nurse*

Effectiveness with Communication Strategies (SPEACS) who agreed to the use of their video-recorded observation sessions for future research (R01-HD043988; Happ 2003-2008). The University of Pittsburgh's institutional review board reviewed and approved this study.

3.4.1 Setting and Participants

The SPEACS study sample was compromised of MV patients and their ICU nurses. It was conducted in a 32-bed medical ICU (MICU) and a 22-bed cardiothoracic ICU (CT-ICU) of a large academic medical center located in southwestern Pennsylvania. Eligibility criteria and recruitment procedures have previously been in detail (Happ et al., 2008; Nilsen, Sereika, & Happ, 2013).

3.4.2 Patient Characteristics

The 38 patient participants in this secondary analysis were 60 to 87 years of age (Mean=70.3 years, SD= 8.5), predominantly white (90%), with 8 to 21 years of formal education (Mean =12.9 years, SD= 2.8). **LOC** was measured with the Glasgow Coma Scale (GCS) (Teasdale & Jennett, 1974) adapted to account for patient ability to communicate words through nonvocal methods (Happ et al., 2011). Because GCS scores lacked variability, they were dichotomized to represent 1) awake and completely oriented (GCS=15) or 2) compromised (GCS$\leq$ 14). **Delirium** was measured as either present or absent through the Confusion Assessment Method for ICU (CAM-ICU) (Ely, Margolin, et al., 2001). **Acuity,** was measured by the Acute Physiology and Chronic Health Evaluation (APACHE III) scoring system, is the sum of three components including acute physiology, age, and chronic health problem, with a total score range of 0-299 (Wagner et al., 1994). D**uration of intubation prior to study enrollment** was recorded from the electronic medical record as the number of days during the current admission that a patient was intubated before entry in the study. This variable was included because previous analysis demonstrated that length of intubation prior to study enrollment had a curvilinear association with the amount of time the nurse talked to a patient during interactions (Nilsen et al., 2013). Table 5 provides reliability statistics for the measurements.

Table 5: Variables, Measures, and Measurement Schedule for Patient Characteristics

			Observation Session				
Variables	Measures	Inter-rater Reliability	Baseline	1	2	3	4
Delirium	Confusion Assessment Method for ICU (CAM-ICU)	.96*[1]	*	*	*	*	*
Level of Consciousness	Glasgow Coma Scale (GCS)	.64*[2]	*	*	*	*	*
Severity of Illness	Acute Physiology and Chronic Health Evaluation (APACHE III)	.90+[3]	*	*	*	*	*
Days Intubated Prior to Enrollment	Days intubation prior to enrollment (in days)	-	*				

*Cohen's Kappa Coefficient, +Interclass Correlation
Note: References for inter-rater reliability statistics: 1- (Ely, Inouye, et al., 2001), 2- (Ely et al., 2003), 3- (Knaus et al., 1991)

3.4.3 Nurse Characteristics

The 24 nurses in this study ranged from 22 to 55 years of age (Mean=35.1 years, SD= 10.4), were largely female (79%), baccalaureate prepared (83%) with years in nursing practice and in critical care ranging from 1 to 33 with means of 10.0 (SD=10.7) and 7.2 (SD= 9.3) years, respectively. Nurses in the SPEACS study received basic communication skills training (BCST), training in electronic augmentative and alternative communication (AAC) device use or AAC training plus individualized speech language pathologist (SLP) consultation, depending on group participation. Low-tech communication materials (e.g., alphabet boards, picture boards, writing materials) were available to those who received BCST. Low tech materials and high tech (electronic) AAC devices were available to those who received AAC and SLP (Happ et al., 2008). Nurses were included in the present study irrespective of group participation to enable sampling of interaction behaviors by nurses with varied training. **Nursing shift** was used as a marker of possible interaction exposure between nurses and patients. It was measured as a binary variable denoting whether the study nurse worked a 12-hour or 8-hour shift for each observation day.

3.4.4 Augmentative and Alternative Communication (AAC) Strategy Usage

AAC strategies were defined as all forms of communication (other than oral speech) that were used to express thoughts, needs, and wants when an individual had a communication limitation that hindered the ability to meet their needs through natural speech (Beukelman & Mirenda, 2005). These strategies were categorized as: (1) unaided communication strategies (mouthing, gesture, head nods, facial expressions, or non-verbal but communicative action), (2) low-technology (drawing, writing, use of picture boards or communication boards) and (3) high-technology strategies (direct selection or scanning using an electronic speech generating device) (Beukelman et al., 2007). Use of AAC strategies was determined by observation of the video recording and analysis of research observer field notes for each session. Because usage was relatively uncommon, low-tech and high-tech strategies categories where combined to denote whether any AAC strategies/devices were used during an observation session. The count of different AAC strategies was computed for each category.

3.4.5 Nursing Care Quality Indicators

Physical restraint use was defined as the presence or absence of wrist restraints on the patient and was measured during each session by direct observation. **Pain management** was measured as presence or absence of pain via patient or nurse report. The patient was recorded as having pain if the nurse provided a pain score, stated the patient had pain without a score, or if the patient received “as needed” opioid analgesia (i.e. Percocet® or oxycodone) during the observation day. **Sedation use** was calculated using a total equivalent dose of opioids and benzodiazepines for the observation days. These totals were converted to morphine and lorazepam equivalents using an established conversion formula (Cammarano et al., 1998; Lacy et al., 2004). **Sedation-agitation level** was measured using the Richmond Agitation and Sedation Scale (RASS) during each observation session to complement information to sedation use. The RASS is a 10-point scale with four levels of agitation, one level for calm and alert, and 5 levels of sedation (Sessler et al., 2002). Due to lack of variability in this sample, scores were collapsed to represent two categories: 1) calm or 2) agitated/sedated.

3.4.6 Interaction Behaviors

The tool used to measure interaction behavior was modified from prior observational studies that enrolled ICU patients with and without the ability to speak (de los Ríos Castillo & Sánchez-Sosa, 2002; Hall, 1996b; Salyer & Stuart, 1985). The modified tool, termed the communication interaction behavior instrument (CIBI), was reviewed for face and content validity and demonstrated respectable inter-rater reliability on several of the behaviors. Eight of the 14 positive nurse behaviors had kappa coefficients of 0.60 or greater and 6 out of the 9 positive patients had kappa coefficients of 0.60 or greater for 75% of the sessions. The current recommendation for application of the tool is to have dual raters observe interactions and adjudicate discrepancies, which is what we did in this study (Nilsen, 2013) The CIBI consisted of 29 interaction behaviors divided into the four subscales: (1) positive nurse, (2) negative nurse, (3) positive patient, and (4) negative patient (see Table 6). Nurses and patients could demonstrate both positive and negative behaviors during an interaction. Each behavior was measured as any occurrence (presence/absence) during an observation session. A count of different behaviors observed was computed for each subscale

Table 6: Interaction Behaviors (n=29)

Positive Nurse Behaviors (n=14): behaviors that communicate interpersonal support and encouragement	
Sharing	Offers the patient an item to support their wellbeing (other than prescribed medications or treatments)
Praising	Verbal comments indicating approval, recognition or praise
Visual Contact	Looks the patient in the eyes for as long as the nurse is at the bedside
Proximity with Speech	Stands at least arm's length from the patient and provides spoken information
Physical Contact	Touches, pats or hugs the patient.
Social Politeness	Uses terms including "please", "thank you", and greets patient by name
Preparatory Information	Information given before a procedure.
Expanded Preparatory Information	Information given before a procedure, includes expanded explanation
Preparatory Information (Brief Delay)	Information given before a procedure but the procedure start is >10 seconds after the information is given
Expanded Preparatory Information (Brief Delay)	Information given before a procedure that includes expanded explanation but the start of the procedure is > 10 seconds after the information is given.
Smiling	Lifting lip scorners while looking the patient in the eyes
Modeling	Body changes or movements accompanied by the corresponding descriptive verbalization, reproduced by the patient
Laughing	Lifting the lips corners or congruently opening the mouth while emitting the characteristic voiced laughter sound
Augmenting	Augments patient's auditory comprehension by writing, gesturing, showing object,

Table 6 (continued)

Negative Nurse Behaviors (n=3): actions/behaviors by the nurse that inhibit the interpersonal relationship	
Disapproving	Verbalizations implicating disagreement, negation, disgust or criticism
Yelling	Loud verbalizations containing comments, threats, criticism or disapproval
Ignoring the Patient	After a request by the patient, the nurse does not answer or perform the requested action within five seconds in a congruent manner
Positive Patient Behaviors (n=9): behaviors that communicate interpersonal engagement, responsiveness and interdependence in the care recipient role	
Acceptance	Head, eyes or hand movement expressing agreement, acceptance or satisfaction.
Following Instructions	Engaging in a behavior in response to an request or instruction by the nurse
Visual Contact	Looks the nurse in the eye when the nurse asks a questions/addresses patient
Physical Contact	Touches, pats or hugs the nurse.
Request	Verbal, digital or manual indications to express a need or request
Smiling	Lifting lips corners while looking the patient in the eyes
Maintaining Attention	Keeps eye contact while nurse provides an explanation, information, instruction
Laughing	Lifting the lips corners or congruently opening the mouth.
Praising	Clearly distinguishable gesture or message expressing gratefulness or approval
Negative Patient Behaviors (n=3): behaviors that are expressions of disapproval or withdrawal from the interpersonal care relationship	
Disagreement	Actions expressing opposition to nurse's actions
Disgust	Gestures/facial expression indicating disgust, annoyance, frustration
Ignoring the nurse	After a request, the nurse does not answer or respond within 5 seconds in a congruent manner

3.4.6.1 Coding

Two trained coders independently rated interaction behaviors on each of four 3-minute video-recorded observation sessions of nurse-patient interaction (morning and afternoon) with each nurse-patient dyad. The length of 3 minutes for an observation session was based on previous research that demonstrated ICU interactions between nurse and patients lasted approximately 1-3 minutes (Ashworth, 1980; Happ et al., 2008). There were a total of 4 sessions (n=152 observation sessions) over the two-day observation period (n=76 observation days). If the coders differed on the presence or absence of a behavior and could not come to a consensus, a third experienced coder reviewed the session in question and provided feedback and arbitration.

3.4.7 Data Analysis

Data analysis was conducted using IBM® SPSS® Statistics (version 20.0, IBM Corp., Armonk, NY) and SAS (version 9.3, SAS Institute, Inc., Cary, NC). Summary statistics were computed to describe interaction behaviors and AAC strategy use. Frequencies, percentages, and ranges were calculated for individual interaction behaviors and individual AAC strategies. For the count of different interaction behaviors (by subscale) and the count of different AAC strategies (by category), means and standard deviations were calculated as measures of central tendency and dispersion, respectively. Since study nurses were paired with more than one study patient, random nurse effects were also considered.

Group comparative statistics were utilized to evaluate differences in overall interaction behaviors by AAC categories. Linear mixed effect modeling was applied to treat AAC strategy use as a time-dependent predictor variable (i.e., allowed to vary from session to session) to model the interaction behaviors. F-tests were used to investigate AAC strategy for unit and regression coefficients were used to summarize these associations. In addition, marginal modeling with generalized estimating equation) was utilized to explore individual patient unaided communication strategies association with individual positive patient behaviors. The level of significance was set at .05 for two-sided hypothesis testing.

Nursing care quality indicators were both continuous (sedation use) as well as binary (physical restraint use, sedation level, and pain management). For all models fitted, regression coefficients with 95% confidence intervals and appropriate test statistics were computed to describe and test the associations between counts of behaviors and specific nursing care quality indicators. Linear mixed effect modeling was used to evaluate the association between the count of different interaction behaviors and sedation use, assuming a normal error distribution. For binary outcome variables, including pain management and sedation-agitation level, marginal modeling with generalized estimating equations was employed. GCS, acuity, delirium, length of intubation prior to study enrollment, and nursing shifts were included as time-dependent covariates in the repeated measures analyses. Because the occurrence of restraint use was rare (only 18% overall), linear mixed effects modeling could not be performed. To evaluate the association between the counts of positive nurse and patient behaviors and restraint use, positive nurse behaviors, positive patient behaviors, and the covariates, including APACHE, CAM-ICU, GCS, were each individually aggregated as a mean across the four observation sessions in order to perform binary logistic regression with any restraint use (yes, no) as the dependent variable.

