MULTIDISCIPLINARY TEAMWORK PERCEPTIONS WHEN MOBILIZING VENTILATED NEUROSURGERY PATIENTS

by

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Submitted in partial fulfillment of the requirements for the degree of
Doctor of Philosophy at
The University of Texas at Arlington
May, 2023

Arlington, Texas

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ABSTRACT

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This two-manuscript dissertation focuses on mobilization in ventilated neurosurgery patients along with the nursing and multidisciplinary perceptions associated with this patient care task. The first manuscript consists of a published comprehensive literature review based on 20 published articles from the years 2010-2020. This review provides background information on the topic of mobility, nursing and provider perceptions, and teamwork for vulnerable critically ill populations including neurosurgery patients on mechanical ventilation. The evident gaps in knowledge based upon these findings and premise for the second article will also be discussed.

The second manuscript submitted for publication focuses on a quasi-experimental pilot study aimed at exploring multidisciplinary teamwork perceptions when mobilizing ventilated neurosurgery patients at a medical center's neuroscience intensive care unit (NSICU) with and without a nurse-led protocol. Multidisciplinary teamwork perceptions were assessed via the Nursing Teamwork Survey tool. The findings from this study will be examined, as well as limitations and future implications for the field of nursing and nursing research.

ACKNOWLEDGMENTS

I would like to thank the faculty at the University of Texas at Arlington College of Nursing and Health Innovation for their support in my Ph.D. journey over the past few years. Their sincere dedication to further my knowledge in nursing research is unparalleled to what I have experienced in the past. I would also like to acknowledge my dissertation committee members, Drs. Behan, Cipher, and Daniel, for their encouragement and steadfast commitment to assist me in achieving my academic goals. Additionally, the second study would not have been possible without the support and participation from management and staff at the University of Southwestern Medical Center's Neurosciences Intensive Care Unit, especially Byron Carlisle, who has always encouraged me to explore and pursue various opportunities in the field of nursing.

DEDICATION

For with God, all things are possible.

Firstly, this dissertation is dedicated to my academic mentor and dissertation chair, Dr. Deborah Behan for opening my eyes to a world of endless possibilities in nursing science. From the time I was an honors student in the BSN program at UTA to years later when I decided to pursue my Ph.D. in nursing, you have been a constant believer in my abilities to achieve desired goals, regardless of my age or growing experience. Your passion to further promote holistic nursing care, while staying humble, kind, and true to one's self are qualities I aspire to carry forward in my career following graduation. There are not enough words to describe how much your guidance and seeing my potential as your student, has positively impacted my motivation to reach milestones along the way. Please know you have left a lasting impression on those around you, including me, as one of the finest role-models in nursing academia and research. I will always remain grateful and honored for being mentored by you.

I would also like to dedicate this dissertation to some of the greatest supporters I am fortunate to have with me throughout my journey including my loving husband, Josh, who has fully supported my ambitions and continually reminded me to persevere until I reached the finish line. Regardless of any achievement, you will continue to be the biggest blessing in my life. To my mother, thank you for your unceasing prayers and encouragement. I would not be here without them. To my father, thank you for teaching me the importance of education and power of academic and professional writing. Finally, to my dear brother, Jonathan, thank you for challenging me intellectually and spiritually from the very start. Thank you for joining me in exemplifying resiliency when facing challenges in both healthcare and academia. What once seemed like a childhood dream, is now turning into a reality by God's grace in our lives.

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CHAPTER 1

INTRODUCTION

Multidisciplinary teamwork is essential in delivering holistic care to critically ill populations, such as ventilated neurosurgery patients. Mobilization of this vulnerable population is one aspect of missed care and is problematic since immobility is associated with severe negative short-term and long-term clinical outcomes (Epstein, 2014; Karic et al., 2017; Panda et al., 2019). Approximately 13% hospitalized bedridden patients are at risk of developing at least one major complication associated with immobility (Wu et al., 2018). Complications including pressure ulcers, respiratory decompensation, pneumonias, deep venous thrombosis/pulmonary embolisms, and infection may result (Epstein, 2014; Wu et al, 2018). Although a lack of information on specific associations between levels of mobility and neurosurgery exists, consequences are similar to those previously stated. Additionally, cognitive, neuromuscular, functional, and psychological deterioration may be associated with neurosurgery patients (Karic et al, 2017). For example, immobility interferes with spine surgery patients' healing and increases risk of thromboembolic events (Panda et al., 2019).

Background and Significance

Teamwork is a significant predictor of missed nursing care, accounting for 11% variance in missed nursing care (Kalisch & Lee, 2010). Among these facets of missed nursing care is patient mobilization. Research studies associate using teamwork to achieve early mobilization, to positive clinical outcomes including decreased length of stay, increased rates of mobility, and

faster time to early mobilization in critically ill populations (Lall & Behan, 2022; Dubb et al., 2016; Hickmann et al., 2016).

High levels of perceived teamwork are associated with decreased levels of missed care worldwide (Ghezeljeh et al., 2021; Kalisch et al., 2012). Furthermore, understanding teamwork is essential to improving its quality in the healthcare setting (Rosen et al., 2018). Multidisciplinary teamwork has been suggested to overcome barriers in performing patient care interventions in acute care settings (Nydahl et al., 2014; Olkwoski & Shah, 2017; Titsworth, 2012). Such principles should also be considered for mobility in the context of specific patient populations including ventilated neurosurgery patients.

Teamwork experts suggested studying the effects of an intervention on multidisciplinary teamwork perceptions could provide evidence for team effectiveness (Kalisch et al., 2010). Yet, few studies utilizing these teams have been conducted, particularly for recovering ventilated neurosurgical patients. Nurse-led interventions to engage postoperative patients in early mobility activities may increase maximum mobility, lower complication rates, decreased average hospital and ICU length of stay, hospital costs, and morbidity (Klein et al., 2015; Kumar et al., 2020; Leong et al., 2017). Studies implementing nurse-led mobility interventions are available (Bahouth et al., 2018; Moyer et al., 2017; Rupich et al., 2018; Young et al., 2019). However, no quantitative studies comparing perceptions of multidisciplinary team members participating in nurse-led versus non-nurse-led teams following a patient care intervention have been conducted.

Rationale for Manuscript One

While literature on the benefits of early mobility and implications of immobility in critically ill populations are abundant, little is known regarding the incidence of mobilization in specific patient populations, including ventilated neurosurgery patients. Experts believe mobility

in this population is overlooked due to perceived barriers. Neurosurgeons speculate that mobilizing patients with hemodynamic instability, acute hemiplegia, altered consciousness, intracerebral pressure and perfusion changes, visual field loss may lead to exacerbation of deficits or dislodgment of indwelling devices (Castro-Avila, 2015; Klein et al., 2015) Notably, clinical trials show mixed results when it comes to patient outcomes in this patient population (Karic et al., 2017; Klein et al., 2015). Physician perceptions regarding mobility challenges in neurocritical patients are well-established. However, the perceptions of nurses and multidisciplinary staff members who are actually responsible for performing mobility have not been collectively examined. Therefore, the first manuscript aimed to explore what is known regarding nursing perceptions on mobilization and multidisciplinary team roles for mobilization in ventilated neurosurgery patients.

Rationale for Manuscript Two

The review of literature in manuscript one demonstrated a continued need for understanding nursing perceptions and role in teamwork to mobilize ventilated neurosurgery patients. Results in the first manuscript and further review of existing literature provided evidence that perceptions in teams caring for neurosurgery patients who are also ventilated are unavailable. Studies focused on analyzing teamwork dynamics in general, were limited to teams solely composed of nurses, nursing assistants, and unit secretaries (Lall & Behan, 2022), while others included physicians and nurses (Dubb et al., 2016) or nurses only (Boehm et al., 2020). Hence, studies regarding perceptions of teamwork, which integrate vital staff members belonging to other disciplines, such as respiratory therapy (RT) and physical therapy (PT), to complete patient care tasks, for example mobilization, are also needed.

While qualitative studies which analyze nursing teamwork perceptions following an

intervention via interviews are available (Dubb et al., 2016), quantitative studies providing statistical comparisons between control and interventional groups for such perceptions are scarce. Previous quantitative studies utilized a survey to analyze perceptions solely related to structural barriers (such as staffing and equipment availability) for mobility, rather than barriers related to teamwork dynamics (Boehm et al., 2020; Jolley et al., 2014). The Jolley et al. (2014) study was further limited as it was not guided by a theoretical framework and took place solely on a single medical intensive care unit (ICU).

These gaps in literature served as the premise for the second study, which aimed to answer the following research question: *Will implementation of a nurse-led protocol using a multidisciplinary team significantly affect teamwork perceptions when mobilizing ventilated neurosurgical patients?* By determining whether levels of teamwork vary or not between nurse-led and non-nurse-led mobility implementation, nurses and nursing management can determine what changes, if any, need to be made to mobility policies and procedures to promote the most feasible and optimal levels of mobility on the unit in critically ill patients. Such action enables nursing staff to advocate for altruistically altering unit culture and sustain increased levels of mobilization for recovering ventilated neurosurgery patients. Nurse-led mobility protocol implementation may also result in an increase in safely achieving early mobility goals within the vulnerable population of ventilated neurosurgery patients, which will further promote healing.

Theoretical Framework

Salas' teamwork theory was developed to serve as a framework for researchers and practitioners to analyze performance, processes, and effectiveness of a team during high stakes situations (Salas et al., 2005). Although this middle-range theory originates from psychology, it is highly generalizable to other research fields, including nursing. Upon searching current

nursing literature, studies in which the teamwork theory has been applied are available (Bragadóttir et al., 2016; Costello et al., 2021; Goh et al., 2020; Kaiser & Westers, 2018; Kalisch et al., 2010; Kalisch, Labelle, et al., 2013; Kalisch, Xie, et al., 2013; Polis et al., 2017; Rochon et al., 2015). These studies demonstrate that the teamwork theory can be utilized as an appropriate framework to guide nursing research studies, specifically those which aim to describe teamwork among nurses and multidisciplinary staff.

Concepts

The five core concepts, known as The Big Five to promote effective teamwork include team leadership, mutual performance monitoring, backup behavior, adaptability, and team orientation. Salas et al. (2005) also describe the concepts of shared mental models, mutual trust, and closed-loop communication, which are coordinating mechanisms necessary for successful teamwork. The final concept defined is the outcome of team effectiveness (Salas et al., 2005).

Of The Big Five, team leadership refers to directing and coordinating team member activities, assessing team performance, assigning tasks, among holding other responsibilities (Salas et al., 2005). For example, the bedside nurse may become a team leader when taking on responsibility to safely coordinate ambulation of a critically ill patient and delegate roles to members of a mobility team. Secondly, mutual performance monitoring is developing a baseline understanding of the environment and applying task strategies appropriately to monitor team performance. Backup behavior is the capacity to anticipate the needs of other team members via correct knowledge regarding their responsibilities (Salas et al., 2005). Adaptability refers to adjusting strategies based on observations of the environment (Salas et al., 2005). For example, if a nursing team member notices a patient's blood pressure dropping critically low while turning, he/she must adapt to the change by repositioning the patient quickly and safely in hopes of the

patient's blood pressure returning to baseline/normal. Team orientation is accounting for other members' behavior during interactions and placing the team's goals over one's own (Salas et al., 2005).

The first concept which serves as a coordinating mechanism is shared mental model—an organized structure of relationships among the task at hand and the interaction of team members (Salas et al., 2005). An example of a shared mental model utilized by intensive care unit nurses is a standardized team rounding template to coordinate daily patient care activities verbally and via written orders. Next, mutual trust is the belief that members will perform their respective roles and protect interests of fellow teammates (Salas et al., 2005). Thirdly, closed-loop communication refers to a sender and receiver exchanging information (Salas et al., 2005). Lastly, team effectiveness is the holistic perspective of whether the team completed the task and how the team interacted to achieve the team outcome (Salas et al., 2005).

Assumptions

There are ten propositions which can be identified based upon the theoretical framework. A model can be utilized to graphically depict the concepts and propositions of the theory (see Appendix A). Notably, there are direct and indirect, positive relationships between the concepts and the final outcome of team effectiveness. For example, team leadership and orientation are necessary for backup behavior and mutual performance monitoring (Kalisch et al., 2010). Also, team effectiveness is directly impacted by mutual performance monitoring and backup behavior, the latter of which is facilitated by adaptability (Kalisch et al., 2010). Shared mental models and trust are needed for mutual performance monitoring and communication to occur (Kalisch et al., 2010). Team effectiveness is directly impacted by adaptability and indirectly affected by shared mental models (Kalisch et al., 2010).

Application

Studies utilizing a theoretical framework to assess perceptions regarding multidisciplinary teamwork are scarce. Using such a guide, like the teamwork theory, provides increased clarity and organization for studies, particularly when it comes to decision-making factors for mobilization. Few tools have been developed to collectively operationalize the concepts within teamwork theory. One such tool which encompasses five of these concepts and was utilized as the primary measurement tool for this research study is the Nursing Teamwork Survey (NTS) (Kalisch et al., 2010). Therefore, for the purposes of this study the concepts of interest, which will be operationalized and measured using the NTS include team leadership, team orientation, trust, shared mental models, and backup behavior. Permission to NTS in the pilot research study in manuscript two was obtained by its creator, Dr. Beatrice Kalisch (see Appendix B).

Salas' teamwork theory has rarely been applied to team-based patient care interventions, such as mobilization. By conducting more interventional studies, each desired concept's effect on the outcome of teamwork can be evaluated. The significance of conducting such studies lies in nurses and hospital management further developing and implementing action-based interventions which take multidisciplinary teamwork perceptions into consideration. In the case of mobilizing ventilated neurosurgery patients with use of multidisciplinary teams, areas of improvement can be pinpointed via result analysis of the measured concepts. By evaluating the results of perceptions provided by nurses and other multidisciplinary team members during the mobilization process for ventilated neurosurgery patients, researchers can identify where a change is needed in the process. A specific example would be if the scores for the survey item of "knowing where assistance is needed before being asked" (Kalisch et al., 2010, p. 46) is low as

perceived by members of the multidisciplinary mobilization team, then this signifies room for improvement in the concept of backup behavior. Per the teamwork theory by Salas et al. (2005), improved backup behavior is directly and positively correlated with adaptability and team effectiveness. Therefore, an intervention, such as focused education to nurses and other members of the multidisciplinary team, could be implemented. Results from the NTS can then be analyzed to evaluate whether these weaknesses during the mobility process have in fact been addressed. Resultingly, researchers can create and incorporate protocols/guidelines for standardized use by multidisciplinary teams to mobilize ventilated neurosurgery patients. Ultimately, this will help achieve higher rates of mobilization with numerous benefits and it contributes to the holistic care nurses strive to provide to their patients. Results should also be compared between nurse-led multidisciplinary teams and non-nurse-led multidisciplinary teams in order to determine which type of team may be structurally desirable for mobility implementation in specific patient populations such as ventilated neurosurgery patients.

Definitions of Terms

The definition for what constitutes a multidisciplinary team, was adapted from the literature and is a group of two or more healthcare providers, belonging to any of the following disciplines: licensed nurses, patient care technicians (PCTs), RTs and/or PTs (Ervin et al., 2018; Kalisch et al., 2009). Multidisciplinary teams could also include additional personnel belonging to any of these disciplines to ensure safety during patient mobility activity, as long as at least two members belonged to different disciplines.