3.5 FINDINGS

3.5.1 Patient Characteristics

Patients were awake and completely oriented (GCS =15) during 129 of the 152 observation sessions (85%). Ten patients (26%) had a compromised LOC for at least one observation session, while two patients (5%) were compromised during all sessions. Patients experienced delirium in 52 observation sessions (35%). Delirium status was missing for 13 sessions (9%). Of the 38 patients, 21 (55%) were delirious during at least one observation session and of these patients, 6 (16%) were delirious during all sessions. During the 76 observation days, APACHE

III scores ranged from 36 to 105 with a mean of 62.8 (SD=14.32). The number of days intubated prior to study enrollment ranged from 1 to 85 days with a mean of 17.4 days (SD=16.04). Finally, the study nurse worked an 8-hour shift as opposed to a 12-hour shift on 6 observation days (8%).

3.5.2 Nurse and Patient Interaction Behaviors

Positive nurse behaviors were associated with an increase in positive patient behaviors ($F(1,107)=15.43$, $p \leq .001$). On average, nurses utilized 5.40 different positive behaviors per observation session (SD=1.82, Min=0, Max=9), while patients used a mean 3.11 different positive behaviors per observation session (SD=1.74, Min=0, Max=7). The mean count of different positive patient behaviors and the mean count of different positive nurse behaviors did not vary by type of ICU.

Individual nurse and patient interaction behaviors are described in Table 7. Preparatory information was more common in the MICU (n=32) than in the CT-ICU (n=18) (Wald Chi-Square=4.69, p=.030). The remaining positive nurse behaviors did not differ significantly by ICU. For patient negative behaviors, disagreement and disapproval co-occurred for two patients. Patient smiling occurred more often in the CT-ICU (n=23) than in the MICU (n=7) (Wald Chi-Square=6.58, p=.010). There were no significant differences between units for the remaining positive patient behaviors.

Table 7: Individual Interaction Behaviors Across All 4 Sessions (Nurse-Patient Dyad n=38)

	Mean±SD	Min	Max
Positive Nurse Behavior			
Proximity with Speech	3.76±0.59	2	4
Visual Contact	3.45±0.89	1	4
Social Politeness	2.95±1.06	0	4
Augments	2.89±1.03	0	4
Physical Contact	1.89± 1.23	0	4
Praising	1.55±1.31	0	4
Preparatory Information	1.32±1.09	0	3
Smiling	0.92±1.12	0	4
Sharing	0.92±0.85	0	3
Laughing	0.74±1.13	0	4
Expanded Preparatory Information	0.45±0.69	0	3
Preparatory Information (Brief Delay)	0.42±0.68	0	2
Expanded Preparatory Information (Brief Delay)	0.21±0.47	0	2
Modeling	0.11±0.31	0	1
Negative Nurse Behaviors			
Disapproving	0.03±0.16	0	1
Yelling	0.00±0.00	0	0
Ignoring	0.00±0.00	0	0
Positive Patient Behaviors			
Instruction Following	3.42±0.95	0	4
Acceptance	2.55±1.25	0	4
Maintaining Attention	1.95±1.37	0	4
Visual Contact	1.87±1.30	0	4
Requests	1.32±1.19	0	4
Smiling	0.79±1.12	0	4
Physical Contact	0.24±0.59	0	2
Laughing	0.13±0.41	0	2
Praise	0.16±0.49	0	2
Negative Patient Behaviors			
Ignoring	0.16±0.37	0	1
Disgust	0.08±0.27	0	1
Disagreement	0.05±0.23	0	1

3.5.3 AAC Strategy Use

A mean of 3.4 different unaided patient communication strategies were used per observation session (SD=1.35, Min=0, Max=6). On average, low-tech and high-tech strategies usage was less common then unaided communication strategy usage (Mean±SD=0.16±0.42, Min=0, Max=2). The mean and standard deviations for individual communication strategies is reported in Table 8. Mouthing was the only unaided communication strategy that was significantly different by unit: CT-ICU patients used mouthing more frequently than MICU patients (53 occurrences vs. 33 occurrences) (F(1,107)=15.43, *p*=.03).

Table 8: Communication Strategies Across the Sessions for the 38 Nurse-Patient Dyads

	Mean±SD	Min	Max
Unaided Strategies			
Mouthing	2.26±1.55	0	4
Gesturing	2.58±1.33	0	4
Head Nods	3.55±0.92	0	4
Facial Expression	1.68±1.38	0	4
Non-verbal but communicative action	3.34±0.88	1	4
Low Tech Strategies			
Drawing	0.03±0.16	0	1
Writing	0.32±0.77	0	3
Points to letter board	0.18±0.56	0	3
First letter spelling while mouthing	0.03±0.16	0	1
Point to an encoded symbol representing a phrase	0.03±0.16	0	1
Indicate phrase in response to partner's auditory/visual scanning of phrase choice list	0.03±0.16	0	1
High Tech Strategies			
Direct Selection- Message	0.03±0.16	0	1
Scan- spell	0.03±0.16	0	1

3.5.4 Relationship between Interaction behaviors and AAC use

The count of different unaided communication strategies was positively associated with the count of positive nurse behaviors (F(1,121)=9.93, *p*=.002). In addition, the use of head nods was significantly associated with the count of different positive nurse behaviors (F(1,8)=10.85, *p*=.01). Table 9 shows the co-occurrence of individual patient unaided communication strategies with individual positive nurse behaviors.

Table 9: The Association Between Presence of Individual Patient Unaided Communication Strategies with the Presence of Individual Positive Nurse Interaction Behaviors (Univariate Results)

Positive Nurse Behavior	Patient Unaided Communication Strategies	b	SE	z-value	p-value
Praising	Facial Expression	0.608	0.240	2.53	.011
Visual Contact	Head Nods	1.661	0.742	2.24	.025
	Nonverbal but communicative	1.298	0.548	2.37	.018
Physical Contact	Gesturing	-1.003	0.366	-2.75	.006
	Nonverbal but communicative	1.032	0.324	3.19	.001
Preparatory Information	Mouthing	-0.887	0.361	-2.46	.014
Smiling	Mouthing	0.776	0.382	2.03	.042
	Head Nod	1.509	0.694	2.18	.030
	Nonverbal but communicative	1.194	0.468	2.55	.011
Laughing	Gesturing	1.456	0.462	3.15	.002
	Facial Expression	1.042	0.368	3.00	.003
Augments	Mouthing	1.756	0.555	3.17	.002
	Gesturing	1.874	0.425	4.41	<.001
	Head Nods	2.574	0.880	2.92	.003
	Nonverbal but communicative	1.396	0.556	2.51	.012

3.5.5 Nursing Care Quality Indicators (Outcome)

Patients had bilateral wrist restraints in 27 of the 152 observation sessions (18%). Of the 38 patients, 10 patients (26%) had bilateral wrist restraints present for at least 1 observation session and 3 patients (8%) had restraints during all four sessions. There were no occurrences of unilateral restraints. There were no significant associations between positive nurse behaviors, positive patient behaviors, or unaided communication strategies and the use of restraints.

Patients were in pain during 33 of the 76 observation days (43%); only 5 observation days were missing any description of pain (7%). The count of different positive nurse behaviors was positively associated with the absence of reported pain (b=0.436, SE=0.136, z=3.21, *p*=.001) and remained positively associated when all covariates were incorporated into the model (b=0.276, SE=0.108, z=2.55, *p*=.011). The count of different positive patient behaviors was not associated with the absence of reported pain (b=0.097, SE=0.168, z=0.58, *p*=.563).

Patients were calm for 93 of the 152 observation sessions (61%). Eight patients (21%) had some degree of sedation or agitation for 3 or more observation sessions. Count of different positive patient behaviors was associated with the patient being calm (unadjusted: b=0.488, SE=0.144, z=3.39, $p \leq .001$ and adjusted: b=0.505, SE=0.143, z=3.53, $p \leq .001$). When controlling for the significant covariates of delirium and LOC, the association between count of different positive patient behaviors and the probability of the patient being calm remained (b=0.504, SE= 0.131, z=3.85, $p \leq .001$). In contrast, the count of different positive nurse behaviors was not significantly associated with agitation-sedation (unadjusted: b=0.047, SE=0.102, z=0.46, *p*=.648; adjusted: b=-0.021, SE=0.122, z-test=-0.18, *p*=.861).

The mean morphine equivalent for the 76 observation days was 14.93 mg (SD=45.28, Min=0, Max=325.0). Of the 38 patients, 16 patients (42%) received no opioids during the 2 observation days. After the models were adjusted for all the covariates, the count of different positive nurse behaviors and the count of different positive patient behaviors were not significantly associated with opioid use (b=-4.939, SE= 2.606, z=-1.90, *p*=.067; b=-4.176, SE= 2.986, z=-1.40, *p*=.172, respectively). The mean benzodiazepine equivalent for the 76 observation days was 0.25 mg (SD=0.76, Min=0, Max=4). Of the 38 patients, 29 (76%) did not receive any benzodiazepines. After the models were adjusted for all the covariates, the count of different positive nurse behaviors and the count of different positive patient behaviors were not significantly associated with benzodiazepine use (b=-0.016, SE=0.036, z=-0.44, *p*=.660, b=0.001, SE=0.042, z=0.02, *p*=.980, respectively).

3.6 DISCUSSION

In this study, we described nurse and patient interaction behaviors and how AAC use impacted communication between nurses and nonspeaking critically ill older adults and explored the association between nurse and patient interaction behaviors and nursing care quality indicators. Our results showed that 1) there were positive associations between positive nurse and patient interaction behaviors, 2) unaided communication strategy use was associated with the count of different positive nurse behaviors, 3) individual unaided communication strategies tended to co-occur with positive nurse behaviors and 4) nurse and patient interaction behaviors were associated with the nursing care quality indicators of pain management and sedation level.

On average, nurses used 5 different positive interaction behaviors and patients utilized 3 different positive behaviors during an observation session. An increase in positive nurse interaction behaviors was associated with an increase in positive patient behaviors. Our findings support previous research conducted by Salyer and Stuart demonstrating that positive nurse behaviors yield positive patient behaviors (1985) and provide further evidence that nurses have the ability to influence the tone of communication with ICU patients. We observed few negative behaviors, which may relate to presence of the video camera during observation sessions.

Patients most often used unaided AAC communication strategies, e.g., head nods, non-verbal but communicative action, gestures, and mouthing, consistent with previous research (Menzel, 1998; Thomas & Rodriguez, 2011). In addition, most patients utilized more than one strategy during an observation session, consistent with prior reports (Fried-Oken et al., 1991; Happ, Roesch, et al., 2004). An increased use of patient unaided communication strategies was associated with increased positive nurse behaviors.

Our observations identified several unaided communication strategies that tended to co-occur with positive nurse behaviors. To our knowledge, we are the first to demonstrate a co-occurrence between unaided communication strategies and positive nurse behaviors. Critical care nurses are in a position to help improve patient communication by guiding them to try and use multiple unaided communication strategies to express their needs. Due to limited use of low and high-tech AAC strategies, a larger sample or longer observation segments when such techniques were readily available would be needed to evaluate whether there is an association between low and high tech AAC strategies and interaction behaviors.

Finally, our results demonstrate an association between interaction behaviors and nursing care quality indicators. The count of different positive nurse behaviors was associated with the probability that the patient had no reported pain. In respect to sedation level, the count of positive nurse behaviors was associated with the patient being calm. Because our study did not test these associations using an experimental design, more work would need to be done to determine direction of the relationship and causation. Calm patients tended to use more unaided communication strategies. However, there was no association between sedation use and interaction behaviors. In is important to note that only 58% of patients received opioids during the observation period and even smaller percent of patients received benzodiazepines, which may be related to the fact that these patients were at a later stage in the critical illness trajectory. While further work needs to be done, this study provides important evidence that interaction behaviors are associated with indicators of nursing care quality.

3.6.1 Limitations

The patients in this study were older, recruited following an extended ICU stay and therefore representative of the chronically, critical ill population (Carson & Bach, 2002). Results of this study may not be generalizable to patients who are initially admitted to an ICU or those younger than 60 years of age. While all patients could use unaided communication strategies, not all patients had access to low and high tech AAC devices. Further research in the area of interaction behaviors and nursing care quality indicators should include larger samples where low and high technology devices are more readily accessible to all patients

Finally, one of the main limitations of this study is that behaviors were measured as any occurrence during the observation session. While Salyer and Stuart (1985) tallied the number of behaviors and reactions used during an observation period, we choose to measure the variables at the session level because determining when certain behaviors cease and another begins is imprecise. For example, when evaluating behaviors such as smiling or laughing, it can be difficult to discretely identify what constitutes an endpoint for these behaviors. Behaviors such as smiling or laughing were not included in Salyer and Stuart's work (1985). A count of individual behaviors within each session could have provided more robust data. It is important to note that even at this aggregated level of measurement, we were still able to demonstrate the tendency of individual behaviors to co-occur with individual unaided communication strategies (Table 9).

3.7 CONCLUSION

This is the first study to explore the association between nurse and patient interaction behaviors with nursing care quality. Our findings provide supportive evidence that nurses' behaviors can significantly impact communication interactions. Our findings highlight individual interaction behaviors that critical care nurses can incorporate into daily care interactions for mechanically ventilated patients and AAC strategies that can be used to guide patients to utilize to facilitate communication. In addition, the intentional use of positive interactions by the nurse, such as touching, and smiling, may encourage patients to engage in communication and help establish a therapeutic nurse-patient relationship. Further research should include large sample sizes in order to evaluate other care indicators, such as device disruption, and younger populations to determine if the results are generalizable to other age groups

4.0 DATA-BASE MANUSCRIPT: ADAPTATION OF A COMMUNICATION INTERACTION BEHAVIOR INSTRUMENT FOR USE IN MECHANICALLY VENTILATED, NON-SPEAKING OLDER ADULTS

4.1 ABSTRACT

Background: Valid and reliable instruments are needed to measure communication interaction behaviors between nurses and mechanically ventilated (MV) intensive care unit (ICU) patients who are without oral speech.

Objectives: To develop, refine and evaluate preliminary validity and reliability of a communication interaction behavior instrument (CIBI) adapted for use with nonvocal, MV ICU patients.

Methods: Raters were asked to observe nurse-patient communication interactions from four 3-minute video-recorded sessions of five MV adults (<60 years) and their nurses to establish preliminary inter-rater reliability and confirm appropriateness of definitions. Based on expert input and reliability results, the CIBI's behaviors and definitions were revised. The revised tool was then tested in a larger sample of 38 adults (≥60 years) and their nurses (N=24) to determine inter-rater reliability.

Results: For preliminary testing, agreement for individual items ranged from 60-100% for the nurse behaviors and 20-100% for patient behaviors across the 5 test cases. Based on these

results, 11 definitions were modified, and 4 items were dropped. Using the revised 29-item instrument, percent agreement improved for nurse behaviors (73-100%) and patient behaviors (68-100%). Kappa coefficients ranged from 0.13-1.00, with lower kappa coefficients for patient behaviors.

Conclusion: Preliminary results suggest that the CIBI has good face validity and demonstrates good reliability for many of the behaviors but further refinement is needed. The recommended appropriate use of this tool is to employ dual raters with adjudication of discrepancies.

Keywords: mechanical ventilation, critical care, interaction behaviors

4.2 INTRODUCTION

Mechanical ventilation poses a significant barrier to communication for critically ill patients. Mechanically ventilated patients, especially those who require oral intubation, find themselves unable to use the most natural method of communication, oral speech. Behaviors that nurses utilize during communication interactions with critically ill, mechanically ventilated patients can influence the quality of the interaction, and patient outcomes (de los Ríos Castillo & Sánchez-Sosa, 2002; Riggio et al., 1982; Salyer & Stuart, 1985).

Positive and negative behaviors are primary components of provider-patient communication interaction measures used in varied patient populations and settings (Bernzweig, Takayama, Phibbs, Lewis, & Pantell, 1997; de los Ríos Castillo & Sánchez-Sosa, 2002; Hall, 1996b; Morse et al., 1992; Roter, Geller, Bernhardt, Larson, & Doksum, 1999; Salyer & Stuart, 1985; Shapiro, 1990). For mechanically ventilated, non-speaking patients, these responses are primarily measured by non-vocal behaviors instead of spoken communication (Hall, 1996b; Salyer & Stuart, 1985).

Attempting to measure non-vocal behaviors is challenging. Few instruments have been developed for the purpose of identifying interaction behaviors in mechanically ventilated, critically ill patients. The limited psychometric evaluations of existing instruments employed small samples and minimal information was provided regarding patient characteristics (Salyer & Stuart, 1985). Some studies included patients who required assistance breathing but were still able to communicate vocally (de los Ríos Castillo & Sánchez-Sosa, 2002). Finally, more robust measures of agreement, such as kappa coefficients, were not performed.

Video technology is gaining acceptance as a means to capture behavioral observations in the acute care setting (de los Ríos Castillo & Sánchez-Sosa, 2002; Happ et al., 2011; Sloane et al., 2007). While video-recorded observation may lack contextual information and limit the focus of the observer, it does allow for repeated viewing of the whole interaction or segments of observations. The ability to pause, rewind, and review can contribute to improved reproducibility (Haidet, Tate, Divirgilio-Thomas, Kolanowski, & Happ, 2009) which makes it an appropriate choice for evaluating nurse-patient interaction behavior, especially non-verbal communication behaviors that can be fleeting or occur simultaneously with other behaviors. The purpose of this study was to refine and evaluate the preliminary reliability and validity of a previously developed instrument designed to measure communication interaction behaviors.

4.3 BACKGROUND

To date, there have been three published studies measuring nurse and patient interaction behaviors in the ICU (de los Ríos Castillo & Sánchez-Sosa, 2002; Hall, 1996b; Salyer & Stuart, 1985). Salyer and Stuart utilized the Categories of Nurse-Patient Interaction tool, which measured nurse and patient actions and reactions, to observe 20 mechanically ventilated, critically ill patients for a period of 5 minutes (Salyer & Stuart, 1985). The behaviors included on the tool were identified through content analysis, but procedures involved in the analysis were not well described. To minimize bias, two observers were present during the observation period. Observers had 100% inter-rater reliability. The authors provided very limited descriptive information regarding the medical ICU patient sample, described only as “not comatose or not sedated”. The high level of reliability might have been related to sample homogeneity (Salyer & Stuart, 1985). It is unclear if this same level of inter-rater reliability would be achievable in a more diverse patient population.

Hall conducted a cross-sectional study using the Categories of Nurse-Patient Interaction tool to examine the actions and reactions of 30 ICU nurses caring for mechanically ventilated patients (Hall, 1996b). Although the study used the Categories of Nurse-Patient Interaction tool, only nurse actions and reactions were coded, a single observer was used, and no psychometric evaluation was performed (Hall, 1996b).

In a randomized trial, de los Ríos Castillo and Sánchez-Sosa evaluated nurse and patient interaction behaviors after nurses in the experimental group attended a specialized 8-week intensive training program focused on interpersonal communication behaviors and skills (e.g., eye contact, tone and touch) (2002). The interaction behaviors evaluated in this study were similar to items on the Categories of Nurse-Patient Interaction tool (Hall, 1996b; Salyer & Stuart,

1985) but the behaviors were defined in detail. Behaviors were rated from video-recorded observation by two separate researchers. Percent agreement, defined as agreements divided by the sum of agreements and disagreements multiplied by 100, ranged from 93-99% for nurse behaviors. Percent agreement for patient behaviors ranged from 95-98%. (de los Ríos Castillo & Sánchez-Sosa, 2002). Patients in this study were described as in need of "assistance breathing". However, it was not clear what type of support patients required or the number who were unable to speak due to mechanical ventilation. Many of the behavior definitions focused predominantly on verbalization by the patients, such as "yes" or "answering questions", but no attention was given to alternative methods of communication beyond head nods, facial expressions, and gesturing. While total and occurrence reliability were reported, more robust measures of agreement, such as kappa coefficients, were not reported.

In summary, three previous studies used similar but not identical behavioral observation tools to measure nurse-patient interaction behaviors in the ICU. Behaviors in the Categories of Nurse-Patient Interaction tool lacked definitions, making it difficult to understand positive and negative behavior categorizations. For example, the "negative" nurse behavior, "gives a command" lacked definition or criteria to establish what encompassed a command or if there were exceptions to the negative category assignment (Salyer & Stuart, 1985). In contrast, definitions provided in the de los Ríos Castillo and Sánchez-Sosa's instrument were detailed enough to provide justification for their category assignment. Therefore, the de los Ríos Castillo and Sánchez-Sosa's instrument was selected for adaptation and beginning psychometric testing in this study (see Table 10).

Table 10: Communication Interaction Behavior Instrumentation

Original Tool with 26 Interaction Behaviors*	
13 *Nurse Interaction Behaviors*	
10 Positive Behaviors	Sharing, Praising, Visual Contact, Brief Contact, Proximity, Physical Contact, Verbal Request, Smiling, Modeling, Laughing
3 Negative Behaviors	Disapproving, Yelling, Ignoring
13 *Patient Interaction Behaviors*	
10 Positive Behaviors	Acceptance, Instruction Following, Visual Contact, Visual Contact, Physical Contact, Request, Smiling, Maintaining Attention, Laughing, Praise
3 Negative Behaviors	Disagreement, Yelling, Ignoring
Pilot Version with 33 Interaction Behaviors	
20 Nurse Interaction Behaviors	
17 Positive Behaviors	Sharing, Praising, Visual Contact, Brief Contact, Brief Contact with Speech, Proximity, Proximity with Speech, Physical Contact, Social Politeness, Preparatory Information, Expanded Preparatory Information, Delayed Preparatory Information, Delayed Expanded Preparatory Information, Smiling, Modeling, Laughing, Augmenting
3 Negative Behaviors	Disapproving, Yelling, Ignoring
13 Patient Interaction Behaviors	
10 Positive Behaviors	Acceptance, Instruction Following, Full Visual Contact, Partial Visual Contact, Physical Contact, Request, Smiling, Maintaining Attention, Laughing, Praise
3 Negative Behaviors	Disagreement, Disgust, Ignoring

*The definitions for these behaviors are reported in de los Ríos Castillo and Sánchez-Sosa, 2002

4.4 METHODS

Four main steps were performed to adapt and conduct preliminary psychometric evaluation of a new tool based on de los Ríos Castillo and Sánchez-Sosa's instrument, which we will refer to as the communication interaction behavior instrument (CIBI), in a mechanically ventilated, nonspeaking older adult population. These steps included: 1) definition refinement and expansion, 2) preliminary testing, 3) instrument revision and 4) application and testing in a larger sample.

4.4.1 Step 1- Definition Refinement

We first refined the tool to make it applicable for use in a non-speaking population. In addition to modifying the behavior definitions, defining criteria and coding decision rules were established for each item to help establish parameters for coders. An example of definition refinement was the interaction behavior titled, “sharing.” The original definition of “sharing” was “facing the patient, the nurse offers him/her such items as a glass of water, prescribed food, special urinals, the patient’s CD or MP3 player or some other object used to support the patient’s well-being or treatment” (de los Ríos Castillo & Sánchez-Sosa, 2002). The revised definition of sharing included the following coding decision rule: “objects should not include medication or treatments (Example: offering pain medication or suction”). The decision rule for sharing provided guidelines to clarify what items should and should not be included as support for the patient’s well-being. We considered providing medication as a required interaction, which is why it was not included for this behavior.