Ventilated neurosurgery patients are those admitted to the neurosciences intensive care unit (NSICU) in a medical center located in a large urban setting, who had neurosurgery during

the current hospitalization and were simultaneously on mechanically ventilated-assisted breathing via oral or nasal endotracheal tube and/or tracheostomy.

While numerous definitions of mobilization exist in the literature, mobilization is defined as physical activity performed with the appropriate intensity, which produces physiological benefits (Castro-Avila et al., 2015). Specifically, progressive mobility consists of assisting the patient to transition from lying in bed, to sitting up in bed in the chair position, to sitting at the edge of the bed and dangling his/her feet, to standing, to taking steps, then ambulating as tolerated.

Overview

This two-manuscript dissertation will focus on mobility in ventilated neurosurgery patients and perceptions associated with this patient care task. The first manuscript is a published comprehensive literature review which provides background on mobility, nursing and provider perceptions, and teamwork for vulnerable critically ill populations including mechanically ventilated neurosurgery patients. The second manuscript submitted for publication provides details on a quasi-experimental pilot study, which aimed to explore multidisciplinary teamwork perceptions when mobilizing ventilated neurosurgery patients at a medical center's neuroscience intensive care unit (NSICU) with and without a nurse-led protocol. This dissertation will also discuss limitations and future implications for the field of nursing and nursing research.

CHAPTER 2

MANUSCRIPT ONE

A formal review of literature was not provided for this dissertation as agreed upon by dissertation committee members, since the first manuscript consisted of an integrative literature review pertaining to the topic of interest. A brief summary of available and relevant literature was also provided in introductory sections for the second manuscript.

This is a non-final version of an article published in final form in the *Journal of Neuroscience Nursing*. The link for this journal article is: https://journals.lww.com/jnnonline/Abstract/2022/02000/Mobilizing_Ventilated_Neurosurgery_Patients__An.4.aspx. A pinch table for the studies retained for synthesis in this manuscript was published as Supplemental Digital Content (see Appendix C).

APA Reference

Lall, A., & Behan, D. (2022). Mobilizing ventilated neurosurgery patients: an integrative literature review. *The Journal of neuroscience nursing: journal of the American Association of Neuroscience Nurses*, *54*(1), 13–18. https://doi.org/10.1097/JNN.0000000000000624

Mobilizing Ventilated Neurosurgery Patients: An Integrative Literature Review

Abstract

BACKGROUND: Lack of mobilization in ventilated neurosurgery patients is problematic due to significant consequences.[1,2] While early mobility addresses these complications, few studies have been conducted in this population, resulting in infrequent mobilization efforts.[3] Nurses prioritize and implement patient care interventions, including mobilization, with use of multidisciplinary teams. Therefore, this integrative literature review examines what is known regarding nursing perceptions on mobilization and their role within a multidisciplinary team for mobilization in ventilated neurosurgery patients. **METHODS**: A comprehensive literature search was conducted utilizing online databases to identify research articles on early mobility studies in ventilated critically ill and neurosurgical patients from 2010-2020. **RESULTS**: Twenty studies were identified and indicated a paucity of research specific to mobilizing ventilated neurosurgery patients. Nurses understand the purpose and benefits of early mobility in critically ill and mechanically ventilated patients. Mixed perceptions exist regarding the responsibility for prioritizing and initiating mobilization. Main barriers include patient safety concerns, untimeliness due to limited resources, unit culture, lack of nursing knowledge, and need for improved teamwork. Associations between teamwork-based interventions and decreased LOS, increased rates of mobility, and faster time to early mobilization, exist. Nurse-led interventions showed additional benefits including positive perceptions such as empowerment, confidence, increased knowledge, and a progressive shift in unit culture. **CONCLUSION**: This review demonstrates a continued need for understanding nursing perceptions and role in teamwork to mobilize ventilated neurosurgery patients. Future research should focus on testing nurse-led

mobility interventions so higher rates of mobilization and provision of holistic patient care can be achieved.

Introduction

Neurosurgical patients frequently require mechanical ventilation to sustain postoperative respiratory needs. They are often placed on bedrest and do not participate in mobility exercises until extubated. Furthermore, nurses prioritize and implement interventions, including mobilization, with multidisciplinary teams to effectively provide holistic care. An overall paucity of nursing research regarding mobility in ventilated neurosurgical patients exists. This literature review aims to explore nursing perceptions and the nurse's role within a multidisciplinary team for mobilization in ventilated neurosurgery patients. By understanding these perceptions, researchers can develop future interventional studies for this vulnerable patient population.

Background

Lack of mobilization is problematic and results in pressure ulcers, respiratory decompensation/pneumonias, deep venous thrombosis/pulmonary embolisms, and infection.[1,2] In fact, global studies reveal approximately 12.72% of hospitalized bedridden patients develop at least one major complication from immobility.[2] Although little is known regarding the association between mobility and neurosurgical outcomes specifically, immobility complications in neurosurgical patients are akin to those found in critically ill patients, with few exceptions.[4] For example, experts note immobility places subarachnoid hemorrhage (SAH) patients at increased risk for cognitive, neuromuscular, psychological, and functional deterioration, and cerebral vasospasm.[4]

Mobilization is physical activity which produces physiological benefits with proper intensity.[5] Due to a lack of interventional studies, the benefits of early mobilization specific to

the neurosurgical population are unknown.[6,8] However, research shows engaging postoperative patients in mobilization increases maximum mobility and decreases complications, average hospital and intensive care unit (ICU) length of stay (LOS), hospital costs, and morbidity.[6-8]

Despite these benefits, data shows little mobilization in neurosurgical patients, regardless of mechanical ventilation status.[3] Although expert guidelines for safety parameters exist for multidisciplinary teams caring for this population,[9-11] a lack of mobility implementation exists.[12] Neurosurgeons speculate that mobilizing patients with hemodynamic instability, acute hemiplegia, altered consciousness, intracerebral pressure and perfusion changes, visual field loss may lead to exacerbation of deficits or dislodgment of indwelling devices.[5,6] Notably, clinical trials show mixed results when it comes to patient outcomes in this patient population.[4,6] While literature supporting physician perceptions regarding mobility challenges in neurocritical patients is well-established, nursing perceptions regarding this topic is scarce.

Methods

A comprehensive literature search was conducted utilizing CINAHL Complete, PubMed, PubMed Central, and Cochrane Library. Inclusion criteria consisted of full-length, primary source research articles, in English, published from 2010-2020. The following key words with their variants were used: mobilizing, ambulation, mechanical ventilation, neurosurgery, nursing perceptions, nursing teamwork, nurse-driven, nurse-led, mobility protocol, and ambulation protocol.

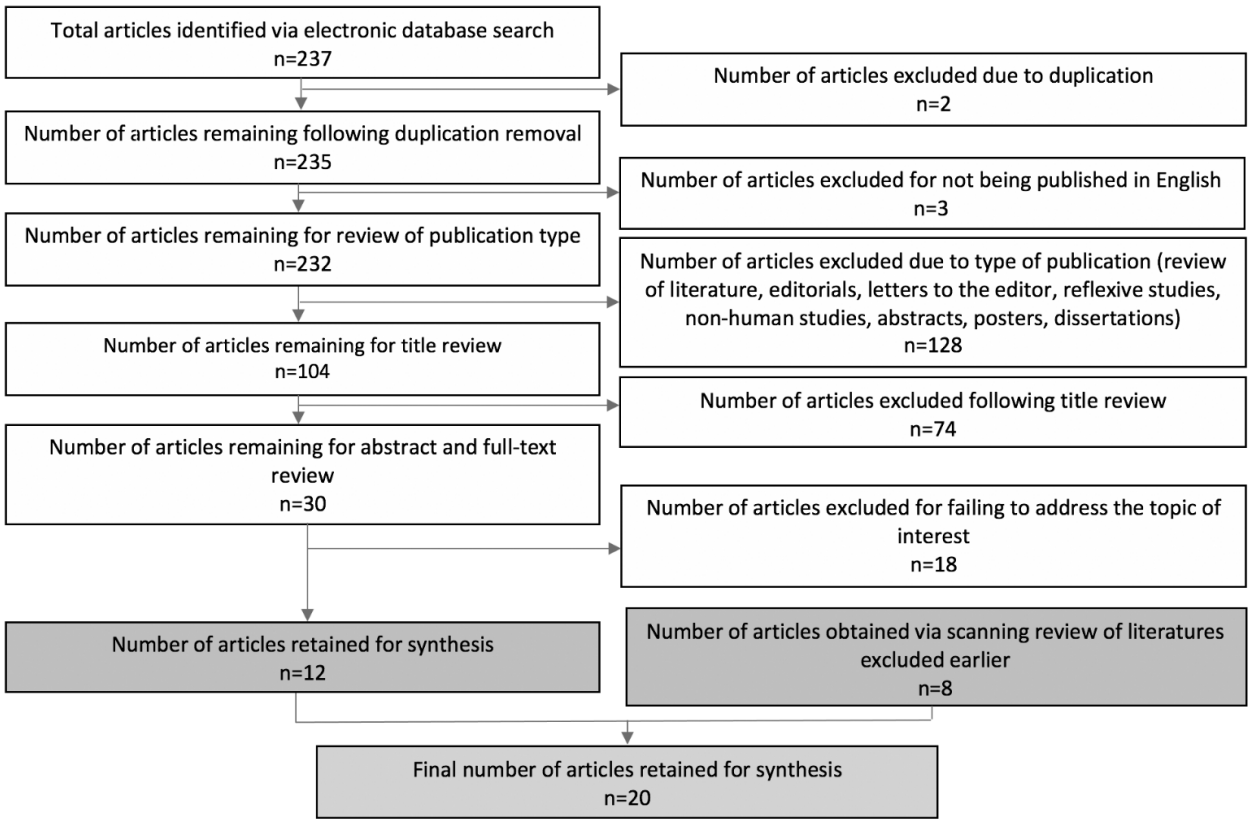
Results

A notable lack of research studies regarding mobility in the neurosurgical population was evident. Therefore, those pertaining to critically ill patients with and without mechanical ventilation were considered. Twenty studies were retained for synthesis including four

qualitative, fifteen quantitative, and one mixed methods study, which are summarized in Table 1. Figure 1 illustrates search outcome via flow diagram. Three themes emerged per results review regarding nursing perceptions: purpose and benefits of early mobility, responsibility of initiation, and barriers. These repeated themes were illustrated according to presence of an association between mobility-related intervention and nursing perceptions. Two themes pertained to teamwork in early mobilization: multidisciplinary team (not nurse-led) and nurse-led teamwork interventions. These were demonstrated according to presence of a significant association between nurse's role in a mobility team and the effectiveness of early mobilization in critical patients. Strengths and weaknesses were compared regarding generalizability, sample obtained, and study design.

Figure 1

Flow Diagram for Retrieved Articles



Nursing Perceptions

Purpose and Benefits of Early Mobility

Researchers reported nurses accurately comprehend early mobility prevents complications, promotes engagement to surroundings and independence for activities of daily living, meets unit standards, and reaches predetermined goals.[13,14] However, obscurity is present regarding the existence of an association between mobility protocol use and nursing perceptions. While nurses in one study were aware a mobility protocol was available at their hospital facility,[13] information was not provided on whether nurses knew such protocols were available at their facility in the other study.[14]

Responsibility of Initiation for Mobility Goals

One study examined perceptions by interviewing medical-surgical nurses who believed patient ambulation was nurses' responsibility with physical therapy (PT) collaboration and included appropriate activity orders to diminish risks and adjust necessary resources.[15] This group was reported more likely to ambulate patients. The second nursing group believed mobilization was PT or physicians' responsibility and deferred ambulation initiation decisions. Half of the nurses received additional training in the Nurses Improving Care of Health systems Elders (NICHE) mobility intervention. NICHE nurses showed a stronger sense of responsibility to ambulate than control group nurses.[15] A small sample size of nurses (n=25) who cared for geriatric patients limits generalizability of findings to nurses caring for other populations. Likewise, a large number of ICU nurses believed mobilizing critically ill patients was detrimental due to high illness acuity.[13,16] These nurses resultingly believed PT was primarily responsible for exercising critically ill patients. Aforementioned studies supported these mixed

perceptions in which nurses believed either they themselves or PT was responsible for initiating mobility.[13,14]

Nursing perceptions varied in studies utilizing team-based mobility interventions. Nurses were more likely to initiate mobility in two studies,[15,29] while in a third study, nurses felt more empowered to consult PT and occupational therapy (OT) after the mobility intervention.[16] A significant correlation was reported between the mobility intervention and number of ambulated patients within 72 hours of admission (20.2%; P<.001 for ICU and 71.8%; P<.001 for intermediate care unit patients).[16] Missing demographics and/or single site usage limited generalizability of the studies.

Barriers

Nine studies addressed nursing barriers to initiate or progress mobilization including patient safety concerns, untimeliness due to limited resources, unit culture, lack of nursing knowledge, and need for improved teamwork.[11,13-15,17-21] ICU nurses expressed anxiety and fear of adverse events (falls and equipment failure), causing mobility omission.[13,14] Mobilization was also hindered due to hesitant nurses seeking provider confirmation and having lengthy pre-mobilization preparation.

Neurosurgical patients are at high risk of falls and impulsivity due to factors including sedation and physiologic consequences of neurosurgery. Nurses feared such behaviors during mobilization could further hinder patient healing by causing physiologic instability or pain.[17-19] However, researchers report mobilizing neurosurgical patients with external ventricular drains (EVDs) was safe and feasible with the proper precautions embedded in a nurse-driven mobility protocol.[19] One limitation included inconsistent data collection of mobility session duration.

Unit activity, limited resources and patient availability, and nursing practice variation contributed to omitted mobilization.[13] For example, unit activity is a barrier when insufficient staff is available to care for patients during unit admission peaks or patient deterioration. Similar to other studies,[11,17,18] nurses noted inconsistent decision-making concerning mobility level, frequency, and duration of activity. Unit culture also posed a barrier in nurses not prioritizing mobilization since it was not considered routine.[13,14] Also, although ambulation protocols existed, bedside nurses were unaware of their presence at their hospital and expressed deficient education to safely progress mobilization.[14,18]

Education interventions may reduce barriers when mobilizing mechanically ventilated patients, as trauma nurses reported satisfaction in receiving appropriate training, understanding proper patient referral to OT, educating patients to increase physical activity, and identifying patient resistance.[20] This was consistent with the aforementioned study demonstrating a positive association between the NICHE mobility program intervention and ambulation initiation.[15] However, the aforementioned study lacked objective outcome measures to confirm that the intervention positively affected nursing practice and patient outcomes.[15]

Minimal ambulation efforts were also associated with ineffective teamwork. Notably, researchers identified that teamwork significantly accounted for 9% of missed care ($P<.001$) because of inadequate labor resources, material resources, and communication.[21] Although this study had a large sample size (n=334), the significance of results for individualized units is unknown. Furthermore, baseline data regarding inclusion of mechanically ventilated or neurosurgery patients was not specified.