Patient interaction behaviors were also revised. Many of the original definitions included vocalization that mechanically ventilated patients typically cannot do. For example, the original definition of “acceptance” stated “after the nurse offers or performs a health-related or comfort providing function, the patients says “yes”; “mmhm”; thanks the nurse; or nods affirmatively with the head, eyes, or hand, expressing agreement, acceptance, or satisfaction”. The revised definition of acceptance added that patients could also utilize augmentative and alternative communication (AAC) strategies including writing, alternative yes/no signals, communication boards, or speech generating devices to demonstrate agreement, acceptance, or satisfaction. Two senior researchers, with expertise in observational research with nonvocal care recipients, reviewed the behaviors and definitions for face validity.

4.4.2 Step 2- Preliminary Testing

The primary goal of the preliminary testing of the CIBI was to establish inter-rater reliability and face validity of the instrument before testing it in a larger sample. The CIBI was expanded to include 33 interaction behaviors. The behaviors were divided into 4 categories, i.e., positive nurse (n=17), negative nurse (n=3), positive patient (n=10) and negative patient (n=3) (see Table 10).

Preliminary reliability testing was performed using four 3-minute video-recordings of interactions between 5 randomly selected nurse-patient dyads (N=20 sessions) from the SPEACS study (Happ et al., 2011; Happ et al., 2008). All sampled patients were under 60 years of age; nurses ranged from 22 to 55 years of age and all had at least 1 year of critical care experience. Younger adults were selected to permit future selection of older adults from the available pool of videos.

During training, the raters reviewed the behaviors on the observation tool and discussed any questions regarding the definitions. Raters then reviewed two cases together and identified behaviors. Finally to attain coding competency, raters proceeded to review and code training cases individually until 90% agreement was achieved.

For the five pilot cases, two raters coded each video-recorded observation of nurse-patient communication independently. Coders were required to watch the video at least 4 times: 1) without coding, 2) to code patient behaviors 3) to code nurse behaviors, 4) to review for any missed behaviors. Raters met to review and adjudicate coding differences by watching the video session together, discussing coding definitions, and coming to consensus on whether a behavior was present or absent. If the two coders could not come to a consensus, a third experienced coder reviewed the session in question and provided feedback and arbitration. Agreement for the total scale, four subscales, and individual items was investigated.

4.4.3 Step 3- Definition Revision

Once preliminary testing was completed, behaviors and definitions were revised. If a behavior had low percent agreement (<60%) for multiple sessions, the description was revised. In addition to percent agreement, expert feedback and persistent issues identified during coding were used to guide behavior and definition revisions. Revisions included removing behaviors from the instrument, merging behaviors, modifying definitions, and providing additional criteria for coders. The revised CIBI consisted of 29 behaviors, i.e., 17 nurse (14 positive and 3 negative) and 12 patient behaviors (9 positive and 3 negative) (see Tables 11 and 12).

Table 11: Nurse Interaction Behaviors and Definitions

Positive Behaviors (14)	
Sharing	Facing the patient, the nurse offers him/her such items as a blanket, pillow, ice chips, prescribed food (ex: ice cream), the patient's CD, TV (ex: on/off or closer), or MP3 player or some other objects* used to support the patient's wellbeing or treatment. **objects should not include medication or treatments (Ex: offering pain medication or suction)*"
Praising	Verbal comments involving approval, recognition or praise to the patient, such as "good", "that was very well done", "you look much better today", and "you are recovering real fast". All comments must involve clear, audible and a kind tone of voice, and may or may not involve such physical contact as patting the patient's feet, arms, hands or shoulders.
Visual Contact	The nurse looks the patient in the eyes for as long as the nurse is at the patient's bedside (unless engaged in incompatible technical procedures, assessment of monitor, or interruptions by family, clinical or other healthcare professionals), regardless of whether the patient is looking at her/him. **This is limited to when the nurse is within the camera frame.*
Proximity with speech	The nurse stands at a distance no longer than an arm's length from the patient's upper body (from waist up), for a period of <u>> five seconds AND </u>include spoken information from the nurse. The nurse may be performing medical interventions or procedures.
Physical contact	The nurse touches, pats or hugs the patient. Physical contact includes attention getting touch and touch for comfort. Does NOT include technical/procedural touch.
Social Politeness	The nurse uses terms including "please", "thank you", and greets the patient by name. Social politeness also includes asking the patient permission before an action. Ex: "Can I turn off the light"
Preparatory Information	Information given before a procedure. Examples include "you are going to feel a mild sting but it will hurt very little", "we're going to give you a sponge bath". **To achieve "present', the procedure needs to be started <u>within 10 seconds</u> of preparatory information being given.* This does NOT apply if preparatory information occurs simultaneously to the procedure or in reaction to a patient response.
Expanded Preparatory information (education)	Information given before a procedure that includes expanded explanation/education prior to starting the procedure. Examples include: "I am going to give you your medication now. I have your Pepcid. It is used to help prevent stomach ulcers and treat reflux". *To achieve "present', the procedure needs to be started <u>within 10 seconds</u> of preparatory information being given.* This does NOT apply if preparatory information occurs simultaneously to the procedure or in reaction to a patient response.

Table 11 (continued)

Preparatory Information with Brief Delay	Same definition as preparatory information but the start of the procedure is > 10 seconds after the information is given as long as the nurse stays on task (ex: collecting supplies, drawing up medications)
Expanded Preparatory information with Brief Delay	Same definition as expanded preparatory information but the start of the procedure is >10 seconds after the information is given as long as the nurse stays on task (ex: collecting supplies, drawing up medications)
Smiling	Lifting lips corners while looking the patient in the eyes
Modeling	Body changes or movements accompanied by the corresponding descriptive verbalization, reproduced by the patient within the following ten seconds (“Please cough like this”, “lift your tongue like this”). Requires patient to model nurses’ gestures, such as thumbs up.
Laughing	Lifting the lips corners or congruently opening the mouth while emitting the characteristic voiced laughter sound, with or without an appropriate comment such as “that was funny Mrs/Mr.(patient’s name)”.
Augmenting	Augments patient's auditory comprehension be writing, gesturing, showing object, etc.
Negative Behaviors (3)	
Disapproving	Verbalizations implicating disagreement, negation, disgust or criticism of the patient. Ex: “No, not like that”, “I´ve already told you how to turn around”.
Yelling	Loud verbalizations or utterances containing comments, threats, criticism or disapproval of the patient. Ex: “Hey, that was really bad!”, “Don’t get out of bed!”, “Don’t remove that bandage!”
Ignoring the Patient	After a request or summons by the patient, the nurse does not answer verbally within five seconds in a congruent manner, or does not perform the requested action or does not give an explanation of why it cannot be done, or simply nods (yes or not), without establishing distinct visual contact with the patient

Note: These definitions have been revised from previous by de los Ríos Castillo, J.L. and Sánchez-Sosa, J. (2002)

Table 12: Patient Interaction Behaviors and Definitions

Positive Behaviors (9)	
Acceptance	After the nurse offers/performs a health related or comfort providing function, the patient nods affirmatively with the head, eyes or hand, expressing agreement, acceptance or satisfaction. Patients can utilize AAC strategies (ex: writing, alternative yes/no signals, communication boards, or speech generating devices) to demonstrate agreement, acceptance, or satisfaction **May receive a "present" if the nurse provides a plan of care for the rest of the shift (ex: Nurse offers to change patient's bed after the physicians finishes a procedure. The patient nods yes to accept the plan)*
Following Instructions	Engaging a behavior (within the patient's actual capabilities) in response to an appropriate request or instruction by the nurse, <u>within ten seconds</u> of the request. Ex: posture changes, answering questions. **If patient's response is ambiguous and not interpretable to the nurse, then this behavior is absent.*
Visual Contact	Looks the nurse in the eye when the nurse asks a question or addresses the patient <u>while the nurse is at the bedside</u> (unless the nurse is engaged in incompatible technical procedures, assessment of monitor, or interrupted by family, clinical or other healthcare professionals), regardless of whether the nurse is looking at her/him. **Patient may receive a "present" if the nurse is out of the frame but it is clear that the patient is focused on and responding to the nurse.*
Physical Contact	Touches, pats or hugs the nurse. Includes attention-getting touch and touch for comfort. Ex: reaching out to nurse to pat their arm or shake their hand. Does not include grabbing for support during position changes.
Request	Digital or manual indications initiated by the patient to express a need or request, followed by the corresponding nurse appropriate behavior. Ex: requesting a glass of water, pain medication, etc.
Smiling	Lifting lips corners while looking the patient in the eyes **Exceptions may be made if the patient has a neurological deficit (facial droop) or other impediment that doesn't allow one corner of the mouth to raise*
Maintaining Attention	Keeps sustained eye contact while the nurse provides an explanation, information, instruction or appropriate comment. **may receive a "present" if the nurse is out of the frame but the patient is still focused on and responding to the nurse.*
Laughing	Lifting the lips corners or congruently opening the mouth. Patients may appear to take an extra breath while their chest and shoulders rise. It may appear to be more of a chuckle.
Praise	A clearly distinguishable gesture or message expressing gratefulness or approval of an action by the nurse.

Table 12 (continued)

Negative Behaviors (3)	
Disagreement/Negativity	Actions expressing opposition to nurse's, includes threatening gestures, striking or refusal.
Disgust	Gestures or facial expressions indicating disgust, exasperation, annoyance, or frustration. Examples: head shaking, turning away, upward eye movement or eye roll **In order to determine if the eye roll/movement is an expression of disgust, the coder must take into account verbal context, and other nonverbal indicators.*
Ignoring the Nurse	Same definition as the category for nurses in absence of a justifying situation such as being asleep or unconscious.

Note: These definitions have been revised from previous by de los Ríos Castillo, J.L. and Sánchez-Sosa, J. (2002)

4.4.4 Step 4- Application and Testing

After completion of preliminary reliability and validity evaluation, the revised CIBI was tested using video-recordings of 38 nurse-patient dyads (four observations per dyad, total = 152 observations) in mechanically ventilated, non-speaking older adults ($\geq$60 years of age). We repeated the coding strategies used in the preliminary testing. Two coders independently rated all 152 sessions to test inter-rater reliability on 100% of the sample.

4.4.5 Data Analysis

Data were analyzed using IBM® SPSS® Statistics (version 20.0, IBM Corp., Armonk, NY). Agreement between raters for individual behaviors was determined through the computation of percentage agreement. Kappa coefficients for the individual nurse and patient positive behaviors and two-way mixed effects intraclass correlations coefficients (ICC) for the sum of different nurse and patient positive behaviors were calculated for the revised CIBI on the larger sample only. Kappa coefficients provided an assessment of agreement, which corrects for chance agreement (Landis & Koch, 1977; Viera & Garrett, 2005). A kappa coefficient of 0.60 has been recommended as the minimally acceptable kappa value for inter-rater reliability (Landis & Koch, 1977; Wynd, Schmidt, & Schaefer, 2003). Finally, t ICC provides an index for absolute agreement by taking into account the ratio of subject variability and total variability (McGraw & Wong, 1996). Moderate agreement is considered to be an ICC of 0.61 to 0.80 and 0.81 to 100 is considered excellent agreement (Bartko, 1966).

4.5 RESULTS

4.5.1 Preliminary Reliability and Validity

The total scale agreement ranged from 76% to 100%. Subscale agreement for nurse behaviors ranged from 80% to 100%. For patient behaviors, subscale agreement ranged from 76% to100%. Finally, individual item agreement ranged from 60% to 100% for nurse behaviors and item agreement ranged from 20-100% for patient behaviors (See Table 13).