Teamwork in Mobilization

Eight studies described the use of multidisciplinary teams (not nurse-led) to overcome

obstacles and accomplish mobilization.[10,11,17,22-26] Research supports safe and feasible mobilization, even in mechanically ventilated patients, within 24 hours of ICU admission.[17] A multidisciplinary team protocol was used to assess physiological limitations to early mobilization, which led to successful patient mobilization as evidenced by few adverse events. A major weakness included active PT sessions for only 61% of cases, due to staffing availability. Although another study supported these findings,[11] the nursing role within the protocol remains ambiguous due to imprecise data collection.

One study mobilized ventilated patients via the early goal-directed mobilization (EGDM) algorithm, resulting in significantly doubled mobility rates.[10] A separate study also using the EGDM algorithm significantly increased mobility levels in surgical populations. Additionally, LOS decreased and functional mobility at discharge improved. Neurosurgical patients from an ICU in the United States comprised 3% of the sample. Study limitation includes non-blinded patient group assignments.[22]

Nurses performed passive mobility activities, while PT/OT performed all other mobility in a study utilizing the ABCDEF (Assess, prevent and manage pain; Both spontaneous awakening and breathing trials; Choice of analgesia and sedation; Delirium assessment, prevention and management; Early mobility and exercise; and Family engagement and empowerment) bundle to promote holistic care of ICU patients.[23] Ultimately, combining the ABCDEF bundle and the American Association of Critical-Care Nurses protocol significantly increased mobility levels and decreased LOS, delirium, and complications among neurosurgery patients.[23]

Quantitative studies suggested a hospital-based algorithm utilized by multidisciplinary teams (not nurse-led) results in safe and feasible mobilization for patients with external

ventricular drains (EVDs).[24,25] However, the study which retrospectively analyzed implementation of a PT-led protocol involving nurses had questionable findings due to its small sample size (*n*=18) and lack of hypothesis testing to compare pre-/post-intervention outcomes.[24] Teams in the other study mobilized patients solely during PT/OT sessions in which nurses only monitored/managed EVDs. Authors found daily interdisciplinary screening resulted in decreased average length of time to first mobilization (18.7 to 6.5 days) in the intervention group versus control group.[25]

A qualitative study revealed team physicians primarily opted for patient participation in physical activity based on patient hemodynamics, medical and neurosurgical stability, rather than nurse opinion. PT/OT led early mobility sessions, while nurses monitored vital signs and change in patient symptoms/condition with clamped EVDs. Consequently, mobilization in EVD patients was safely achievable. However, usage of a mobility protocol was unspecified for this study. [26]

The literature review yielded several studies pertaining to nurse-driven teamwork.[7,16,18,19,27-29] Researchers developed a protocol to mobilize neurosurgical spine patients, in which nurses and patient care technicians independently led mobilization. Nurse practitioners (NPs) or physicians adjusted medications if pain hindered mobility efforts. High protocol compliance resulted in a significant nine-hour LOS reduction per hospitalization reduction as well as a shift in unit culture.[18] This result was supported by a separate study which implemented the Progressive Upright Mobility Protocol (PUMP) Plus, emphasizing nursing education implementation in neurosurgical care.[27] Additional outcomes included decreased hospital acquired infections and associated medical costs.[18]

Researchers implemented mobilization in three phases among patients with SAHs and EVDs. Phase 0 (baseline) retrospectively identified patients with SAH. Phase I was led by

PT/OT, with the bedside nurse present during all mobilization. A nurse-driven protocol was implemented for Phase II. During the last phase, nurses mobilized patients before PT/OT evaluation and implemented autonomy to monitor/drain cerebral spinal fluid as needed. Nurse-led mobilization during Phase II resulted in more frequent mobilization (average of 7 sessions in Phase II versus an average of 3 sessions in Phase I).[19] However, some results were inconsistent with those of previous studies.[18,25] Researchers of the present study found no significant differences between the two phases versus a study in which ICU LOS was lower in Phase II compared to Phase I.[18] The present study revealed no significant differences between the two groups, while another study revealed multidisciplinary mobilization was associated with earlier mobilization.[25]

Nurses were responsible for patients' daily readiness assessments and the response to current therapies used in a study's phase-based, nurse-driven protocol.[28] Although protocol compliance increased over time like aforementioned studies, there was no significant decrease in pressure ulcers as originally hypothesized. Also, the inconsistent outcome of significantly increased ICU LOS compared to a previous study[18] may be attributed to higher acuity patients in the post-intervention group.

A majority of nurses (75%) including neurosurgical ICU nurses mobilized ventilated patients using passive ROM, active ROM, or both at least three times per twelve-hour shift.[7] Consequently, authors suggested nurse-led multidisciplinary teams should be utilized to identify patient readiness for early mobilization implementation. Results varied from a previous studying taking place in Australia[21] and may be attributed to practice differences between countries.

Associations exist between nurse-driven protocols prioritizing training and positive nursing perceptions. Nurses felt empowered to make their own assessment and appropriately

consult PT/OT upon utilizing the Move to Improve protocol. Ultimately, rates of mobilization significantly rose from 6.2% in non-ventilated ICU patients and 15.5% in IMCU patients during pre-intervention to 20.2 % and 71.8% respectively in postintervention.[16] Likewise, another study evaluated nursing perceptions and outcomes of the MOVIN protocol including increased ambulation frequency per week and distance.[29] Along with ambulation becoming more visible on the unit, nurses expressed increased confidence and support due to clinical training and patient engagement to ambulate without PT.[29] Further research is warranted as these studies were conducted at a single site.

Discussion

This review included a comprehensive search via electronic databases yielding relevant quantitative and qualitative studies. Nurses understand the purpose and benefits of early mobility in critically ill patients, including those with mechanical ventilation. However, more studies are needed in nurses providing mobility to neurosurgery patients.

Mixed perceptions exist regarding the responsibility for prioritizing and initiating mobilization. Main barriers to mobilization include patient safety concerns, untimeliness due to limited resources, unit culture, lack of nursing knowledge, and need for improved teamwork. Furthermore, an association between teamwork-based interventions and decreased LOS, increased rates of mobility, and faster time to early mobilization, exists. Nurse-led interventions result in positive perceptions including empowerment, confidence, increased knowledge, and progressive shifts in unit culture.

Of the several existing gaps within the literature, studies lacked a theoretical framework to assess both nursing perceptions and teamwork. Such an outline would provide increased standardization and clarity, particularly when considering decision-making for nurse-led

mobilization. Teamwork for healthcare providers can be described via Salas' teamwork theory, which applies concepts to assess team performance and processes.[30] By developing the application of this theory in nurse-led multidisciplinary team mobilization, the teamwork processes can be evaluated and amended to safely achieve increased mobilization in ventilated neurosurgery patients. Additionally, nurses may become more knowledgeable, competent, and confident to initiate mobilization.

Furthermore, current studies utilized questionnaires and interventions which warrant further testing of their validity and reliability to accurately measure outcomes. Also, convenience sampling limited generalizability of study results. Moreover, studies regarding mobilizing mechanically ventilated patients were more prevalent than those focusing on neurosurgery patients.

Conclusion

By understanding nursing perceptions and roles in teamwork to mobilize ventilated neurosurgery patients, researchers can focus future studies to standardize and test nurse-led mobility interventions within this population. Doing so will help achieve higher rates of mobilization, which contains many benefits. Providing mobilization to ventilated neurosurgery patients contributes to the holistic care nurses strive to provide.

Acknowledgments

The authors would like to thank librarians and staff at the University of Texas at Arlington College of Nursing and Health Innovation.

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CHAPTER 3

MANUSCRIPT TWO

The pilot study conducted in the second manuscript is registered in ClinicalTrials.gov under the following identifier: NCT05583487 (see Appendix D). IRB approval from both the medical center and UTA with a formed reliance agreement were obtained (see Appendix E). Supplemental Digital Content for the manuscript was provided (see Appendix F). This manuscript was submitted for publication in the *Journal of Neuroscience Nursing* and is currently under review (see Appendix G).

Multidisciplinary Teamwork Perceptions When Mobilizing Ventilated Neurosurgery Patients

Abstract

BACKGROUND: Multidisciplinary teamwork is essential in delivering holistic care to critically ill populations, including ventilated neurosurgery patients. Although it is considered a safe and feasible aspect of patient care, mobilization is often missed in this population due to negative healthcare provider perceptions regarding barriers and patient safety. Nurse-led teamwork has been suggested to overcome these barriers and to achieve earlier mobilization for patients, as well as positive provider perceptions, which may affect the culture and frequency of mobilization on neurointensive care units. Quantitative studies analyzing multidisciplinary teamwork perceptions to mobilize ventilated neurosurgery patients with or without a nurse-led protocol have not been previously conducted. Analyzing such perceptions may provide insight to team-related barriers related to missed mobility. This pilot quasi-experimental study aimed to determine if the use of a nurse-led mobility protocol affects teamwork perceptions when mobilizing ventilated neurosurgery patients. **METHODS:** A sample of multidisciplinary teams, composed of nurses, patient care technicians and respiratory therapists mobilized ventilated neurosurgery patients according to either standard of care (for the control group) or a nurse-led mobility protocol (for the interventional group). Teamwork perceptions were measured via the reliable and valid Nursing Teamwork Survey (NTS) tool. **RESULTS:** Linear mixed models analyses revealed that multidisciplinary teams in the nurse-led mobility protocol group had significantly higher levels of overall perceived teamwork, than those in the control group, $t(3) = -3.296$, $P = 0.038$. Such differences were also noted for teamwork variables of team leadership and mutual trust. **CONCLUSION:** Nurse-led mobility protocols may enhance the perception of

multidisciplinary teamwork and should therefore be considered when performing mobility for ventilated neurosurgery patients. Nurse-led mobility protocols may also increase the frequency of mobilization by promoting positively perceived multidisciplinary teamwork interactions which are effective in achieving mobility goals in recovering ventilated neurosurgery patients. Clinical trial registration: ClinicalTrials.gov identifier NCT05583487.

Introduction

Multidisciplinary teamwork is fundamental to deliver holistic care in critically ill populations, such as ventilated neurosurgery patients. Mobilization of this vulnerable population is an aspect of missed care and considered to be problematic since immobility is associated with severe cognitive, neuromuscular, functional, and psychological deterioration.[1-4] Although expert guidelines to safely and feasibly mobilize neurosurgery patients with mechanical ventilation have been established, [5-9] a lack of mobility persists due to negative healthcare provider perceptions regarding teamwork-related barriers.[10]

Background

High levels of perceived teamwork are associated with decreased missed care.[11,12] Applying teamwork to achieve mobilization is associated with decreased length of stay, increased mobility frequencies, and faster time to initiate mobilization in critically ill populations.[10,13,14] Experts believe nurse-led interventions result in earlier time to patient mobility, empowerment and confidence, increased knowledge, and progressive shifts in unit culture with long-term benefits.[10] Although studies implementing nurse-led mobility interventions in neurosurgery patients are evident,[10,15] no quantitative studies statistically comparing perceptions of multidisciplinary team members participating in nurse-led versus non-nurse-led teams to provide mobility have been conducted.

Of the few relevant studies which assessed multidisciplinary teamwork perceptions for mobilization, most are qualitative and analyzed nursing teamwork perceptions following interventions via interviews, or are quantitative and focused on perceptions related to structural barriers, rather than teamwork dynamic barriers.[13,16,17] Studies analyzing teamwork dynamics for daily unit workflow were limited to nurses, nursing assistants, unit secretaries, and physicians, but did not include essential disciplines, such as respiratory therapy (RT) and physical therapy (PT), who are highly involved in completing patient care tasks, especially mobilization. Analyzing teamwork perceptions from multiple disciplines permits researchers to make comparisons and provide insight to barriers related to the missed care activity of mobilization.

Theoretical Framework

Salas' teamwork theory serves as a framework for researchers and practitioners to analyze team performance, processes, and effectiveness during high stakes situations.[18] Multiple nursing research studies have applied this theory to analyze teamwork among nurses and multidisciplinary staff.[19-27] Concepts of interest for this study include team leadership (directing/coordinating team member activities, assessing team performance, and assigning tasks), backup behavior (capacity to anticipate needs of other team members based on their responsibilities), team orientation (accounting for other members' behavior during interactions and placing team goals over one's own), shared mental models (organized structure of relationships and interaction of team members), and mutual trust (believing members will perform their respective roles and protect interests of fellow teammates).[23] Direct and indirect positive relationships between these concepts exist.

By determining whether levels of teamwork vary between teams utilizing nurse-led protocols and teams which do not, changes can be made to existing policies and procedures to

feasibly promote optimal levels of mobility on neuroscience intensive care units (NSICUs). Such action enables nursing staff to advocate for altruistically altering unit culture and sustain increased levels of mobilization for recovering ventilated neurosurgery patients. The aim of this study was to determine if using a nurse-led mobility protocol significantly affects multidisciplinary teamwork perceptions when mobilizing ventilated neurosurgery patients. The research team hypothesized implementing nurse-led mobilization would result in higher levels of perceived teamwork compared to standard of care.

Methods

A quasi-experimental design was implemented to determine if a nurse-led mobility protocol intervention had an effect on the outcome of teamwork perceptions. True randomization of participants was not feasible and considered a limitation, since each patient had a pre-assigned multidisciplinary care team per shift. IRB approval from the medical center and relying university was obtained for the study's protocol and all modifications.

Definitions

Two or more healthcare providers with at least two members belonging to different disciplines form a multidisciplinary team.[23,28] Ventilated neurosurgery patients had at least one neuro-related procedure during current hospitalization and were simultaneously on mechanically ventilated-assisted breathing via oral/nasal endotracheal tube or tracheostomy during time of mobility. Progressive mobility refers to patients physically transitioning as tolerated from lying in bed, to sitting up in bed in the chair position, to sitting at the edge of the bed and dangling their feet, to standing, to taking steps, then ambulating.

Sampling

A convenience sample of multidisciplinary teams from the medical center's NSICU was

obtained. The primary population of interest was multidisciplinary teams, composed of the patient's assigned primary nurse, patient care technician (PCT), RT, and PT. Nurses and RTs providing patient care are associated with lower ICU mortality.[28] PCTs assist multidisciplinary staff to promote physical patient safety. PTs hold specific knowledge/training to mobilize patients. However, due to departmental barriers, PT did not participate in the current study. Pending approval to not include PT resulted in a shortened data collection period from three to two months. Therefore, this study took place from December 1, 2022 to February 1, 2023.

An a priori power analysis via G*Power 3.1.9.7 revealed a minimum of 144 participants were required to test the study hypothesis.[29] Sample size estimations were based upon a Cohen's *d* of 0.475, beta of 0.20, and a two-sided alpha of 0.05. Since no prior experimental studies using the NTS in teams of nurses, PCTs, and RTs have been conducted, a moderate effect size was chosen.[30] The planned analyses would reach sufficient statistical power with moderate effect size of $d = 0.475$ or greater.

Inclusion/Exclusion Criteria

Multidisciplinary team members were adults (18 years of age or older) of any gender, who were registered nurses (RNs) or Licensed Vocational Nurses/Licensed Practical Nurses (LVNs/LPNs), PCTs, RTs, or PTs working part-time or full-time on day or night shift. Float staff not routinely assigned to the NSICU or staff employed by an outside agency were excluded.

Mobility Procedures

Screening for ventilated neurosurgery patients took place using electronic medical records. The research team consulted with and obtained consent from nurses, RTs, and PCTs to form multidisciplinary teams for the selected patients and established a time to mobilize patients during the shift. Interventional groups mobilized ventilated neurosurgery patients with the nurse-

led protocol, while control groups were asked to mobilize selected patients according to the medical center's standard mobility procedures, incorporating any written information, equipment, and previous training/experience. Researchers assigned participants to respective control and interventional teams, who were blinded to group assignment until time of mobility. All teams were asked to progressively mobilize the selected patient, then to complete the paper and pen questionnaire. Maximum allotted time to complete both parts was one hour and thirty minutes. Consents and questionnaires were coded to protect participant identity and securely stored.

Intervention

The nurse-led mobility protocol incorporated a checklist for participating disciplines to follow before/during/after patient mobility, steps to progress mobility from in-bed to out-of-bed activities, and patient exclusion checklist for mobility contraindications (see Supplemental Digital Figure 1). Team members were permitted to delegate missing roles and utilize additional team members as needed for patient safety. Nurse-led protocol teams were allowed to review the protocol upon arrival at the patient's room prior to implementation.

Measurement Tool

The questionnaire was comprised of a total of 42 items including 33 questions from the Nursing Teamwork Survey (NTS) and nine demographic questions. The NTS is a valid and reliable tool which directly measures overall teamwork and the five aforementioned teamwork theory concepts, consisting of Likert-type scale items ranging from 1-5. Higher scores indicate more positive perceptions, while lower scores reflect more negative perceptions of teamwork. Utilizing the NTS appropriately serves to examine nurse-led multidisciplinary mobility teams that include RTs, because like nurses and PCTs, RTs are routinely assigned to care for ventilated

neurosurgery patients. Although previous NTS studies assessed perceptions for nursing teamwork dynamics on inpatient units as a whole and not following specific patient care interventions,[20,22] this tool can adequately capture mobility perceptions since mobility is a coordinated team effort involving consultation of multiple staff members on a shift-to-shift basis. The author of the tool, Dr. Beatrice Kalisch, granted permission for NTS use in the current study.

Statistical Analysis

Discrete parameters are reported as *n* and percent (%). Control and intervention groups were compared on demographic variables, with Pearson chi-square tests. Mean scores for overall teamwork and teamwork subcategories from the NTS were calculated. Overall teamwork and teamwork subcategory scores over time were examined using linear mixed models (LMM) for repeated measures. Time of assessment was specified as the repeated effect with two levels and participant was specified as the random effect, with an unstructured covariance structure. LMMs were computed so that data from all participants, including those who completed questionnaires more than once, could be utilized. Analyses were performed with SPSS 29.0 for Windows. The study alpha was set to 0.05, two-sided.

Results

Staff Characteristics

Of the 36 staff members who signed consent forms, 8 were unable to complete surveys, yielding an attrition rate of 22.2%, due to providers unexpectedly needing to extubate patients to resolve patient agitation and maintain safety. The final sample was composed of 28 total participants with 14 in each of the control and nurse-led mobility protocol groups (see Supplemental Digital Table 1). RNs comprised 53.6% of participants, while 21.4% were PCTs, and 25% were RTs. Participants were predominantly female (*n*=20, 71.4%) with a bachelor's

degree (*n*=19, 67.9%). Age varied with most participants being under 25 years (*n*=8, 28.6%), 35 to 44 years (*n*=7, 25%), and 45 to 54 years (*n*=6, 21.4%). Day and night shift staff participated (*n*=18, 64.3% versus *n*=8, 28.6%, respectively), while *n*=2 (7.1%) participants rotated between day and night shift. Most participants were employed full time (*n*=24, 85.7%). Distribution varied for current unit and overall neurosurgical care experience. Pearson chi-square analyses revealed no significant differences between control versus nurse-led protocol groups (see Supplemental Digital Table 2).

Teamwork Perceptions

Cronbach's α for the 33 NTS items in this study sample was 0.901, indicating strong internal consistency.[30] Although no patient was mobilized repeatedly, multidisciplinary team members could participate in mobility multiple times as needed. Of the 28 participants, five completed the survey twice, yielding a total of 33 completed questionnaires. Repeated survey responses were statistically adjusted via linear mixed model (LMM) analyses to account for potentially correlated observations. Eleven total multidisciplinary teams were analyzed—five from the control and six from the nurse-led protocol groups. Mean scores and standard deviations for overall teamwork and teamwork subcategories are presented in Table 1.

Table 1
Means and Standard Deviations for Nursing Teamwork Survey Scores

Variable	Total *n*=33	Control *n*=15	Intervention *n*=18
Overall Teamwork	113.58 ± 17.24	98.80 ± 11.23	125.89 ± 10.11
Trust	24.33 ± 7.36	18.07 ± 5.99	29.56 ± 2.98
Orientation	19.15 ± 6.16	15.13 ± 3.74	22.50 ± 5.80
Backup Behavior	24.52 ± 3.49	24.73 ± 4.80	24.33 ± 1.97
Shared Mental Models	31.64 ± 2.71	31.60 ± 2.97	31.67 ± 2.57
Leadership	13.94 ± 5.29	9.27 ± 4.10	17.83 ± 1.86

Note: All 33 surveys were examined for this analysis.

LMM results controlled for discipline are summarized in Table 2. Compared to the control group, the nurse-led protocol groups had significantly higher scores for overall teamwork, t(3) = -3.296, P = 0.038, and subcategories of trust, t(3) = -3.343, P = 0.044, and leadership, t(22) = -4.164, P = 0.018. While mean scores for orientation also appeared to be lower in control groups, these results were not statistically significant, t(3) =-1.368, P = 0.253. Contrastingly, scores for backup behavior were significantly higher in the control than the nurse-led protocol group, t(2) = 5.332, P = 0.047. There was no significant difference between the two groups for shared mental models, t(3) = 1.327, P = 0.268.

Table 2
Linear Mixed Model Results of Teamwork for Control Versus Interventional Groups

Outcome	***t***	**df**	***p***
Overall teamwork	-3.296	3	0.038
Trust	-3.343	3	0.044
Orientation	-1.368	3	0.253
Backup	5.332	2	0.047
Shared mental models	1.327	3	0.268
Leadership	-4.164	4	0.018

Note: These parameters were controlled for discipline.

Time Effects

Main effect of time on overall teamwork and teamwork subcategories indicated no significant differences from first to second time participants completed the survey, regardless of group assignment. Likewise, there was no significant time and intervention interaction for these scores (see Supplemental Digital Table 3).

Discussion

The research team's original hypothesis was supported by findings of the current study. Scores were significantly higher in the nurse-led mobility protocol group when compared to the control group for overall teamwork (P = 0.038), trust (P = 0.044), and leadership (P = 0.018),

indicating nurse-led protocol implementation was associated with higher perceptions of teamwork for these categories. No significant differences in orientation (P = 0.253) or shared mental model (P = 0.268) scores were present. Lastly, scores for backup behavior were significantly higher in the control group than in the nurse-led protocol group (P = 0.047).

Significantly higher scores of team leadership in the nurse-led protocol group was expected, since the intervention suggested a specific leadership role. Significant differences between groups for overall teamwork, team leadership, and mutual trust, are supported by findings from a previous study, which implemented a unit-based train-the-trainer intervention.[25] These direct relationships between concepts support propositions identified in Salas' teamwork theory.[18] No significant differences for shared mental models were noted between the groups in both studies. Researchers from the previous study did not explain this obscure finding. The current study unexpectedly revealed a nonsignificant difference in orientation scores between the two groups, while the former study demonstrated a significant increase for orientation as a result of intervention implementation. Nonsignificant results for shared mental models and orientation in the current study may be due to a small sample size. Additionally, in contrast to backup behavior being significantly higher as a result of the intervention in the former study, scores for this subcategory were lower in the nurse-led protocol group versus the control group in the current study. This finding was attributed to outliers within the original data set. It is also necessary to consider that the intervention did not specifically encompass action items pertaining to backup behavior. Nurse-led mobility interventions may require revision or additional steps, such as incorporating verbal cues for team members to address whether additional equipment or assistive personnel may be needed, to increase levels of backup behavior.

Limitations

Originally estimated power was not achieved due to a small sample size, resulting from limited availability of ventilated neurosurgery patients who met screening criteria due to changing unit census or varying hemodynamic or neurological status. Increasing length of study duration to capture more mobility instances would produce more staff participants. Team composition and patient-related factors including time between neurosurgery to the postoperative day on which mobilization for this study occurred, may have contributed to variability in multidisciplinary teams' and patients' abilities to achieve maximum level of mobility. Such factors should be analyzed in prospective studies.

Future Research

Due to the current study's piloted intervention, introduction of RT perceptions, and context of mobility in ventilated neurosurgical patients, subsequent studies are needed to validate presented findings. Replication studies at multiple sites are needed to verify results and increase generalizability of findings. Studies aimed at examining differences between disciplines, which also include PTs, should be conducted. Additionally, existing correlations between perceived teamwork by multidisciplinary staff and patient mobility outcomes should be studied.

Determining if maximum mobility levels are directly associated with utilizing nurse-led protocols may link patient outcomes with staff perceptions. Lastly, research studies and quality improvement initiatives on NSICUs are essential to analyze if nurse-led mobility protocols influence unit culture by comparing benchmark and intervention implementation data for mobility frequency in ventilated neurosurgical patients.

Conclusion

Utilizing a nurse-led multidisciplinary protocol is associated with higher teamwork when

mobilizing ventilated neurosurgery patients. Evidence-based protocols focusing to increase specific aspects of teamwork concepts and resultingly overall multidisciplinary teamwork, should be further developed for implementation on NSICUs, to safely achieve mobility. Nurses promoting mobility culture on units may use associations between perceived teamwork and nurse-led mobility interventions to amend existing hospital-based policies and procedures. Nurse-led mobility interventions could also increase the frequency of achieving mobility goals within ventilated neurosurgery patients, which will further promote healing.

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CHAPTER 4

DISCUSSION

Based off both manuscripts, a continued need to understand multidisciplinary teamwork for mobility in ventilated neurosurgery patients exists. The first manuscript was essential to identify what is known regarding nurse-led and non-nurse led teamwork and mobility, specifically in ventilated neurosurgical patients—a population in which mobility is missed. Findings from the pilot research study in the second manuscript can be used to add to the body of existing knowledge regarding nursing and multidisciplinary teamwork perceptions, and the effects of utilizing a nurse-led mobility protocol in the specific population of ventilated neurosurgery patients.

Manuscript One

Quantitative and qualitative studies demonstrate nurses understand the purpose and benefits of early mobility in critically ill patients, including those with mechanical ventilation. Mixed perceptions exist regarding the responsibility for prioritizing and initiating mobilization. Main barriers to mobilization include patient safety concerns, untimeliness due to limited resources, unit culture, lack of nursing knowledge, and need for improved teamwork. Furthermore, an association between teamwork-based interventions and decreased LOS, increased rates of mobility, and faster time to early mobilization, exists. Nurse-led interventions result in positive perceptions including empowerment, confidence, increased knowledge, and progressive shifts in unit culture.

Limitations

Limitations of this literature review included limiting the search to four electronic databases and encompassing studies between the years 2010 to 2020. Since then, more literature

has evolved regarding this topic. Additional review of the literature was necessary to incorporate the most updated information for the second publication and the current dissertation.

Based on the presented gaps in knowledge, particularly relating to a lack of interventional studies on this topic, and further looking into what constitutes a multidisciplinary mobility team, the research study in manuscript two was designed to compare teams using a nurse-led protocol.

Manuscript Two

Implementation of a nurse-led mobility protocol in multidisciplinary teams to mobilize ventilated neurosurgery patients is associated with higher levels of perceived teamwork. Overall teamwork, trust, and leadership scores were significantly lower in the control group when compared to the interventional group, indicating that implementation of the nurse-led protocol resulted in higher perceptions of teamwork for these categories.

Limitations

Firstly, randomization of individual participants related to patient safety concerns was not feasible. This is due to the facility's charge nurses and respiratory therapists making patient care team assignments for nurses and PCTS, and RTs, respectively, every 12 hours—a process which often took place hours prior to the time the research team screened patients. These assignments were not changed for mobility to prioritize continuity of care for these patients.

The original estimated power for the study was not achieved due to a small sample size, resulting from multiple contributing factors. This study had a total of 28 participants, compared to the anticipated 144 participants. Availability of ventilated neurosurgery patients who met the screening criteria for team mobilization was limited, due to varying census of these patients on the unit at any given time. Secondly, turnover in the NSICU due to changing acuity, often resulted in unpredictable safety status to mobilize desired patients during times of screening. For

example, at the time of screening at the beginning of the shift, the patient of interest qualified to be mobilized by the multidisciplinary team. However, by the time the multidisciplinary team would gather to mobilize him/her, the patient's hemodynamic status declined, no longer making it safe nor feasible to mobilize using the anticipated multidisciplinary team. Also, instances in which patient's primary nurse would belong to float pool or had floated from another unit were prevalent. This resulted in no mobility taking place during the desired shift for the screened patient. In two instances, mobility was deferred from taking place on day shift to night shift to ensure that the primary nurse belonged to the NSICU when the patient was mobilized. A larger sample size may have been obtained if the length of study duration was increased to capture more mobility instances for ventilated neurosurgery patients, yielding more staff participants.

Additionally, although the teams themselves were blinded to whether or not they would utilize a nurse-led protocol until the time of patient mobility, researchers assigned each multidisciplinary team to its respective control or interventional group. This was done to ensure a relatively consistent number of teams for both the control and interventional groups so statistical comparisons could be made.

One unforeseen barrier was data collection and storage methods. Initially, the research team intended to track and collect data, and maintain screening and mobility logs in a password-protected folder on the medical center's secured G-drive. However, due to multiple attempted failures by the medical center's technical/information resources department to be able to provide this feature, a modification was made and approved by the site's IRB to collect and store data via pen and paper methods to be secured physically on site at the medical center.

Furthermore, the research team sought to obtain data from physical therapists at the medical center. Review of the literature reveals healthcare providers perceive PTs to be an

integral part of multidisciplinary mobility teams (Lall & Behan, 2022). However, PTs were not included in the current study due to departmental refusal to participate in the study. This also delayed and subsequently shortened the data collection period from an approved 3-month to a 2-month time frame, following modification approval from the primary site's IRB.

Use of a convenience sample from a single site may not be representative of the population of multidisciplinary staff caring for neurosurgical patients in ICUs throughout the United States and even worldwide. Therefore, in order to overcome this limitation in external validity, future studies should focus on obtaining study samples from multiple neurosurgical ICUs.

Future Research

Due to the uniqueness of the nurse-led intervention, introduction of RT perceptions, and the context of mobility in ventilated neurosurgical patients in the pilot study, subsequent studies with larger sample sizes are needed to ascertain the validity of findings. PTs should also be included as they are known for being highly involved in the multidisciplinary teams used to mobilize ventilated neurosurgery patients. Potentially extending the data collection period and recruitment to other NSICUs may be beneficial to increase the sample size and therefore power of the study, as well as incorporating PT. This may offer further explanation of nonsignificant findings.