Table 13: Percent Agreement by Session and Mean Item Agreement

Behaviors	Percent Agreement				Mean Item Agreement
	Session				
Positive Nurse	**1**	**2**	**3**	**4**	
Sharing	100	100	100	100	100
Praising	60	80	80	100	80
Visual Contact	60	100	100	80	85
Brief Contact	100	80	80	80	85
Brief Contact with Speech	100	80	80	80	85
Proximity	100	100	80	100	95
Proximity with Speech	80	100	100	100	95
Physical Contact	100	60	100	100	90
Social Politeness	80	80	100	80	85
Preparatory Information	80	80	100	80	85
Expanded Preparatory Information	100	80	60	80	80
Preparatory Information with Delay	100	80	80	100	90
Expanded Preparatory Information Expanded Preparatory information with Delay	100	60	100	80	85
Smiling	80	100	100	100	95
Modeling	100	100	100	100	100
Laughing	60	100	100	100	90
Augmenting	80	100	60	60	75
Negative Nurse					
Disapproving	100	100	100	100	100
Yelling	100	100	100	100	100
Ignoring	100	100	100	100	100
Positive Patient					
Acceptance	100	60	100	100	90
Following Instructions	100	80	80	80	85
Full Visual Contact	80	100	60	80	80
Partial Visual Contact	100	100	40	20	65
Physical Contact	100	100	100	100	100
Requests	60	100	100	100	90
Smiling	80	100	100	100	95
Maintaining Attention	80	100	60	100	85
Laughing	60	100	100	100	90
Praise	100	100	100	100	100
Negative Patient					
Disagreement	100	100	100	80	95
Disgust	80	100	100	80	90
Ignoring	100	80	100	100	95

4.5.2 Definition Revisions

Based on the above results and expert feedback, 11 behavior definitions, including 7 nurse behaviors and 4 patient behaviors, were modified. ‘Laughing’ is a prime example of a definition that was modified in order to be appropriate for use in mechanically ventilated patients. Initially the definition for the patient positive behavior of ‘laughing’ was the same as the definition for the nurse. “Laughing” by the nurse was characterized as “lifting the corners of the lip or congruently opening the mouth while emitting the characteristic voiced laughter sound, with or without an appropriate comment.” While patients who are mechanically ventilated can laugh, the characteristics of laughter while on the ventilator are quite different. The laugh may not be audible and may resemble more of a chuckle where the patient’s shoulders and chest raise briefly. Patients who are mechanically ventilated via oral endotracheal tube may not be able to “open the mouth” or “lift lip corners” due to the presence of the endotracheal tube and/or the devices to secure the tube to the face and mouth. The definition was modified to highlight the physical features that may be present when the patient laughs while on the ventilator (See Table 12).

Four behaviors, including 3 nurse positive behaviors and 1 patient positive behavior, were removed from the instrument. The three positive nurse behaviors removed were: brief contact, brief contact with speech, and proximity (Table 10). In the majority of these interactions, the nurses were performing brief technical procedures or tidying the bed/bedside area. Although the nurses were in close proximity to the patients, there was little real social interaction in these very brief technical encounters or contacts. We felt that these one-side behaviors did not meet the criteria for a communication interaction.

The category “partial visual contact” that only required the patient to look at the nurse if asked a question or when a comment was directed towards the patient was renamed “visual contact” and replaced two separate visual contact behaviors. “Full visual contact,” where the patient was required to look the nurse in the eye for as long as the nurse was at the patient’s bedside, regardless of whether the nurse was looking at the patient was the only patient behavior removed from the instrument. It was viewed as extremely uncommon for a patient to have visual contact with the nurse the entire time they were at the bedside. In addition, this behavior did not appear realistic behavior for the majority of critically ill patients given difficulties with energy, focus and attention (Ely et al., 2004; Li & Puntillo, 2006; Nelson et al., 2004; Pandharipande, Jackson, & Ely, 2005).

4.5.3 Inter-rater Reliability

Tables 11 and 12 provide an outline of the revised instrument with definitions and decision rules. When using the revised instrument, the following positive nurse behaviors were observed to occur in over 50% of the sessions: “proximity with speech” (94%), “visual contact” (86%), “social politeness” (74%), and “augmenting” (72%). “Disapproval” was the only negative nurse behavior that did occur (n=1). “Following instructions” (86%) and “acceptance” (64%) were the only patient behaviors that occurred in over half of the sessions. Negative interaction behaviors were relatively rare occurrences: “disagreement” (1.3%), “disgust” (2.0%), and “ignoring the nurse” (3.9%), occurred in less than 5% of the sessions.

For the positive nurse behaviors, individual item agreements ranged from 73.6% to 100% with kappa coefficients ranging from 0.13 to 1.00. “Social politeness”, “preparatory information”, and “augmenting” all had at least one observation with agreement less than 80%.

“Modeling” had the highest agreement with 3 observations with 100% agreement. “Social politeness”, “augmenting” and all 4 categories related to preparatory information had at least 2 observations with a kappa coefficient of less than 0.60 (see Table 14).

Table 14: Percent Agreement and Kappa Coefficients

Behaviors	Percent Agreement				Kappa Coefficients			
	Session				Session			
Positive Nurse	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Sharing	84.2	92.1	92.1	89.5	0.42	0.77	0.73	0.71
Praising	94.7	86.8	84.2	97.4	0.87	0.72	0.69	0.94
Visual Contact	94.7	89.5	97.4	94.7	0.84	0.61	0.87	0.72
Proximity with Speech	97.4	100.0	94.7	97.4	0.84	1.00	0.48	0.66
Physical Contact	84.2	92.1	92.1	92.1	0.68	0.84	0.84	0.84
Social Politeness	81.6	76.3	81.6	84.2	0.56	0.43	0.60	0.63
Preparatory Information	86.8	73.7	81.6	81.6	0.70	0.43	0.51	0.58
Expanded Preparatory Information	89.5	86.8	86.8	94.7	0.54*	0.37*	-	0.47*
Preparatory Information with Brief Delay	92.1	92.1	92.1	92.1	0.36*	-	0.36*	0.62*
Expanded Preparatory Information with Brief Delay	89.5	81.6	100	97.4	0.30*	0.13*	1.00	-
Smiling	92.1	89.5	89.5	86.7	0.69*	0.61*	0.68	0.63
Modeling	97.4	100	100	100	-	1.00	-	1.00
Laughing	94.7	92.1	94.7	97.4	0.72*	0.68*	0.84	0.92
Augmenting	92.1	73.7	92.1	84.2	0.84	0.47	0.80	0.53
Negative Nurse								
Disapproving	100	100	97.4	100	-	-	-	-
Yelling	97.4	100	100	100	-	-	-	-
Ignoring	100	100	100	100	-	-	-	-
Positive Patient								
Acceptance	68.4	84.2	78.9	81.5	0.39	0.68	0.56	0.63
Following Instructions	92.1	94.7	86.8	89.5	0.73	0.80	0.54	0.71
Visual Contact	73.7	81.6	84.2	86.7	0.49	0.61	0.68	0.74
Physical Contact	97.4	100.0	97.4	100	0.79	1.00	0.79	1.00
Requests	86.8	78.9	76.3	81.6	0.69	0.51	0.44	0.51
Smiling	89.5	97.4	81.6	89.5	0.66*	0.89	0.37*	0.65*
Maintaining Attention	68.4	81.6	89.5	89.5	0.35	0.60	0.79	0.79
Laughing	97.4	100	94.7	97.4	-	-	0.47*	0.79
Praise	100	97.4	100	100	-	0.79	1.00	1.00
Negative Patient								
Disagreement	94.7	100	100	100	-	-	-	-
Disgust	92.1	100	94.7	97.4	-	-	-	-
Ignoring	89.5	94.7	86.8	94.7	-	-	-	0.48*

Note: The symbol – denotes behaviors that kappa coefficients were unable to be calculated due to limited variability in the response. *denotes behaviors with limited variability in response, which may contribute to the lower kappa.

For positive patient behaviors, the individual item agreements ranged from 68.4% to 100% and the kappa coefficients ranged from 0.35 to 1.00 for positive patient behaviors. “Physical contact” and “praise” were the only two patient interaction behaviors that had kappa coefficients of greater than 0.60 for all the observations. Percent agreement for identification of the three negative patient behaviors ranged from 91.4 to 98.7% but there was not enough variability to calculate kappa coefficients for majority of observations (see Table 14).

The two-way mixed effects intraclass correlation for the count of different positive nurse behaviors ranged from 0.817 to 0.921 (Session 1=0.918, Session 2=0.817, Session 3=0.862 Session 4=0.921). For the count of different positive patient behaviors, intraclass correlation ranged from 0.871 to 0.910 (Session 1= 0.871, Session 2= 0.910, Session 3=0.877, Session 4=0.893). There appears to be no proportional bias between raters for the count of different nurse positive behaviors (all sessions $p > .100$) or for the count of different patient positive behaviors (all sessions $p > .100$).

4.6 DISCUSSION

We adapted the CIBI, derived from prior observational research in the ICU, and began to psychometrically evaluate the tool for use in a nonspeaking, mechanically ventilated population. Mechanically ventilated, critically ill patients cannot express positive and negative behaviors through vocalizations during communication interactions with their care provider. Therefore, they need to rely on alternative methods to communicate, such as head nods, facial expressions, or speech generating devices (Leathart, 1994; Menzel, 1998; Thomas & Rodriguez, 2011). In order to evaluate these behaviors, a psychometrically valid tool is needed. Our study 1) adapted interaction behaviors and definitions to address the needs of mechanically ventilated patients, and 2) demonstrated that good reliability is possible when using the instrumentation to document many of the interaction behaviors.

Individual percent agreements for the revised CIBI ranged from 73.6 to 100% with kappa coefficients ranging from 0.13 to 1.00. Overall, the majority of the nurse behaviors had a percent agreement of 80% or greater. This level of agreement has been identified in previous research to be an appropriate cut-point for inter-rater reliability of observational coding from video (de los Ríos Castillo & Sánchez-Sosa, 2002; Morse, Beres, Spiers, Mayan, & Olson, 2003). There were only three behaviors, including “social politeness”, “preparatory information”, and “augmenting” that fell below this cut-point on one or more observations.

The nurse behaviors of social politeness and the 4 behaviors related to preparatory information had multiple observations with kappa coefficients below 0.60, which indicates that further definition refinement or category collapse may be needed. It should be noted however that a lack of occurrence, which was experienced with several of the interaction behaviors, can contribute to smaller, unreliable kappa coefficients (Viera & Garrett, 2005) (see Table 14).

The percent agreement and kappa coefficients tended to be lower for patient behaviors; however, similar reliability scores were seen in previous work (de los Ríos Castillo & Sánchez-Sosa, 2002). Non-verbal behaviors were the primary method for patients to demonstrate interaction behaviors. These behaviors can be very brief and may be difficult to identify when lighting and position of the camera are not optimal. Many instances of disagreement between raters occurred because they had difficulty hearing the nurse due to poor sound quality or were not able to clearly see the patient’s face because of low light or movement of the video camera.

4.6.1 Limitations

The sample size and lack of variability of behaviors limited our ability to perform more comprehensive psychometric evaluation. In addition, the larger sample utilized for primary application testing was comprised solely of older adults, thus limiting the generalizability of the results. In order to complete a more extensive evaluation, such as exploratory or confirmatory factor analysis, a larger more diverse sample would be needed.

While analysis of video-recorded observations provided the advantage of replaying interactions, it also limited observations. There were times when the nurse was out of frame or faced away from the camera and therefore behaviors could not be coded. It is important to note that this is a secondary analysis and, therefore, the primary purpose of the video observations were targeted to measure SPEACS study outcomes and not necessarily interaction behaviors. Because of the complex, dyadic nature of nurse-patient communication, further research focusing on interaction behaviors would benefit from multiple methods of observation, including direct and video-recorded analysis. Finally, behaviors were recorded in regard to whether or not they occurred at least once over a three-minute session. A count of individual behaviors during an entire observation period may also provide more robust data for psychometric analysis.