Future studies should aim to analyze whether or not relationships exist between perceived teamwork by multidisciplinary staff and patient mobility outcomes. Secondly, although measuring patient mobility levels was not the primary purpose of the second manuscript's research, prospective studies should aim to determine if achieving maximum levels of mobility are directly associated with use of a nurse-led protocol. Also, teamwork-related factors, such as

team composition, may contribute to maximum level of mobility achieved. For the current study, some multidisciplinary teams consisted of all three disciplines (nurses, PCTs, and RTs), while others consisted of nurses and PCTs only, or nurses and RTs only. The highest progressive level of mobility achieved by a ventilated neurosurgery patient was standing at bedside. This took place during mobilization by one of the interventional groups consisting of two nurses and a patient care technician. Comparison of teamwork scores across all disciplines should also be considered.

Patient-related factors, such time between neurosurgery to the postoperative day on which mobilization for the purposes of the study took place, may have contributed to the abilities of both the multidisciplinary teams and patients themselves participating in and achieving their maximum level of mobility. In other words, patients who were mobilized on postoperative day five may have achieved a higher level of mobility with the use of multidisciplinary teams than those who participated on postoperative day three, due to more recovery time and therefore more hemodynamically and neurologically stability to actively participate. Such factors and their effects on teamwork should be analyzed in prospective research studies.

Lastly, research studies and quality improvement initiatives may be used to analyze if presence of a nurse-led mobility protocol influences unit culture by obtaining benchmark data of mobility instances occurring regularly with unit standard of care, then comparing the incidence of mobility in ventilated neurosurgical patients on NSICUs as a result of intervention implementation.

Implications for Nursing

The findings of the research study supported that a nurse-led multidisciplinary protocol is associated with higher teamwork when mobilizing ventilated neurosurgery patients. Therefore,

such evidence-based protocols should be further developed and tested so they may be incorporated and implemented on NSICUs. These interventions, such as the one in this current pilot study, may be ideal as they are perceived to utilize higher amounts of teamwork in multidisciplinary teams to safely achieve mobilization in ventilated neurosurgery patients—a population in which the incidence of mobility is unknown, yet believed to be overlooked.

Although additional studies are needed to fully determine which teamwork related subcategories are significantly correlated with use of a nurse-led mobility intervention, nurses and nurse leads involved in promoting a culture of mobilization may be able to use these results to make changes to existing hospital-based mobility policies and procedures. Such changes would be supported by quantifiable perceptions of increased teamwork, so the multidisciplinary members involved may be more likely to utilize such interventions to increase both the amounts and levels of mobility in ventilated neurosurgery patients, who would essentially procure the multifaceted benefits associated with this completed task.

Conclusion

Using a structured, nurse-led mobility protocol may enhance the perception of overall teamwork and teamwork-based concepts including team leadership and trust. Therefore, nurse-led mobility protocols should be considered to increase teamwork when performing multidisciplinary teamwork-based mobility for ventilated neurosurgery patients. Subsequently, the presence of mobilization may increase by promoting multidisciplinary teamwork interactions which are effective in providing this patient care intervention and achieving mobility goals in recovering ventilated neurosurgery patients.

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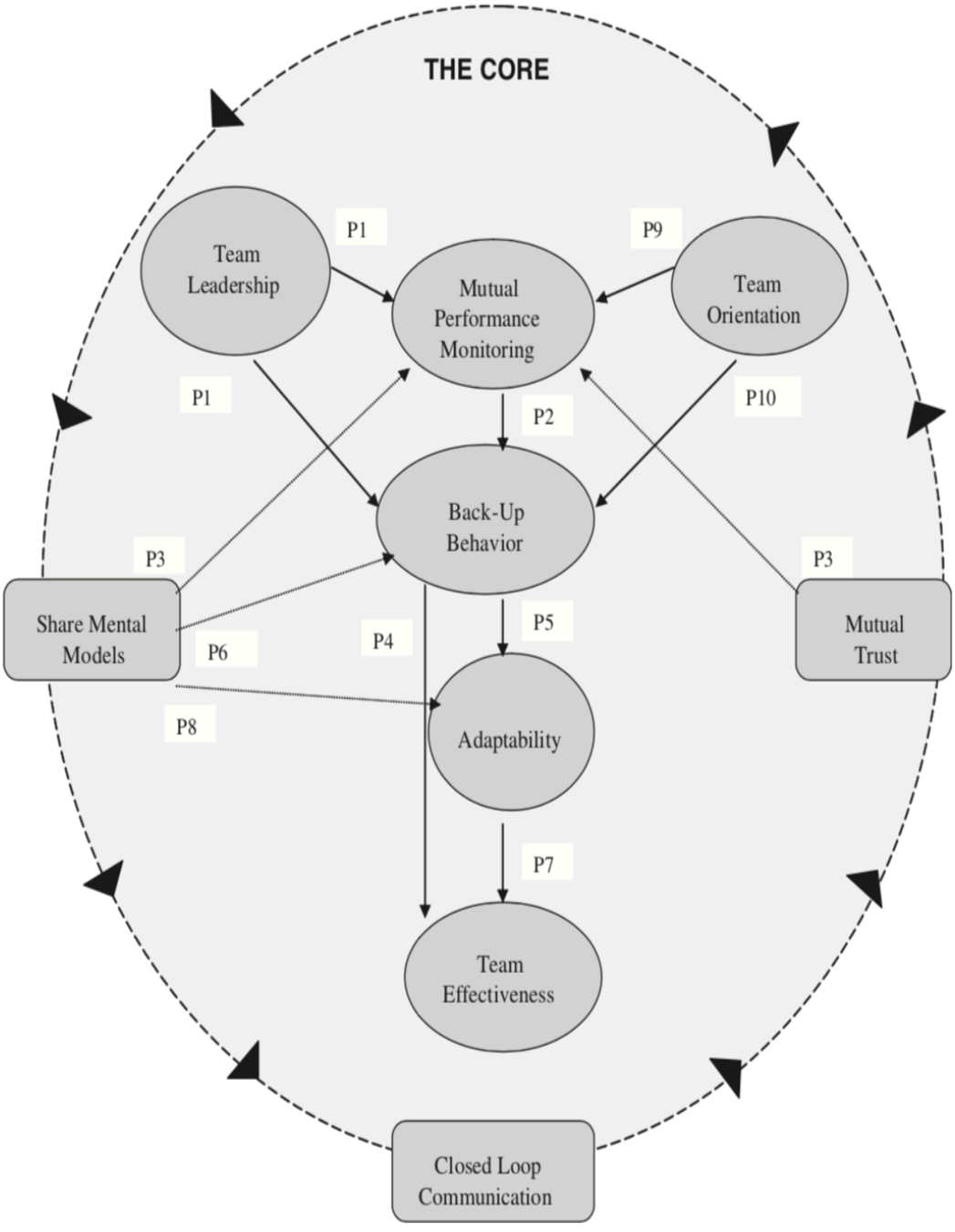
ventricular drain. *Neurocritical Care, 31*(1), 88–96. https://doi.org/10.1007/s12028-019-00670-2

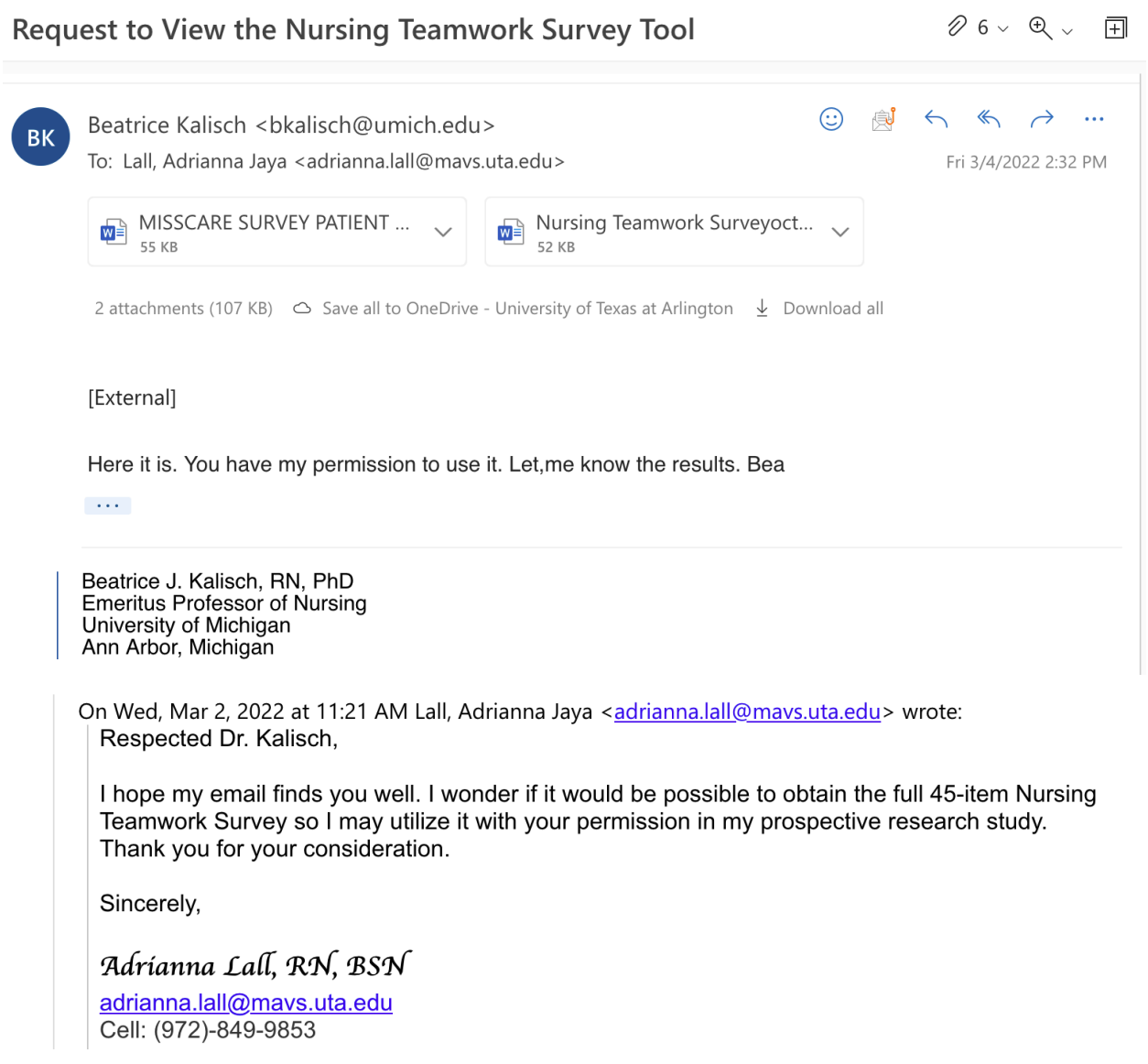
Appendix A

Model for Teamwork Theory



(Salas et al., 2005)

Appendix B



Request to View the Nursing Teamwork Survey Tool

BK

Beatrice Kalisch <bkalisch@umich.edu>

To: Lall, Adrianna Jaya <adrianna.lall@mavs.uta.edu>

Fri 3/4/2022 2:32 PM

MISSCARE SURVEY PATIENT ... 55 KB

Nursing Teamwork Surveyoct... 52 KB

2 attachments (107 KB) Save all to OneDrive - University of Texas at Arlington Download all

[External]

Here it is. You have my permission to use it. Let,me know the results. Bea

Beatrice J. Kalisch, RN, PhD
Emeritus Professor of Nursing
University of Michigan
Ann Arbor, Michigan

On Wed, Mar 2, 2022 at 11:21 AM Lall, Adrianna Jaya <adrianna.lall@mavs.uta.edu> wrote:

Respected Dr. Kalisch,

I hope my email finds you well. I wonder if it would be possible to obtain the full 45-item Nursing Teamwork Survey so I may utilize it with your permission in my prospective research study. Thank you for your consideration.

Sincerely,

Adrianna Lall, RN, BSN
adrianna.lall@mavs.uta.edu
Cell: (972)-849-9853

Appendix C

Studies Retained for Synthesis

Author, year	Research type and design	Related theme(s)	Research Aim/Objective	Sample size (n=) & Subject Characteristics	Measurement tools/Outcome measures	Major findings
Leong et al., 2017[8]	Quantitative; descriptive cross-sectional survey	Nurse-led teamwork	"The objective of this study is to assess nurses' practices regarding early mobilization among mechanical ventilated patient."	n=132 nurses from general, neuro, and cardiac ICUs	Type of mobilization, occurrence of nurses mobilizing patients at least 3 times per shift	"Majority (n=99, 75%) of the nurses mobilized their mechanically ventilated patient 3 times or more per shift" Strengths: identified at which teams (either PT or mobility team) were utilized per mobility level Weaknesses: convenience sample; nurse self-report utilized Generalizability: low (took place in Malaysia so nursing practices

						and staffing resources may vary)
Hodgson et al., 2016[10]	Quantitative; pilot randomized control trial with use of early goal-directed mobilization (EGDM) algorithm	Multidisciplinary teamwork (not nurse-led)	"To determine if the early goal-directed mobilization intervention could be delivered to patients receiving mechanical ventilation with increased maximal levels of activity compared with standard care."	n=50 critically ill adults mechanically ventilated for greater than 24 hours across five ICUs in Australia and New Zealand	ICU mobility scale, strength, ventilation duration, ICU and hospital length of stay, and total inpatient (acute and rehabilitation) stay, 6-month post-ICU discharge health-related quality of life, activities of daily living, and anxiety and depression	"A statistically significant increase in number of occurrences ($t = 4.18$, $P = .001$) and total distance ($t = 2.75$, $P = .01$) and a significantly higher positive slope in percentage of numeric documentation was found during the intervention than before the intervention. Thematic analysis identified three central categories (shifting owner- ship, feeling supported, making ambulation visible) that describe the effect of MOVIN on nursing staff behaviors

						and perceptions of the intervention. ” <u>Strengths</u>: Systems Engineering Initiative for Patient Safety model was used as a framework to develop the protocol <u>Weaknesses</u>: no control group (intervention data compared to previous records); variability in patient characteristics unknown in whom the protocol was administered <u>Generalizability</u>: limited (single-site study)
Green et al., 2016[11]	Qualitative; descriptive and observational approach with protocol implementation	Barriers; nurse-led teamwork	To describe experience and utilize developed practical tools to facilitate	n=1,976 admissions assessed in a tertiary ICU (including medical, trauma, cardiothoraci	Incidence of adverse outcomes, mobilization occurrences	“These tools have been used over the past 5 years in a tertiary ICU with a very low

			early mobilization in the ICU with use of a multidisciplinary team	c, general, and neurosurgical patients) with 50% requiring mechanical ventilation.		incidence of adverse outcomes (<2%).” “patients were mobilized only on 54% of patient days, with avoid- able factors identified in 47% of cases where patients were not mobilized.” Barriers included femoral vascular access, (particularly femoral dialysis catheters), timing of procedures, and patient agitation or low level of consciousness, staffing and availability of PT, equipment, leadership, referral processes, delirium, sedation, and

						perceived lack of safety <u>Strengths</u>: outlines step-by-step approach for patient mobility per levels for patients of various ICU diagnoses and those with and without mechanical ventilation <u>Weaknesses:</u> lack of conducted/reported statistical findings based on protocol implementation; nursing role in outlined protocol is unclear <u>Generalizability</u>: questionable, since study takes place in Australia and resources vary with those in the United

						States; more replication studies needed
Krupp et al., 2019[13]	Qualitative; exploratory descriptive approach using semi-structured interviews with directed content analysis	Purpose and benefits of early mobility, responsibility of initiation, barriers	The aim of this study was "to describe processes that nurses in intensive care units use to make decisions and barriers that influence their decision-making about patient mobility."	n=20 nurses with at least 6 months of current ICU experience, who worked at least 20 hours per week; must be experienced with patient mobility and decision making associated with it	One-on-one interviews with questions on four domains: how nurses define mobility for patients in the ICU, the nurse's role in patient mobility, how nurses make decisions about patient mobility, and barriers to mobilizing patients Interviews transcribed; 3-phase method of content analysis by Elo and Kyngäs used to analyze data; categories and subcategories developed	Participants were able to consistently define mobility and described multiple physical and psychological reasons for initiating and progressing it Reasons for encouraging patients active or passive movement to a chair: engages patients to their surroundings and provides psychologic support; passive movement to a cardiac chair prevents "immediate complications from bed rest (eg, long duration of ventilator

						support, skin breakdown, and delirium)" Long-term benefits include progressive mobility (standing then walking) prevents functional decline so patient can return home Unit culture described in each of the four domains; described as a barrier Some nurses described fear of pushing a patient too hard physically (could delay healing); "most critically ill patients in the unit did not have mobility goals, as their primary goal

						was survival." Mixed perceptions as some nurses are involved in the patient's mobility plan, while others are not and are "hesitant to be the first person to mobilize a patient out of bed and seeking confirmation from other providers (physicians, physical therapists) before engaging the patient in activity." Inconsistent decision-making by nurses regarding mobility level, frequency, and duration of activity. Barriers include: "If help was not readily

						available, mobility was either deferred or limited to passive movement"; unit activity, limited resources, limited patient availability, and variation in nursing practice <u>Strengths:</u> sample was exposed to mobility protocols on unit <u>Weaknesses:</u> lack of descriptive statistics; use of convenience sample <u>Generalizability:</u> limited (Although the sample was collected from 2 adult medical-surgical ICUs, little information is given about the

						patient type (based upon high versus low acuity, intubation status, or surgical status) in which the mobility protocol was implemented.)
Curtis & Irwin (2017) [14]	Qualitative; semi-structured interviews	Purpose and benefits of early mobility, responsibility of initiation, barriers	"The aim of this study is to understand better nurses' perspectives on ambulating mechanically ventilated patients, and to determine why this is not a routine part of ICU patient care."	n=60 ICU nurses from a London hospital who worked with ventilated patients	Data from transcribed semi-structured interviews was extracted utilizing Interpretative phenomenological analysis (IPA).	Staff anxiety and organizational culture (acceptance of inadequate staffing levels), were the two themes identified "The study identified that nursing staff are aware of the benefits of ambulation for patients in ICUs, but the personal satisfaction gained from undertaking this activity does not outweigh the anxiety it causes."

						Some nurses were concerned about potential adverse events that may harm the patient's health. Nurses have mixed perceptions regarding whether or not they themselves are responsible for initiation of patient mobilization . Some participants unaware that guidelines were in place <u>Strengths:</u> interview questions had been piloted twice prior to use <u>Weaknesses:</u> Exposure to mobility protocols unknown; patient demographi

						cs unknown (surgical status); lack of descriptive statistics <u>Generalizability:</u> limited (use of convenience sample from hospital in the United Kingdom; therefore, nursing practice may differ from that of the United States)
Doherty-King & Bowers (2013)[15]	Qualitative; "A descriptive, secondary analysis of data gathered for a parent study was conducted. Grounded dimensional analysis was used to analyze the data."	Responsibility of initiation, barriers	"The purpose of this study was to explore the relationship between nurses' attributions of responsibility for ambulating hospitalized patients and their decisions about whether to ambulate."	n= 25 registered nurses on medical or surgical units from two urban hospitals in the United States	Discriminate sampling and coding used by experts to develop categories based on responses	Two groups: 1) nurses who claimed ambulation of patients was their responsibility (focused on patient independence and psychosocial well-being; collaborated with PT to determine appropriateness of activity orders, diminishing the risk and adjusting to resource

						availability) or 2) nurses who attributed the responsibility to another discipline (deferred decisions about initiating ambulation to either physical therapy or medicine; increased waiting time) The hospital which offered Nurses Improving Care of Health systems Elderly (NICHE) training to their nurses had significantly higher amounts of nurses who claimed responsibility for ambulation (10 nurses versus 2 nurses who attributed

						ambulation to other disciplines). There nurses were more likely to initiate patient mobility overall. In the other hospital which did not offer this training, 5 of 13 nurses claimed responsibility for ambulation (8 attributed ambulation to other disciplines). Awareness of how quickly older patients declined when on bed rest and a strong sense of responsibility for per NICHE nurses helped overcome barriers to ambulating patients.

						Strengths: data analyzed using international group of researchers; conceptual framework utilized Weaknesses: small sample size; only some nurses from one hospital underwent specialized NICHE training, while the other did not; lack of objective measures Generalizability: limited (majority of sample consisted of nurses caring for the geriatric population; patient demographics unknown, especially ventilation status)
Drolet et al., 2013[16]	Quantitative; Quasi-experimental design for	Responsibility of initiation,	"The purpose of this study was to	n=193 ICU patients and 349 IMCU patients	Number of patients ambulated within 72	Nurses felt empowered to consult physical

	pre-/post-mobility protocol intervention (Move to Improve), which was implemented by a multidisciplinary team	nurse-led teamwork	determine the effectiveness of a nurse-driven mobility protocol to increase the percentage of patients ambulating during the first 72 hours of their hospital stay."	during the 3-month pre-implementation period; 426 ICU patients and 358 IMCU patients during the 6-month postimplementation period	hours of hospital admission	therapists or occupational therapists when the nurse-driven protocol was utilized Number of patients who ambulated in the adult ICU and IMCU during the first 72 hours of hospital stay significantly increased <u>Strengths:</u> pre- and postimplementation data provided; need for descriptive statistical analysis <u>Weaknesses:</u> missing patient demographics <u>Generalizability:</u> limited due to single site study (practices may not be the same at other facilities

						including use of mobility protocol implementation)
Hickmann et al., 2016[17]	Quantitative; observational study with mobility protocol implementation by multidisciplinary team	Barriers, multidisciplinary teamwork (not nurse-led)	"This study sought to demonstrate that early mobilization performed within the first 24 h of ICU admission proves to be feasible and well tolerated in the vast majority of critically ill patients."	n=171 ICU patients	ICU patient days, total instances and duration per type of early mobility activity performed; patient alertness level based on RASS; patient perception of pain, fatigue and enjoyment as assessed per Likert scale	Contrary to what was believed based upon previous literature, "Mobilization within the first 24 h of ICU admission is achievable in the majority of critical ill patients, in spite of mechanical ventilation, vasopressor administration, or renal replacement therapy." Early mobilization was achieved on 86%, bed-to-chair transfer on 74%, and at least one physical therapy session on 59%.

						"Median time interval from ICU admission to the first early mobilization activity was 19 h (IQR = 15–23). In patients on mechanical ventilation (51 %), accounting for 46% of patient-days, 35% were administered vasopressors and 11% continuous renal replacement therapy. Within this group, bed-to-chair transfer was achieved on 68 % of patient-days and at least one early mobilization activity on 80%." Some barriers which led to inconsistent decision-making regarding initiating

						patient mobility can be attributed to the following: "Limiting factors to start early mobilization included restricted staffing capacities, diagnostic or surgical procedures, patients' refusal, as well as severe hemodynamic instability. Hemodynamic parameters were rarely affected during mobilization, causing interruption in only 0.8 % of all activities, primarily due to reversible hypotension or arrhythmia. In general, all activities were well tolerated, while

						patients were able to self-regulate their active early mobilization. Patients' subjective perception of physical therapy was reported to be enjoyable." Also, PT was not readily available at times; therefore, active PT only took place in 61% of cases. <u>Strengths</u>: patient demographics specified; includes acutely ill surgical patients and those with mechanical ventilation <u>Weaknesses:</u> convenience sampling <u>Generalizability</u>: moderate (since the

						study took place in Belgium, replication studies are needed in the United States)
Rupich et al., 2018[18]	Quantitative; pre-/postintervention al study with mobility protocol implementation	Barriers, nurse-led teamwork	To establish and use a Nurse Practitioner-led early mobility protocol "to reduce uncomplicated postsurgical spine patients' length of stay (LOS) in the hospital and eliminate the variability of postsurgical care. A secondary objective was to educate and empower nursing staff to initiate the early mobility protocol independe	n=275 patients in the control group and n=440 patients in the intervention group (uncomplicated neurosurgery patients who met the inclusion criteria for the early mobility protocol)	LOS per hospitalization	"The most common compliance barriers were nurses' lack of familiarity with the protocol, no formal early mobility order, indwelling urinary catheters left in place in the OR, and uncontrolled postoperative pain." This often led to inconsistent decision-making regarding patient mobility, even though NPs or physicians would adjust patient pain medication in hopes to increase protocol compliance.

			ntly and incorporate it in their practice to improve patient care."			"Over a one-year period, implementation of the protocol resulted in a nine-hour reduction in LOS per hospitalization in neurosurgical spine patients who underwent lumbar laminectomies. The protocol also allowed nurses more autonomy in patient care and was a catalyst for patient involvement in their postoperative mobility." The authors deemed this as high protocol compliance <u>Strengths:</u> detailed nurse-led mobility protocol developed and implemented

						Weaknesses: "standardized mobility assessment tool was not a component of the patient admission profile; limited by the number of surgical cases during the intervention period; actual cost savings unknown"; results of reported replication studies based off this one is unknown; could be considered a quality improvement study although some descriptive statistics are provided Generalizability: limited to spine patients
Young et al, 2019[19]	Quantitative; Prospective observational cohort study	Barriers, nurse-led teamwork	"The aim of the study was to	Phase 0: no mobility(n=15)	Occurrence of first mobilization by	Safety specific neurosurgical patient

	with one historical cohort; phase-by-phase approach for protocol implementation		determine whether a nurse-driven mobilization protocol would result in safe and more frequent mobilization than institutional standard care."	Phase I: patients mobilized only with PT/OT at bedside; no independent time out of bed occurred (n=24) Phase II: nurses independently mobilized patients with EVDs, and patients could remain out of bed for up to 3 h at a time; PT/OT continued routine consultation (n=17)	hospital day, number of sessions while EVD was in place; hospital and ICU length of stay, number of ventilator days	population barriers include elevated intracranial pressure (ICP), acute onset of headache, and acute focal/worsening of neurologic deficits. Mobilization was withheld due to testing/procedures, hypertension, increased ICP, and symptomatic vasospasm in a small number of cases. Therefore, nursing mobilization of patients with external ventricular drains (EVDs) was considered safe and feasible. Nurse-driven mobilization also leads to more

						frequent ambulation compared to PT/OT therapy-driven protocol. "Nurse-driven mobilization may be associated with improved discharge disposition, although exact causation cannot be determined by these data." Nurses exercised more autonomy as they could independentl y drain EVDs to improve patient status. **"**Phase II patients were mobilized more frequently than Phase I patients [7.1 times per

						ICU stay (± 4.37) versus 3.0 times (± 1.33); p = 0.02], although not earlier [day 4.9 (± 3.46) versus day 6.0 (± 3.16); p = 0.32]. All Phase II patients were discharged to home PT services or acute rehabilitation centers. No patients were discharged to skilled nursing or long-term acute care hospitals, versus 12.5% in Phase I. In a multivariate analysis, odds of discharge to home/rehab were 3.83 for mobilized patients, independent of age and severity of illness. Other quality

						outcomes (length of stay, ventilator days, tracheostomy placement) between Phase I and Phase II patients were similar. No adverse events were attributable to early mobilization." <u>Strengths:</u> descriptive statistics provided and analyzed; patient demographics given <u>Weaknesses:</u> "This mobilization protocol was implemented as standard of care rather than as a formal research study. As such, patient consent was not required for

						inclusion." There was also inconsistent data gathering regarding duration of mobilization sessions, employed mobilization maneuvers, and functional milestones. In addition, there was a lack of prioritizatio n when involving PT and occupational therapy (OT) for mobilization . Therefore, the protocol itself should be considered for revision. Small sample sizes and inadequate power present. Variability of results as neurological acuity decreased as

						phases progressed. <u>Generalizability:</u> limited to neurosurgical patients with EVDs
Johnson et al., 2017[20]	Quantitative; Pre-test/post-test with training intervention	Barriers	"The aim of this study is to examine whether nurses' attitudes and beliefs are barriers for early mobilisation and evaluate whether an education intervention can improve early mobilisation."	n=33 registered nurses and charge nurses in trauma ICU	"Pre-test, post-test survey assessed perceived barriers in knowledge, attitudes, and behaviours followed by targeted education."	"Dependent Sample T-test revealed a statistically significant increase in post-test responses for the subscales knowledge, attitudes, and behaviours with early mobilisation. This over-all increase in post-test results support that understanding barriers can improve patient outcomes." Trauma nurses expressed satisfaction for receiving training, understood when to refer

						patients to OT, educate patients and identify patient resistance Strengths: objective measures with statistical analysis utilized Weaknesses: whether staff mobilized ventilated patients regularly unknown Generalizability: moderate (should be replicated with staff on other units)
Chapman et al., 2017[21]	Quantitative; descriptive exploratory study	Barriers	Investigate effects of teamwork on missed nursing care across a healthcare network in Australia.	n= 334 nurses ("Registered (RN) and Enrolled nurses (EN) working on medical, surgical, ICU, specialist wards including coronary care, ED and	MISSCARE survey and Nursing Teamwork Survey	Ambulation three times per day was one of the most common forms of missed care (433%) with most common reasons for missed care being inadequate

				rehabilitation units at four hospitals within one public sector health network.")		labour resources (range 698–527%), followed by material resources (range 593–333%) and communication (range 393– 272%). "Teamwork alone accounted for about 9% of missed nursing care." <u>Strengths</u>: large sample size <u>Weaknesses</u>: significance of results for individualized units unknown; baseline data for patient populations being cared for are unknown, including presence of patients with mechanical ventilation <u>Generalizability</u>: limited