4.7 CONCLUSION

This study provided preliminary psychometric evaluation for the newly adapted CIBI for use in mechanically ventilated, nonspeaking older adults. These findings demonstrate respectable inter-rater reliability on several of the behaviors but further work is needed in order to perform more complex psychometric analysis. Currently, the most appropriate use of this tool would be to have dual raters observe interaction and adjudicate when discrepancies arise because of the fleeting nature of patient interaction behaviors.

APPENDIX A

MANUSCRIPT #1- NURSE AND PATIENT CHARACTERISTICS ASSOCIATED WITH DURATION OF NURSE TALK DURING PATIENT ENCOUNTER S IN THE ICU

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Care of Critically Ill Adults

Nurse and patient characteristics associated with duration of nurse talk during patient encounters in ICU

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ABSTRACT

Background: Communication interactions between nurses and mechanically ventilated patients in the intensive care unit (ICU) are typically brief. Factors associated with length of nurses' communication have not been explored.
Objective: To examine the association between nurse and patient characteristics and duration of nurse talk.
Methods: In this secondary analysis, we calculated duration of nurse talk in the first 3-min of video-recorded communication observation sessions for each nurse–patient dyad ($n = 89$) in the SPEACS study (4 observation sessions/dyad, $n = 356$). In addition, we explored the association between nurses' characteristics (age, gender, credentials, nursing experience, and critical care experience) and patients' characteristics (age, gender, race, education, delirium, agitation-sedation, severity of illness, level of consciousness, prior intubation history, days intubated prior to study enrollment, and type of intubation) on duration of nurse talk during the 3-min interaction observation.
Results: Duration of nurse talk ranged from 0–123 s and varied significantly over the 4 observation sessions ($p = .007$). Averaging the duration of nurse talk over the observation sessions, differences in talk time between the units varied significantly by study group ($p < .001$). Talk duration was negatively associated with a Glasgow Coma Scale ≤ 14 ($p = .008$). Length of intubation prior to study enrollment had a curvilinear relationship with talking duration (linear $p = .002$, quadratic $p = .013$); the point of inflection was at 23 days. Nurse characteristics were not significantly related to duration of nurse talk.
Conclusion: Length of time the patient is intubated, and the patient's level of consciousness may influence duration of nurse communication in ICU.

Introduction

In the United States, approximately 2.8 million adults require mechanical ventilation in an Intensive Care Units (ICU) each year[1,2] and, as a consequence, are unable to communicate using natural speech.[3] The inability to speak during mechanical ventilation can elicit negative emotions including, distress, anger, fear and isolation.[4–20] In addition to emotional distress, patients in acute care settings who have communication problems are three times more likely to experience preventable adverse events.[21]

During an extended period of critical illness, it is essential that patients be provided the opportunity to communicate needs, symptoms, and emotions and participate in decision-making with their healthcare team members. Because of their unique care relationship with critically ill adults, nurses have the potential to mitigate the negative effects of impaired communication.[22] However, observational studies suggest that nurse–patient communication interactions in the ICU typically last only one to five minutes in length.[23–27]

Clinician speaking time is a component of clinician–patient interaction and a well-documented communication measure in a variety of care settings.[23,28–32] Duration of nurse talk is a valid indicator of communication interaction because nurses are the predominant initiators of communication in the ICU, and control communication opportunities with nonvocal patients.[3,26] To date, factors associated with length of nurses' communication interaction have not been explored.

Video recorded observations of nurse–patient interaction from the Study of Patient-Nurse Effectiveness with Assisted Communication Strategies (SPEACS)[33], a three-group clinical trial, provided

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an opportunity to explore the factors associated with duration of nurse talk, which is one measure of the length and quality of nurse–patient communication interaction in the ICU. The majority of clinician–patient communication research has focused on a single interaction, which ignores the role that familiarity and continuity may play.[29,31,32,34] When nurses spend more time caring for and communicating with their impaired patients, they perceived a greater sense of ease and success during the communication interaction.[35] Secondary analysis of the SPEACS dataset provides a unique opportunity to evaluate consecutive communication interactions between nurses and mechanically ventilated, critically ill patients.

The primary aims of this secondary analysis were to: 1) describe the duration of nurse talk across four 3-min interaction observations between nurses and mechanically ventilated (MV), critically ill adults, 2) investigate differences among the observations, study groups, and their combinations, and 3) explore the association between nurses' and patients' characteristics and duration of nurse talk during the 3-min interaction observation.

Methods

Design

This secondary analysis utilized data collected from adult ICU patients and their nurses enrolled in the SPEACS study.[33] The SPEACS study employed a quasi-experimental sequential three-group design to test the impact of two interventions on nurse–patient communication compared to a usual care condition. The interventions included: A) basic communication skills training (BCST) for the study nurses, and B) basic communication skills training and electronic augmentative and alternative communication (AAC) device education with an individualized speech language pathologist (SLP) consultation (AAC-SLP). Low technology communication materials (e.g. alphabet boards, picture boards, writing materials) were available to the BCST group. In addition to low technology communication materials, patients in the AAC-SLP group received a SLP consultation and were offered high technology (electronic) AAC devices.[33] The SPEACS study measured communication process outcomes, including ease, quality, frequency and success of communication. Baseline results have been reported[3] and final results are forthcoming. The University of Pittsburgh's institutional review board approved this secondary analysis.

Setting

The SPEACS study was conducted in the 32-bed medical intensive care unit (MICU) and 22-bed cardiothoracic intensive care unit (CT-ICU) of a large academic medical center located in southwestern Pennsylvania.

Sample

Ten nurses were randomly selected from a pool of eligible nurses prior to the start of each study group for a total of 30 nurses. Patients ($n = 89$) were selected by convenience sampling when a study nurse was available for observation on 2 consecutive day shifts. All nurse–patient dyads ($n = 89$) who completed the parent study were included in this secondary analysis.[3,33]

Patient participants

Eligible patients were: (1) nonspeaking due to oral endotracheal tube or tracheostomy, (2) intubated for 48 h, (3) able to understand English, and (4) scored 13 or above on the Glasgow Coma Scale. The "verbal" score of the Glasgow Coma Scale was adapted to allow for patients to communicate words by nonverbal methods.[3] Patients who were reported by family to have a diagnosed hearing, speech or language disability that could interfere with communication prior to hospitalization were excluded. Recruitment and eligibility have been previously described.[33]

Nurse participants

Eligible nurses were selected for inclusion if they: (1) had at least 1 year of critical care nursing experience, (2) were full-time permanent staff in CT-ICU or MICU, (3) were English-speaking, and (4) were without hearing or speech impairment.

Intervention

The usual care group had access to writing supplies and, more rarely, communication boards however, no patients utilized the boards during observations and six patients used writing at least once.[3] The BCST program intervention consisted of a 4-h interactive educational session conducted primarily by a speech-language pathologist. BCST focused on assessment of the patient's cognitive and motor function, basic interactive communication strategies, and the use of "low tech" communication tools (e.g. alphabet and picture communication boards, writing tools, etc.). These "low tech" communication tools were accessible to ICU staff and located in a designated "communication cart" on each unit. In addition to the basic educational program, study nurses in the third group (AAC + SLP) received a 2-h educational session on the use of electronic AAC devices, which was delivered by a specially trained SLP. The SLP provided an individual assessment and developed a communication plan which included an electronic AAC device option for each study patient.[33,36]

Procedure and data collection

Observational data on 4 separate nurse–patient communication interactions were collected on two consecutive days, in the morning and afternoon/evening, when a nurse participant was assigned to the care of an enrolled patient. The patient–nurse encounters were naturally occurring observation sessions in which trained data collectors followed the nurse into the room during routine care with the exception of emergencies and intimate personal hygiene care. Medical chart review, researcher observations, and nurses' self-report were used to obtain the clinical and demographic characteristics.

Outcome and outcome measurement

Duration of nurse talk

For this secondary analysis, duration of nurse talk was measured by calculating the amount of time in seconds that a nurse spoke to the patient during a 3-min observation period. The 3-min time unit was selected by the parent study researchers because the literature suggested that typical nurse–patient interactions in the ICU last 1–5 min in length[23–25] and 3-min were determined, after viewing videotapes from prior research of gestural communication with nonspeaking ICU patients, to be an adequate amount of time to observe the communication interaction.[33] While this timeframe limits the maximum length of possible nurse–patient communication, it does provide an equal observation time for all dyads. Total lengths of talking duration were calculated for each of the four interaction observations.

No intervention effect was noted on patient initiation of communication,[37] which is an indicator of communication independence. On average, patients initiated 14% of communication exchanges. Given that patients' level of communication independence remained constant over the study groups and since patients' responses were nonvocal and difficult to accurately measure in time increments, it was reasonable to confine our measure of communication time to duration of nurse talk.

Inter-rater reliability of duration of nurse talk was calculated using percent agreement for time calculations performed by a second coder on a random selection of 10% of all cases from the study ($n = 9$). Reliability was ascertained at the 3-min mark of each observation session. Coders achieved time measurement agreements ranging from 67–96% with an overall agreement of 92.4%.

Patient characteristics and clinical characteristics

Patient demographic variables included in this analysis were: patient's age in years, gender (male/female), race (White/Black), prior intubation history (yes/no) and total number of years of education. Demographic variables were self-reported by the patient or a family member. Patient clinical characteristics utilized for this secondary analysis were chosen for the potential to influence communication length[3,25,27] and were selected from the Symptom Communication, Management, and Outcomes model, which was developed in the SPEACS study.[38]

Patient clinical characteristics included delirium, agitation/sedation, severity of illness, level of consciousness, prior intubation history, days intubated prior to study enrollment, and type of intubation.

Presence of delirium was measured by the Confusion Assessment Method for ICU (CAM-ICU).[39] The CAM-ICU was adapted from the Confusion Assessment Method (CAM) for use with nonverbal ICU patients.[40] The CAM-ICU demonstrated excellent inter-rater reliability ($\kappa = .96$, 95% CI, .92–.99) and high criterion validity with excellent sensitivity, specificity, and accuracy when compared to the reference standard.[41] Inter-rater reliability for the CAMU-ICU was checked by an independent rater for 10% of observation sessions, with >.90% agreement.

Sedation–agitation was measured by the Richmond Agitation and Sedation Scale (RASS). The score yielded by the RASS was based on a 10-point scale with four levels of agitation, one level to denote a calm and alert state, and 5 levels of sedation.[42] In 290 paired observations of critically ill adults admitted to a MICU, nurse inter-rater reliability was very high ($\kappa = .91$).[43] In an independent cohort of 275 patients receiving MV, the RASS demonstrated excellent criterion, context, and face validity.[43] An inter-rater agreement of >.90% was achieved on independent ratings of 10% of the observation sessions. Due to the lack of variability among the categories, a derived two-category variable was utilized denoting whether the patient was calm or had some degree of agitation or sedation.

Level of consciousness was measured by using the Glasgow Coma Scale (GCS). The GCS was developed in 1974 as a measurement tool to assess impaired consciousness and coma. It is based on three categories including eye opening, verbal, and motor responsiveness.[44] Scores can range from 3 to 15 with lower scores denoting impaired consciousness and coma. In 290-paired observations by nurses, GCS demonstrated substantial inter-rater reliability ($\kappa = 0.64$; $P = .001$).[43] In the parent study, the GCS was adapted to provide a verbal score, which represented a patient's ability to communicate words using nonvocal methods.[3] Because GCS scores lacked variability in this sample, both baseline and observation-dependent scores were converted to a derived binary variables where 15 (awake and completely oriented) or 14 and below (compromised). CAM-ICU, RASS, and GCS were obtained through researcher assessment and observation of the study patients.

Severity of illness was obtained by using the Acute Physiology and Chronic Health Evaluation (APACHE III) scoring system at enrollment and each study day. APACHE III has a total score range of 0–299.[45] APACHE II tool was shown to be highly reproducible with an intra-class correlation coefficient of .90 and when reanalyzed with the APACHE III tool, results were similar. The predictive accuracy of first-day APACHE III scores is high.[46] APACHE III is also commonly used to determine a daily severity of illness measure.[45] In the parent study, APACHE III scores were obtained on enrollment and for the two consecutive days of observation. All APACHE III ratings for the parent study were checked by a second reviewer to achieve >.90 agreement.[33]

Type of intubation (oral endotracheal tube or a tracheostomy) was identified at each observation session. Finally, *length of intubation prior to study enrollment* was measured as the total number of days a patient was intubated during the current admission and was obtained by medical chart review.

Nurse demographic characteristics

Nurse demographic characteristics utilized for this secondary analysis included: age, gender, education/credentials, nursing experience, and critical care experience. Age was measured in years and gender was identified as a binary variable (male/female). Nursing Education was represented as a derived variable with two categories including 1) Diploma or Associates in Nursing and 2) Bachelor's degree in nursing. Nursing experience was measured as total years of nursing practice and years of practice in a critical care setting (critical care experience).

Statistics

Data analysis was conducted using IBM SPSS Statistics (version 20.0, IBM Corp., Armonk, NY) and SAS (version 9.2, SAS Institute, Inc. Cary, NC). Descriptive statistics were computed to describe duration of nurse talk and nurse and patient characteristics. The data were screened for accuracy, missing values, outliers, and underlying statistical assumptions. Distribution of continuous variables was summarized using frequencies, means, and standard deviations. Frequency counts, percentages, and range were calculated for nominal variables. For ordinal variables, medians and interquartile ranges were also computed. Duration of nurse talk was found to be positively skewed across all four observation sessions therefore a square root data transformation was applied resulting in more normally distributed data. *F*-test from a two-way Analysis of Variance and binary logistic regression with exact conditional inference methods were used to compare nurse and patient characteristics across the units, study groups, and their combinations.

Some missing data were encountered in the dataset but appeared to be missing at random. Of the 89 patient participants, 7% ($n = 6$) were missing CAM-ICU data for 1 to 3 observation sessions and 2% ($n = 2$) were missing data for all observation sessions. The missing data occurred because the patient either refused to complete a section of the CAM-ICU or was unable to answer the questions because of a decreased level of consciousness or emotional state at time of assessment. When examining observation session-dependent CAM-ICU data as a predictor variable, the subjects who were missing all of their CAM-ICU data were dropped and subjects missing partial CAM-ICU data were retained for those time-points were CAM-ICU data were present. In addition to the missing CAM-ICU data, one patient did not report their level of education; hence when examining patient education as a predictor, this subject was dropped from the analysis.

Repeated measures analysis via linear mixed modeling was used to both describe groups and observation session effects and evaluate if there were difference in nurse talk time among observation sessions and/or study groups. This approach was taken because it allowed for the handling of data that were missing at random as well as accommodating for nurse and patient characteristics that were fixed or time-dependent covariates. Linear mixed modeling allowed for the modeling of the covariance matrix for the repeated measure assessments. The Kenward–Roger method was used for the estimation of degrees of freedom given the overall small sample size of the study. As an initial step the covariance matrix for the repeated assessment over the observation sessions was examined to determine the best fitting covariance structure, which was determined to be compound symmetric. *F*-tests and *t*-tests were used to assess main and interaction effects at a significance level of .05 for two-sided hypothesis testing. Least square means were estimated to describe the pattern based on the fitted model. The association between the patient and nurse characteristics and duration of nurse talk were assessed through an expanded version of the linear mixed model generated by the repeated measure analysis for aim 2 whereby each nurse and patient characteristic was added to the repeated measures model. The statistical significance of the association of the patient and nurse characteristics of interest with duration of nurse talk was evaluated using *t*-tests or *F*-tests with corresponding *p*-values as appropriate. The estimated regression coefficient with its standard error was reported to summarize the association between each characteristic with the duration of nurse talk adjusting for other covariates in the model.

The characteristics were screened in a univariate manner using a *p*-value of .20 to identify candidate predictor variables for the multivariate modeling. Continuous predictors were evaluated for their functional form (linear, and non-linear quadratic). Nurse and patient characteristics that met screening criteria of a $p \leq .20$ were then considered jointly via a multivariate model. Two-way interactions were explored by adding products of screened predictors in the multivariate model one by one. Finally, backwards elimination was applied to construct the parsimonious model, which included nurse and patient characteristics that were significant at $p < .05$ in the multivariate model.

Results

The nurses ($N = 30$) ranged from 22 to 55 years of age (Mean ± SD = 35.40 ± 9.99) and were predominantly female (80%). The majority held a Bachelor's degree in nursing (BSN) (83%). Years in nursing practice and specifically in critical care ranged from 1 to 33 with a mean of 10.1 (SD = 10.37) and 7.20 years (SD = 8.58), respectively. Patients ($N = 89$) ranged from 24 to 87 years of age (Mean ± SD = 56.81 ± 15.68). Patients were predominantly white (89%) and had 8 to 21 years of formal education (Mean ± SD = 13.15 ± 2.60). Patients were evenly distributed between males (49%) and females (51%). While patients ($n = 66$) had multiple diagnoses upon admission to the ICU, the most common admitting diagnosis were pulmonary disease/infection ($n = 54$), cardio, thoracic, or vascular surgery ($n = 32$), and postoperative complications ($n = 30$). All patients required mechanical ventilation for respiratory insufficiency (See Table 1 and Table 2 for the breakdown of patient and nurse characteristics by study groups and unit within each study group).

Duration of nurse talk

Duration of nurse talk, the primary outcome for this secondary analysis, ranged from 0 to 98 s for first observation (Median = 23, Interquartile Range = 22), 0–107 s for the second observation session (Median = 26, Interquartile Range = 25), 0–118 s for the third observation session (Median = 35, Interquartile Range = 27), and 0–123 s for the fourth observation session (Median = 30, Interquartile Range = 28). While nurse silence was rare, it did occur in 5 observed sessions during the first three minutes. During the observation sessions with nurse silence, the nurse was conversing with family members, other healthcare professionals, or silently performing technical procedures. There were 3 instances of

Table 1
Baseline nurse characteristics

Characteristic	Usual care			BCST			AAC-SLP			Total			*P*-value		
	CTICU ($n = 5$)	MICU ($n = 5$)	Total ($n = 10$)	CTICU ($n = 5$)	MICU ($n = 5$)	Total ($n = 10$)	CTICU ($n = 5$)	MICU ($n = 5$)	Total ($n = 10$)	CTICU ($n = 15$)	MICU ($n = 15$)	Total ($N = 30$)	Group	Unit	Group by unit
Age (years)	43.2 ± 11.7	40.4 ± 5.3	41.8 ± 8.7	30.0 ± 12.4	30.4 ± 12.3	30.2 ± 11.6	29.6 ± 4.6	38.8 ± 1.9	34.2 + 5.9	34.3 ± 11.5	36.5 ± 8.5	35.4 + 10.0	.03	.50	.33
Female*	3 (60)	5 (100)	8 (80)	4 (80)	4 (80)	8 (80)	5 (100)	3 (60)	8 (80)	12 (80)	12 (80)	24 (80)	1.00	NA	.49
Bachelors degree*	4 (80)	4 (80)	8 (80)	5 (100)	5 (100)	10 (100)	3 (60)	2 (40)	5 (50)	12 (80)	11 (73)	23 (77)	.08	NA	1.00
Nursing experience (years)	13.4 ± 12.1	17.8 ± 6.1	15.6 ± 9.3	8.8 ± 13.6	7.8 ± 14.1	8.3 ± 13.1	5.0 ± 3.7	7.8 ± 7.9	6.4 ± 6.0	9.1 ± 10.5	11.1 ± 10.5	10.2 ± 10.3	.13	.59	.84
Critical care experience (years)	12.0 ± 12.4	10.6 ± 5.5	11.3 ± 9.1	8.0 ± 12.4	5.6 ± 9.2	6.8 ± 10.3	2.4 ± 0.6	4.6 ± 5.3	3.5 ± 3.7	7.5 ± 10.2	6.9 ± 6.9	7.3 ± 8.5	.15	.87	.82

Note: Mean and standard deviation reported for continuous data (Mean + SD) and count and percentages (n, (%)) reported for categorical data.
BCST – basic communication skills training, AAC-SLP – basic communication skills training and electronic augmentative and alternative communication device education with an individualized speech language pathologist consultation.
p-value from an *F*-test from two-way Analysis of Variance.
**p*-value using exact estimation in binary logistic regression.

Table 2
Baseline patient characteristics

	Usual care			BCST			AAC-SLP			Total			p-value		
	CTICU ($n = 15$)	MICU ($n = 15$)	Total ($n = 30$)	CTICU ($n = 14$)	MICU ($n = 15$)	Total ($n = 29$)	CTICU ($n = 15$)	MICU ($n = 15$)	Total ($n = 30$)	CTICU ($n = 44$)	MICU ($n = 45$)	Total ($N = 89$)	Group	Unit	Group by unit
Characteristic															
Age (years)	54.1 ± 15.6	58.5 ± 16.1	56.3 ± 15.7	58.4 ± 16.9	57.8 ± 14.7	58.1 ± 15.5	58.4 ± 10.1	53.7 ± 20.8	56.1 ± 16.2	57.0 ± 14.2	56.7 ± 17.1	56.8 ± 15.7	.87	.93	.55
Female*	5 (33)	11 (73)	16 (53)	8 (57)	8 (53)	16 (55)	6 (40)	7 (47)	13 (43)	19 (43)	26 (58)	45 (51)	.64	.25	.23
White*	12 (80)	11 (73)	23 (77)	13 (93)	13 (87)	26 (90)	15 (100)	15 (100)	30 (100)	40 (91)	39 (87)	79 (89)	.03	NA	1.00
Education (years)	13.1 ± 2.2	12.9 ± 1.9	13.0 ± 2.0	13.6 ± 2.8	12.4 ± 2.1	13.0 ± 2.5	14.1 ± 3.7	12.8 ± 2.7	13.5 ± 3.2	13.6 ± 2.9	12.7 ± 2.2	13.2 ± 2.6	.74	.11	.61
Clinical characteristic															
APACHE III score	48.6 ± 9.9	50.3 ± 16.2	49.5 ± 13.2	55.9 ± 11.7	56.3 ± 25.6	56.1 ± 19.8	59.0 ± 13.3	50.5 ± 17.7	54.8 ± 16.0	54.5 ± 12.3	52.4 ± 20.0	53.4 ± 16.6	.27	.56	.44
Days intubated prior to enrollment	62.8 ± 63.5	24.8 ± 13.5	12.6 ± 11.7	64.3 ± 49.7	66.1 ± 78.3	27.9 ± 24.0	80.4 ± 46.7	97.1 ± 119.9	28.7 ± 31.0	69.3 ± 53.2	62.7 ± 86.5	23.0 ± 24.5	.02	.73	.72
Prior history of intubation*	6 (40)	4 (26.7)	10 (33)	2 (14.3)	7 (46.7)	9 (31)	8 (53.3)	8 (53.3)	16 (53)	16 (36.4)	19 (42.2)	35 (39)	.13	.57	.18
CAM-ICU*-delirium present	2 (13)	5 (33)	7 (23)	3 (21)	6 (40)	9 (45)	3 (20)	2 (13)	5 (23)	8 (18)	13 (29)	21 (32)	.68	.48	.53
RASS*-sedated/agitated	12 (80)	11 (73)	7 (23)	12 (86)	7 (47)	19 (66)	13 (87)	11 (73)	24 (80)	37 (84)	14 (64)	66 (74)	.80	.12	.55
Pulmonary disease/infection	10 (67)	13 (87)	23 (76)	2 (14)	11 (73)	13 (45)	7 (47)	11 (73)	18 (60)	19 (43)	35 (78)	54 (60)	.03	.00	.44
Cardio, thoracic, or vascular surgery	4 (27)	0 (0)	4 (13)	13 (93)	2 (13)	15 (52)	10 (67)	3 (20)	13 (43)	27 (61)	5 (11)	32 (36)	.00	.00	.37
Postoperative complications	6 (40)	1 (7)	7 (23)	13 (93)	2 (13)	15 (52)	4 (27)	4 (27)	8 (27)	23 (52)	7 (16)	30 (34)	.04	.00	.00

Note: Mean and Standard Deviation reported for continuous data (Mean + SD) and count and percentages (n, (%)) reported for categorical data.
BCST – basic communication skills training, AAC-SLP – basic communication skills training and electronic augmentative and alternative communication device education with an individualized speech language pathologist consultation, APACHE – acute physiology and chronic health evaluation, CAM-ICU – confusion assessment method for the ICU, RASS – Richmond agitation and sedation scale.
p-value from an F-test from two-way Analysis of Variance.
*p-value using exact estimation in binary logistic regression.

nonverbal communication (e.g. touch, eye contact) during these 5 observed sessions.