						(study did not take place in United States)
Schaller et al. (2016) [22]	Quantitative; Assessor-blinded, randomized controlled trial Control patients received standard of care per institution and were mobilized according to each individual institution's existing policies. Intervention group patients received early, goal-directed mobilization utilizing the SICU optimal mobilization score (SOMS) algorithm in addition to the standard of care. Mobilization goals were set in the	Multidisciplinary teamwork (not nurse-led)	To test whether or not "early, goal-directed mobilisation, using a strict mobilisation algorithm combined with facilitated inter-professional communication, in critically ill SICU patients leads to improved mobility during SICU admission, decreased length of stay on the SICU, and increased functional independence at hospital discharge."	n=200 (n=96 control patients and n=104 intervention patients) In the control group, the average age was 64 years with 64% being males, and 2% were neurosurgical patients. In the intervention group, the average age was 66 years with 63% being males, and 4% were neurosurgical patients. Between the two groups, baseline characteristics were similar including GCS, APACHE II, Barthel score.	1) The average SOMS level was documented daily and calculated at the end of patient stay. 2) Functional mobility at hospital discharge was calculated using the patient's length of stay and the modified functional independence measuring score tool. 3) The Medical Research Council (MRC) sum score was used to test global muscle strength.	The intervention group had increased levels of mobilization, decreased SICU LOS and improved functional mobility at hospital discharge mmFIM, and more adverse events, more deaths before discharge (22% in intervention versus 17% in control group) compared to the control group. <u>Strengths</u>: included neurosurgery patients (3%) <u>Weaknesses</u>: not blinded (researchers aware of patient

	morning per assessment then was implemented using closed-loop communication.				4) Tertiary endpoints including mobility-related and mobility-unrelated effects were assessed via the following: Mobility related: "daily high serum glucose concentrations (mmol/L), functional status (mmFIM) at SICU discharge, length of stay on the SICU until readiness for discharge (calculated from SICU admission until discharge readiness, as determined by the clinical team), hospital length of stay, in-	group assignments) <u>Generalizability</u>: high (however, the study should be replicated with larger sample of neurosurgical population in future studies)

					hospital mortality, 3-month mortality, and discharge disposition." Mobility-unrelated: "ICU delirium-free days, ventilator-free days, ICU sedation-free days, neuromuscular blocking agent-free days, vasopressor- free days, mean daily morphine equivalent dose (mg), number of days receiving corticosteroids, and daily high serum sodium concentration (mmol/L)."	
Schallom et al., 2020[23]	Quantitative; pre-/postintervention utilizing	Multidisciplinary teamwork (not nurse-led)	"To examine the impact of an interdiscip	Phase 1: 1266 ICU admissions before and 1420 after	Richmond Agitation Scale (RASS) levels,	Results: "In phase 1, the mean (SD) mobility level

	ABCDEF bundle		linary mobility protocol in 7 specialty intensive care units that previously implemented other bundle components."	protocol implementation Phase 2: 258 ICU admissions before and 1681 after implementation	Confusion Assessment Method for the Intensive Care Unit (CAM-ICU), ICU Mobility Scale (IMS)	increased in all intensive care units, from 1.45 (1.03) before to 1.64 (1.03) after implementation ($P <$ .001). Mean (SD) ICU Mobility Scale scores increased on initial evaluation from 4.4 (2.8) to 5.0 (2.8) ($P =$ .01) and at intensive care unit discharge from 6.4 (2.5) to 6.8 (2.3) ($P =$ .04). Complications occurred in 0.2% of patients mobilized. In phase 2, 84% of patients had out-of-bed activity after implementation. The time to achieve mobility levels 2 to 4 decreased (P = .05).

						Intensive care unit length of stay decreased significantly in both phases." <u>Strengths</u>: reliable and valid tools used with descriptive statistical analysis <u>Weaknesses</u>: nurses performed passive mobility while PT/OT performed all other mobility; considered as potential QI study <u>Generalizability</u>: high, especially to population of interest (ventilated neurosurgical population)
Gaspari et al, 2018[24]	Quantitative; retrospective with implementation of hospital-	Multidisciplinary teamwork (not nurse-led)	"The purpose of this study was to examine the number of	n=18 patients with EVDs	Occurrence and highest level of activity, average time between	"Eighteen patients with EVDs received 108 interventions of OOB PT sessions

	based algorithm		adverse events that occurred while performing OOB mobilization in individuals with EVDs in a neurosurgical ICU."		EVD placement and OOB activity; occurrence of adverse events	during this period. No catheter-related mechanical complications occurred during or immediately following the sessions. No serious adverse events were recorded. Minor adverse events included transient dizziness, headache, episodes of hypertension, and hypotension. Vital signs showed no clinically relevant variations before and after the sessions." Strengths: appropriate descriptive statistics provided for comparison Weaknesses: lack of hypothesis testing to

						compare pre- versus post intervention outcomes; mobility protocol steps not clearly outlined in visual format for providers or readers; PT-led protocol used <u>Generalizability</u>: moderate (applicable to neurosurgical population; however, study took place in Brazil and sample size was small)
Moyer et al., 2017[25]	Quantitative; pre-/postintervention with early mobility pathway implementation	Multidisciplinary teamwork (not nurse-led)	"To determine the safety, feasibility, and outcome of an EVD mobilization protocol in patients with subarachnoid hemorrhages (SAH)."	n=25 patients with SAH and EVDs	ICU LOS, day to first mobilization and discharge disposition	Role of the nurse was to monitor drain during PT/OT sessions; interdisciplinary team screened patients Some sessions terminated due to minor patient

						complications; however, overall mobilization in this patient population is safe and feasible Average ICU LOS did not differ between pre- and postinterventional groups (20.7 versus 18.2, p=0.262); day of first mobilization was significantly earlier in the postintervention versus preintervention group (18.6 versus 6.5, <0.0001); "percentage of patients discharged home or to acute rehabilitation was higher in postintervention group (63.2% vs

						88.5%, P=.018)" <u>Strengths</u>: full patient demographic data given for comparison <u>Weaknesses:</u> No measures were given to assess nursing perceptions even though the researchers state nurses becoming more comfortable to mobilize patients <u>Generalizability:</u> moderate(This study trained a multidisciplinary therapy team to become experts prior to implementation of the algorithm. Therefore, it is unknown how much training is needed to train staff

						and implement on a daily level.)
Yatac o et al., 2019[26]	Quantitative; single-site, retrospective chart review	Multidisci plinary teamwork (not nurse-led)	"The aim of our study was to describe the outcomes and adverse events of the first mobilizati on attempt in neurosurge ry patients with EVD who participate d in early functional mobilizati on with physical therapy or occupation al therapy."	n=153 EVD patients who were medically stable	Discharge status, level of assistance, average length of stay, occurrence of mobilizatio n, highest level of mobilizatio n, time from EVD placement to mobilizatio n	"A total of 117 patients were mobilized (76.5%), and the median time to first mobilization after EVD placement in this group of 117 patients was 38 h. Decreased level of consciousne ss was the most common reason for lack of mobilization . The highest level of mobility on the patient's first attempt was ambulation (43.6%), followed by sitting on the side of the bed (30.8%), transferring to a bedside chair (17.1%), and standing up from the

						side of the bed (8.5%).” No major safety events occurred; mild events included mostly headache, nausea, and transient diastolic blood pressure elevation <u>Strengths</u>: exclusion criteria for mobility termination included; comparison of results to those of previous studies given <u>Weaknesses</u>: due to the study’s retrospective design, a power analysis is lacking; unknown what procedures were used (such as a mobility protocol or algorithm)

						to mobilize patients <u>Generalizability:</u> low (due to retrospective nature, more prospective studies are needed to see if these results are still relevant and not simply based on past report or chart review)
Hester et al., 2017[27]	Quantitative; Retrospective analysis of economic and clinical outcome data before, immediately following, and 2 years after implementation of the Progressive Upright Mobility Protocol (PUMP) Plus program	Nurse-led teamwork	"To investigate a progressive mobility program in a neurocritical care population with the hypothesis that the benefits and outcomes of the program (e.g., decreased length of stay) would have a significant positive	n=1,118 adult neurologic and neurosurgical patients in preimplementation, n= 731 patients in the immediate postimplementation period, and n=796 patients in the sustained period (2 years after implementation)	ICU and hospital LOS, average total cost per patient	"ICU length of stay decreased from 6.5 to 5.8 days in the immediate post period and 5.9 days in the sustained period ($F_{(2,2641)}$ = 3.1; p = 0.045). Hospital length of stay was reduced from 11.3±14.1 days to 8.6±8.8 post days and 8.8±9.3 days sustained

			economic impact."			($F_{(2,2641)}$ = 13.0; p < 0.001)." This was despite adjusting for age, sex, diagnoses, sedation, and ventilation. "Hospital-acquired infections were reduced by 50%. Average total cost per patient after adjusting for inflation was significantly reduced by 16% (post period) and 11% (sustained period) when compared with preintervention (F = 3.1; p = 0.045). Overall, these differences translated to an approximately $12.0 million reduction in direct costs"

						within a two-year time period. Emphasized nursing education was imperative for protocol compliance and implementation <u>Strengths:</u> looked at long-term benefits of mobility protocol implementation for population of interest <u>Weaknesses:</u> infection rates related to ventilator-associated pneumonia were not analyzed; this could have impacted the overall infection rates reported in the study <u>Generalizability</u>: high

Dickinson et al., 2013[28]	Quantitative; pre-/postimplementation of early mobility protocol implementation with statistical analysis	Nurse-led teamwork	To determine whether implementation of an early standardized mobility protocol could reduce/eliminate development of pressure ulcers (PUs) in a surgical intensive care unit	n=1112 patients (555 in preimplementation and 557 in postimplementation) admitted in a surgical intensive care unit	Mobility phase compliance and occurrences, PU rate	Even with implementation of the protocol, there was no improvement in "PU rate overall or with time as protocol compliance improved" Hospital and ICU LOS was significantly higher among postimplementation mobility group than the preimplementation (control group) <u>Strengths</u>: patient acuity objectively known <u>Weaknesses</u>: overall protocol compliance was 71% <u>Generalizability</u>: moderate (more studies

						needed in patients with variety of surgery types; ventilation status unknown)
King et al., 2016[29]	Mixed methods pilot study with Mobilizing Older adult patients VIa a Nurse-driven intervention (MOVIN) and focus group interviews	Responsibility of initiation, nurse-led teamwork	"To develop a system-based intervention including five components that target barriers to nurse-initiated patient ambulation."	n=18 registered nurses n= 32 RNs and 10 certified nursing assistants participated in postintervention individual or focus group interviews to provide feedback on the intervention	Ambulation frequency (total number of ambulation occurrences on the unit per week), ambulation distance, (total distance in feet patients ambulated on the unit per week), numeric documentation (percentage of documentation in the EMR in which nursing staff enter a numeric value (e.g., 50 feet); interviews	"A statistically significant increase in number of occurrences ($t = 4.18$, $P = .001$) and total distance ($t = 2.75$, $P = .01$) and a significantly higher positive slope in percentage of numeric documentation was found during the intervention than before the intervention. Thematic analysis identified three central categories (shifting owner- ship, feeling supported, making ambulation visible) that

						describe the effect of MOVIN on nursing staff behaviors and perceptions of the intervention. ” <u>Strengths</u>: Systems Engineering Initiative for Patient Safety model was used as a framework to develop the protocol <u>Weaknesses</u>: no control group (intervention data compared to previous records); variability in patient characteristics unknown in whom the protocol was administered <u>Generalizability</u>: limited (single-site study)

Appendix D

Multidisciplinary Teamwork Perceptions When Mobilizing Ventilated Neurosurgery Patients

ClinicalTrials.gov Identifier: NCT05583487

Recruitment Status : Completed
First Posted : October 17, 2022
Last Update Posted : February 6, 2023

View this study on Beta.ClinicalTrials.gov

Sponsor:
University of Texas Southwestern Medical Center

Information provided by (Responsible Party):
Adrianna Lall, University of Texas Southwestern Medical Center

Study Details | Tabular View | No Results Posted | Disclaimer | How to Read a Study Record

Study Description

Go to

Brief Summary:
The purpose of this research study is to decide if using a nurse-led mobility protocol affects teamwork perceptions, when mobilizing ventilated neurosurgery patients. Participants will mobilize ventilated neurosurgery patients according

to either facility standard procedures or a piloted nurse-led mobility protocol. Each selected patient will be mobilized once during his/her hospitalization for the purposes of this study. Patient mobility may take up to 1 hour. Following this, participating staff will be asked to complete a survey used to measure teamwork perceptions. Participants will be given up to 30 minutes to complete the survey. Total study duration is 3 months.

Condition or disease	Intervention/treatment	Phase
Multidisciplinary Communication	Other: Nurse-led progressive mobility protocol Other: Standard of Care	Not Applicable

Study Design

Go to

Study Type :
Interventional (Clinical Trial)

Actual Enrollment :
28 participants

Allocation:
Non-Randomized

Intervention Model:
Single Group Assignment

Intervention Model Description:
This study will consist of a quasi-experimental research design to examine causality between two or more variables by comparing groups following an intervention. Although the intervention itself will be randomly assigned/administered to each of the multidisciplinary groups for this proposed research study, true randomization of participants cannot be achieved. This is primarily due to each patient having a pre-assigned multidisciplinary care team for each shift. Changing this patient assignment would compromise patient safety while interfering with continuity of care and workflow, which hospital units strive to achieve. By applying the purpose and elements of a quasi-experimental approach to this proposed research study, researchers can determine if an intervention/active independent variable consisting of a nurse-led mobility protocol, has an effect on the outcome measure of teamwork perceptions , which will serve as dependent variables.

Masking:
Single (Care Provider)

Masking Description:
All teams will be asked to progressively mobilize the ventilated neurosurgery patient they are assigned to during the shift. Each team will be blinded to whether or not they will be utilizing the nurse-led mobility

protocol or standard mobility procedures until arrival at the patient's room during the assigned mobility time.

Primary Purpose:

Other

Official Title:

Multidisciplinary Teamwork Perceptions When Mobilizing Ventilated Neurosurgery Patients

Actual Study Start Date :

November 1, 2022

Actual Primary Completion Date :

January 24, 2023

Actual Study Completion Date :

February 1, 2023

Arms and Interventions

Go to

Arm	Intervention/treatment
Active Comparator: Control/non-experimental group The control/nonexperimental group will consist of multidisciplinary teams, who will not be given the nurse-led protocol and will be asked to mobilize the assigned ventilated neurosurgery patient according the facility's standard mobility procedures.	Other: Standard of Care For the purposes of the current study, the control group of multidisciplinary teams requested to mobilize the ventilated neurosurgery patient, may also consist of the primary nurse, RT, PT, and PCT. They will be asked to progressively mobilize the patient to the best of their ability according to standard of care procedures, incorporating any resources the medical center provides including, but not limited to, written information, equipment, ThinkLift, etc.
Experimental: Experimental/interventional group The experimental/interventional group will consist of multidisciplinary teams who will use a given nurse-led protocol (intervention) to mobilize the assigned patient.	Other: Nurse-led progressive mobility protocol The nurse-led mobility progression protocol incorporates a checklist for four primary team members belonging to each discipline to follow before, during, and after providing mobility for each patient. It outlines steps to progress patient mobility from in-bed mobility activities to out-of-bed activities as tolerated. This protocol intervention was created and designed based upon a review of previously conducted studies' interventions and findings, as well as expert

Arm	Intervention/treatment
	guidelines established in the literature. Furthermore, multidisciplinary experts at the medical center who work with ventilated neurosurgery patients were consulted to form the protocol to further establish hemodynamic, neurological, respiratory, and physiological patient safety parameters. This intervention has not been implemented in previous studies and will be piloted for this study. Other Name: nurse-led protocol

Outcome Measures

Go to

Primary Outcome Measures :

1. Teamwork perceptions [Time Frame: Will take each participant no more than 30 minutes to complete. Each participant will take this once following each patient mobility instance.]