Duration of nurse talk varied significantly over the four observation sessions and generally tended to increase in length over the 2-day observation period ($F(3, 228) = 4.14$, $p = .007$). Observation session three had the largest mean duration of nurse talk (seconds) (session 3 = 33.20 vs. session 1 = 24.45, session 2 = 25.72, session 4 = 27.91). (See Fig. 1) Duration of nurse talk did not vary significantly between groups or between units. However when averaging the duration of nurse talk over the observation sessions, differences in talk duration between the units varied significantly by study groups ($p < .001$). In the usual care group, the MICU had a significantly longer mean duration of nurse talk (35.52 vs. 18.23 s) compared to the CTICU. Conversely in AAC-SLP group, the CTICU had significantly longer mean duration of nurse talk when compared to the MICU (34.18 vs. 25.77 s). There was no significant difference in duration of talk between the units in the BCST group.

Results of univariate modeling analyses (i.e. considering one characteristic at a time) are presented in Table 3. Patient characteristics including number of days intubated prior to study enrollment, observation session RASS and observation session GCS, and nurse characteristics including credentials, and years in critical care practice were identified as candidate predictors for the multivariate modeling using the screening criteria of $p < .20$ (See Table 4). Two of these candidate predictor variables, number of days intubated prior to study enrollment and critical care years of experience, were nonlinearly related to duration of nurse talk and were best modeled as a quadratic relationship (linear-quadratic). Two-way interactions were explored and none were deemed statistically significant.

The number of days intubated prior to the observation period and GCS were jointly associated with duration of nurse talk in the parsimonious multivariate model. GCS of ≤ 14 at each session were negatively associated with talk duration ($t = -2.70$, $p = .008$). Days intubated prior to study enrollment had a curvilinear relationship with talking duration (linear $t = -3.24$, $p = .002$, quadratic $t = 2.50$, $p = .013$). The point of inflection was at 23 days of intubation prior to study enrollment.

Discussion

To our knowledge, we were the first to explore the association between nurse and patient characteristics and duration of nurse talk with MV patients in the ICU. As nurses are the main initiators and controllers of communication opportunities in the ICU, it is imperative to understand what can influence nurse communication. Longer duration of nurse talk may help facilitate patient interactions by providing them with more opportunities to interact thus strengthening the nurse–patient relationship and mitigating the negative emotions that patients experience.

This secondary analysis showed that as the number of days that ICU patients were intubated prior to observation increased, talk duration decreased; however at 23 days, the point of inflection,

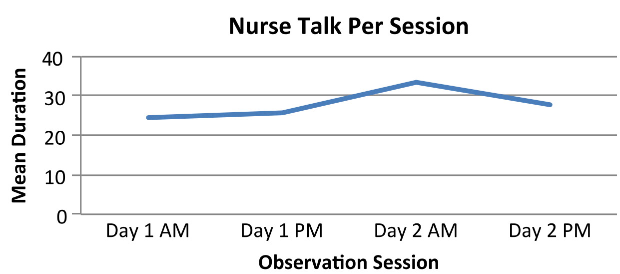

Fig. 1. Mean duration of nurse talk per observation session (in seconds).

Table 3
Associations between characteristics and duration of nurse talk (univariate results)

	b	SE	t-value	p-value
Baseline nurse characteristics				
Age (years)	−0.006	0.015	−0.39	.698
Gender − male	0.416	0.331	1.26	.2125
Credentials − diploma or associate degree	−0.520	0.319	−1.66	.103[a]
Years in nursing practice	−0.004	0.013	−0.28	.781
Years in critical care practice (linear)	0.016	0.032	0.51	.6141[a]
Years in critical care practice (quadratic)	−0.003	0.002	−1.66	.103[a]
Baseline patient characteristics				
Age (years)	0.008	0.008	1.02	.311
Gender − Male	0.239	0.245	0.95	.348
Race − White	−0.502	0.419	−1.20	.237
Education (years) ($n = 88$)	0.035	0.047	0.75	.4582
Baseline patient clinical characteristics				
CAM-ICU − delirium present	0.113	0.292	0.39	.701
RASS − sedated or agitated	−0.1719	0.288	−0.60	.553
APACHE III	0.007	0.007	1.01	.314
Prior Intubation History − Yes	−0.239	0.255	−0.94	.352
Days intubated prior to enrollment (linear)	−0.024	0.008	−3.14	.003[a]
Days intubated prior to enrollment (quadratic)	<0.001	<0.001	2.53	.015[a]
Session-dependent patient clinical characteristics				
CAM-ICU − delirium present ($n = 87$)	−0.182	0.242	−0.75	.452
RASS − sedated or agitated	−0.5129	0.230	−2.23	.027[a]
GCS − score ≤14	−0.801	0.312	−2.57	.011[a]
APACHE III (calculated by day)	0.007	0.006	1.11	.271
Type of intubation − oral intubation	−0.070	0.335	−0.21	.835
Covariate				
Time elapsed from nurse enrollment to first session (days)	0.002	0. 002	1.05	.299

Note: Variable (Referent) − Gender (Female), Race (Black), CAM-ICU (Delirium Absent), RASS (Calm), GCS (Score of 15), Type of Intubation (Tracheostomy).
APACHE − acute physiology and chronic health evaluation, CAM-ICU − confusion assessment method for the ICU, RASS − Richmond agitation and sedation scale, GCS − Glasgow coma scale.
[a] Denote screened variables that were considered jointly in the univariate model.

duration of nurse began to increase. The shift in nurse talk at 23 days may be reflective of the patient status in their illness-recovery trajectory. Earlier in the trajectory, nurses may encounter multiple barriers to talking with MV patients, such as surgery, sedation, patient's illness acuity, interruptions for tests and procedures, whereas later in the trajectory patients are typically more medically stable and the nurse may have become familiar with the patient and their communication methods. Nurses should be aware that attention to communication during the early stage of a patient's ICU stay might be valued by patients and families and may have a positive effect on the patient's psychoemotional response to critical illness. Further research is needed to determine if increased and improved communication during this period has a significant impact on the patient's emotional well being and adjustment to the hospitalization and post-discharge recovery.

Table 4
Associations between characteristics and duration of nurse talk (multivariate results)

	b	SE	t-value	p-value
Baseline nurse characteristics				
Credentials − diploma or associate degree	−0.494	0.322	−1.54	.132
Years in critical care practice (linear)	0.027	0.033	0.83	.411
Years in critical care practice (quadratic)	−0.003	0.002	−1.70	.096
Baseline patient clinical characteristics				
Days intubated prior to enrollment (linear)	−0.022	0.008	−2.78	.007
Days intubated prior to enrollment (quadratic)	<0.001	<0.001	2.50	.016
Session-dependent patient clinical characteristics				
RASS − sedated or agitated	−0.290	0.240	−1.21	.228
GCS − score ≤14	−0.610	0.325	−1.88	.062

Note: Variable (Referent) − Gender (Female), Race (Black), CAM-ICU (Delirium Absent), RASS (Calm), GCS (Score of 15), Type of Intubation (Tracheostomy).
APACHE − acute physiology and chronic health evaluation, CAM-ICU − confusion assessment method for the ICU, RASS − Richmond agitation and sedation scale, GCS − Glasgow coma scale.

The results of this analysis provide confirmation of findings from prior qualitative research that a patient's level of consciousness is a significant factor influencing communication and length of care.[23,25] Our study is the first to provide an actual quantifiable measure of nurse communication demonstrating that nurses talked less to patients who were not completely alert and oriented during bedside care. Because the GCS's verbal score was adapted to accommodate the patient's ability to communicate using nonvocal methods, the difference in a score from 15 to 14 likely reflects a reduced level of consciousness or responsiveness. Clearly, nurses are inclined to talk more to patients who are awake, alert, and oriented during bedside care than patients who have to be aroused or reoriented.

Finally, ours was the first study to use video recording and microanalysis for accurate time measurement of nurse communication in the ICU. Duration of nurse talk ranged from 0 to 123 s per 3-min observation session. Measures of duration of nurse talk as a component of nurse–patient communication were not conducted or reported in previous observational studies of nurse–patient communication.[23–27] Moreover, those studies occurred 10 to 25 years prior to the present study. It is likely that the environment of the ICU has changed over these last two decades as a response to increased technology and changing patient characteristics. For this analysis, measurement of nurse talk was limited to a 3-min video recorded observation session for consistency, which limits the duration of interaction. Our median duration of nurse talk (23–35 s) in 3-min periods (approximately 14%) may be proportionally similar to previous studies.[23] Future studies should compare 3-min sessions to longer interaction sessions to ensure that proportion of nurse talk is similar and that artificially limiting sessions do not bias estimation of the proportion of nurse talk time.

A consistent intervention effect across the study groups was not seen in this analysis. The only intervention effect identified was for the AAC-SLP study group and the effect was not seen across both units. The lack of intervention effect on duration of nurse talk is somewhat expected because the interventions implemented in the SPEACS study focused on enabling and facilitating *patient* communication. Nurses were taught techniques to more actively engage and interpret patient communication, which should not necessarily lead to the nurse talking for longer periods of time.

Limitations

One of the main concerns in secondary analysis is the quality of the data.[47,48] To ensure data quality, the SPEACS study maintained an inter-rater reliability of $r > .90$ on several of the measures, including APACHE III, GCS, CAM-ICU, RASS and duration of nurse talk, that were used in this secondary analysis. Although inclusion in this study was not restricted by race, all patient participants were either White or Black thus limiting the external generalizability to other racial groups. With limited variability in the GCS and RASS scores, collapsing of the categories was necessary. This resulted in some loss of information and inability to analyze more discriminatory aspects of these two variables. In addition, the missing CAM-ICU data in each observation session could have impacted statistical power when examining the associations between delirium and duration of nurse talk. Finally, the video recorded observation sessions were limited to 3 min in length for this analysis. While all observation sessions lasted at least three minutes, there were sessions that lasted in excess of five minutes. Limiting the interaction to three minutes for this analysis provided an equal timeframe for measuring nurse talk duration but in doing so artificially limits and censored actual duration of nurse–patient interaction.

Clinical implications

Nurses can use these findings to be more deliberative in communication interactions with patients who are in the early stages of critical illness and those who are experiencing a decreased level of consciousness. Therapeutic nurse communication with these patients may help reduce the negative emotions patients experience during mechanical ventilation and critical illness. In addition, improved communication may result in reduced need for sedation, thereby impacting length of stay and other untoward clinical outcomes, a more satisfying experience for patients and family members and a more satisfying practice for ICU nurses.

Conclusions

These findings have the potential to significantly impact the future research on critically ill, mechanically ventilated adults. Length of time intubated, and level of cognition influences nurse–patient communication and should be considered when developing studies aimed at enhancing communication between nurses and mechanically ventilated patients. In addition, more research is needed into the role that the illness-recovery trajectory has on communication. Specifically, understanding changes in patient communication patterns and needs over time in the ICU can help tailor communication interventions to best meet patient–nurse communication needs. Finally, nurses should allow and prioritize time for communication during the early stages of ICU admission and focus on methods of communicating with patients with decreased responsiveness.

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