   Will be measured using the reliable and valid Nursing Teamwork Survey (NTS) established by Beatrice Kalisch, PhD. The NTS is composed of items with Likert-type scale ranging from 1-5. Higher scores indicate more positive perceptions of teamwork, while lower scores indicate more negative perceptions of teamwork. This scale has been tested and has good psychometric properties including adequate validity and reliability. The minimum total score is 33, while the highest possible score is 165 per participant.

Eligibility Criteria

Go to

Information from the National Library of Medicine NIH NLM

Choosing to participate in a study is an important personal decision. Talk with your doctor and family members or friends about deciding to join a study. To learn more about this study, you or your doctor may contact the study research staff using the contacts provided below. For general information, Learn About Clinical Studies.

Ages Eligible for Study:

18 Years and older (Adult, Older Adult)

Sexes Eligible for Study:

All

Accepts Healthy Volunteers:

Yes

Criteria

Inclusion Criteria:

- adult (18 years of age or older)
- male or female registered nurses or licensed vocational nurses, patient care technicians, respiratory therapists, and physical therapists
- currently employed by the medical center
- currently care for neurosurgery patients in a part time or full-time capacity
- may work during day shift and/or night shift hours.

Exclusion Criteria:

- staff members employed by an agency outside of the medical center
- staff not routinely assigned to care for neurosurgery patients on the neurosurgical ICU (float pool staff)

Contacts and Locations

Go to

Information from the National Library of Medicine

To learn more about this study, you or your doctor may contact the study research staff using the contact information provided by the sponsor.

Please refer to this study by its ClinicalTrials.gov identifier (NCT number): ***NCT05583487***

Locations

United States, Texas

University of Texas Southwestern Medical Center

Dallas, Texas, United States, 75088

Sponsors and Collaborators

University of Texas Southwestern Medical Center

Investigators

Principal Investigator: Adrianna Lall University of Texas at Arlington

More Information

Go to

Responsible Party:

Adrianna Lall, Principal Investigator, University of Texas Southwestern Medical Center

ClinicalTrials.gov Identifier:

NCT05583487 History of Changes

Other Study ID Numbers:

STU-2022-0903

First Posted:

October 17, 2022 Key Record Dates

Last Update Posted:

February 6, 2023

Last Verified:

February 2023

Individual Participant Data (IPD) Sharing Statement:

Plan to Share IPD:

No

Studies a U.S. FDA-regulated Drug Product:

No

Studies a U.S. FDA-regulated Device Product:

No

Appendix E

UTA Office of Regulatory Services
DIVISION OF RESEARCH ADMINISTRATION

November 17, 2022

Adrianna Lall
Department of Nursing
The University of Texas at Arlington

UTA Protocol No.: 2023-0055
UTA Protocol Title: *Multidisciplinary Teamwork Perceptions When Mobilizing Ventilated Neurosurgery Patients*
IRB of Record Protocol No.: STU-2022-0903

RELIANCE APPROVAL

The UT Arlington Office of Research Administration - Regulatory Services and Institutional Review Board (IRB) are pleased to acknowledge your engagement in this research protocol involving human subjects which has been approved by the IRB at UT Southwestern. The UT Southwestern IRB is noted as the "IRB of record" for this protocol. An IRB of record assumes IRB responsibilities for another institution as specified in each institution's Federalwide Assurance (FWA) and has an agreement of reliability on file. Having met the conditions for approval set forth by the IRB at UT Southwestern, and in compliance with applicable regulations, acknowledgment of such approval has been granted by the UTA IRB or designee.

Please note that you are responsible for providing UT Arlington's IRB with copies of official notifications or approvals from the IRB of record as requested. Once the study is complete, you are responsible for submitting a request for study closure to the UT Arlington IRB.

The UT Arlington IRB and the Office of Research Administration - Regulatory Services appreciate your continuing commitment to the protection of human subjects engaged in research and wish you all the best in your research endeavors. Should you have questions or require further assistance, please contact Regulatory Services at regulatoryservices@uta.edu or 817-272-3723.

REGULATORY SERVICES
SERVICES

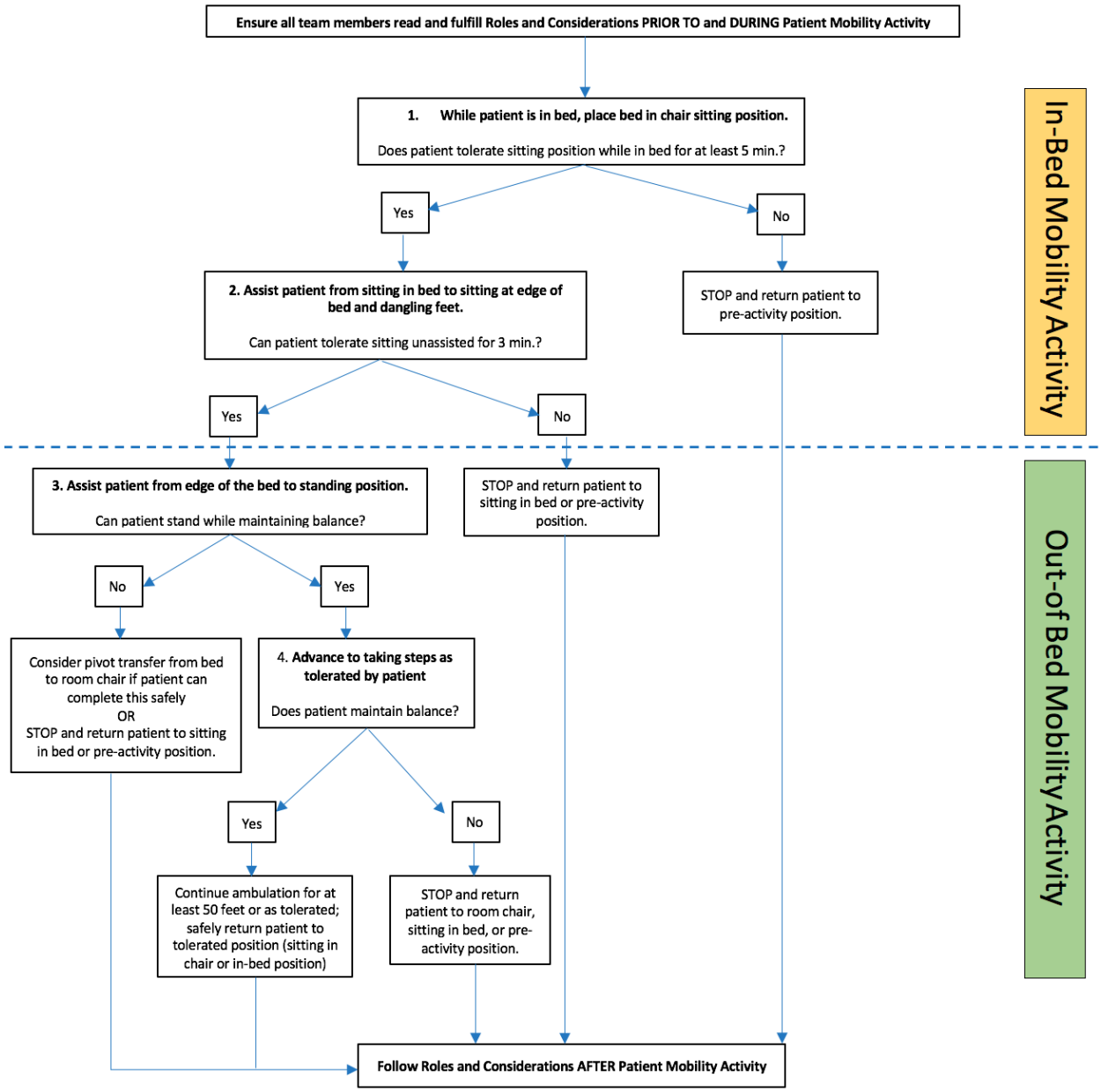
The University of Texas at Arlington
219 W Main St, Arlington, Texas 76010, Box#19188
(T) 817-272-3723 (E) regulatoryservices@uta.edu

Appendix F

Supplemental Digital Figure 1

Nurse-Led Mobility Progression Protocol

Team members may include the team leader (patient's primary registered nurse), a patient care technician, respiratory therapist, and/or physical therapist. If a team member from the listed disicpline is not present at the bedside, responsibilities may be delegated as needed.



Roles and Considerations PRIOR to Patient Mobility Activity

Team Leader (patient's primary registered nurse)

1. Screen patients utilizing the Patient Exclusion Criteria Checklist with all team members.
2. Ensure remaining patients under your care have been safely handed off to another registered nurse for the anticipated designated time it will take to complete the patient mobility activity and survey completion at the end (approximately 1 hour and 30 minutes).
3. Gather additional personnel if necessary.
4. Account for, clamp, and secure all lines, drains and dressings as necessary.
5. Ensure the last time the patient was administered any medication or tube feedings via enteral routes (nasogastric, orogastric, PEG/G-tube, etc.) was at least 30 minutes prior to the start of active ambulation activities. If continuous tube feeds need to held, obtain permission from the physician and do so.
6. Take baseline vital signs when patient is in laying position (if applicable), sitting, and standing position. Vital signs should be recorded by the primary nurse in the patient's electronic health record in real time and by a member of the research team on the Data Collection Tool. Vital signs include:

a. Temperature (°C) (with route)
b. BP (with route)
c. Heart rate and rhythm per EKG monitor
d. Respiratory rate
e. SpO2
f. ETCO2
g. ICP (if applicable)
h. Other critical measurements if applicable

7. Review the plan of action with the patient and the team in order for him/her to sit up, stand, and walk as tolerated to participate in mobility activities.
8. Ask team members questions as needed. Clarify orders as needed with physician and primary care team.
9. If patient's family member is present at the bedside, inform them that mobility intervention will occur. A family member may be present at the bedside at the time of mobilization.

Patient Care Technician

1. Screen patients utilizing the Patient Exclusion Criteria Checklist with all team members.
2. Ensure remaining patients under your care have been safely handed off to another patient care technician or charge nurse for the anticipated designated time it will take to complete the patient mobility activity and survey completion at the end (approximately 1 hour and 30 minutes).
3. Gather travel monitor and hook patient up to continuous monitoring equipment if out of bed mobility is anticipated.
4. Assess the environment in which patient activity is planned to take place for any obstacles or safety concerns.
5. Advocate for any physical safety concerns that may occur and communicate these to other members of the team so appropriate interventions may be taken.
6. Ask team leader questions as needed.

Respiratory Therapist

1. Screen patients utilizing the Patient Exclusion Criteria Checklist with all team members.
2. Ensure remaining patients under your care have been safely handed off to another respiratory therapist for the anticipated designated time it will take to complete the patient mobility activity and survey completion at the end (approximately 1 hour and 30 minutes).
3. Note and verbalize to a member of the research team (who should also record these in the Data Collection Tool) the following ventilator settings:
4. Mode
5. FiO2
6. Set respiratory rate
7. Set Vt
8. Patient's Vt
9. Set PEEP
10. ETCO2
11. Obtain and set up portable ventilation with oxygen tank (and appropriate carrier), full enough for at least 1 hour, if not more.
12. Suction patient orally and via ETT/trach.
13. Make changes to ventilator settings with the physician's permission if these better suit the patient's ventilatory requirements for active ambulation. These changes should also be verbalized to the principal investigator and documented. Consider increasing FiO2 up to 20% as needed to keep SaO2 >90% with maximum FiO2 of 80%.

14. Have emergency travel airway equipment including, but not limited to ambu bag, suction and ventilator tubing.
15. Ask team leader for assistive personnel if needed.
16. Ask team leader questions as needed.

Physical Therapist

1. Screen patients utilizing the Patient Exclusion Criteria Checklist with all team members.
2. Assess the need for and gather all assistive equipment (including but not limited to gait belt, gown, non-slip socks or slippers, walker, wheelchair, and other hospital Fall Prevention Bundle components, etc.). This is dependent on the facility's policies and procedures, along with the PT's discretion.
3. Ask team leader for assistive personnel if needed.
4. Ask team leader questions as needed.

Roles and Considerations DURING Patient Mobility Activity

Team Leader (patient's primary registered nurse)

1. Throughout all mobility phases, assess the patient for hemodynamic instability, which includes but is not limited to arrhythmias, hypertension, or orthostatic hypotension (a decrease in systolic blood pressure of 20 mm Hg or a decrease in diastolic blood pressure of 10 mm Hg within three minutes of standing when compared with blood pressure from the sitting, then supine position).
2. Assess the patient for neurological instability (ICP > 20 cmH2O or out of parameters per physician order if an extra ventricular drain is available, and/or changes in neurological status.
3. Assess the patient for syncope or physiological signs of discomfort.
4. Advocate for any concerns that may occur and communicate these to other members of the team so appropriate interventions may be taken.
5. In the case of patient intolerance or adverse event, safely and promptly discontinue patient mobility activity and return patient
6. Utilize assistive equipment and personnel as needed.
7. Ask team members questions as needed.

Patient Care Technician

1. Assess the environment in which patient activity is planned to take place for any obstacles or safety concerns.
2. Advocate for any physical safety concerns that may occur and communicate these to other members of the team so appropriate interventions may be taken.
3. Assist other team members as needed.
4. Ask team leader questions as needed.

Respiratory Therapist

1. Assess the patient for presence of respiratory complications and/or distress including but not limited to inadequate tidal volumes, excessive bucking of the ventilator (resistance against the ventilator resulting in coughing and asynchronous breathing), increased respiratory rate, or inadequate levels of oxygen as monitored by continuous vital signs.
2. Suction the patient as needed.
3. Ensure ventilatory and airway tubing remains intact.
4. Ask team leader questions as needed.

Physical Therapist

1. Assess the environment in which active ambulation is planned to take place for any obstacles or safety concerns.
2. Advocate for any physical safety concerns that may occur and communicate these to other members of the team so appropriate interventions may be taken.
3. Utilize assistive equipment and personnel as needed.
4. Ask team leader questions as needed.

Roles and Considerations AFTER Patient Mobility Activity
Team Leader (patient's primary registered nurse)
1. Take vital signs have been taken upon completion of active ambulation when patient is in resting position, back in his/her room. Vital signs should be recorded by the primary nurse in the patient's electronic health record in real time and by the principal investigator on the Data Collection Tool. Vital signs include: a. Temperature (°C) (with route) b. BP (with route) c. Heart rate and rhythm per EKG monitor d. Respiratory rate e. SpO2 f. ETCO2 g. ICP (if applicable) h. Other critical measurements if applicable 2. Ensure all lines and drains are intact. Tube feedings should be resumed per order if disconnected for active ambulation activities. 3. Ensure patient is safely positioned back in bed/chair with siderails up and bed/chair alarm on. 4. Ask team members questions as needed. 5. Record the mobility occurrence including mobility start and end time in the patient's electronic medical record.
Patient Care Technician
1. Ensure patient has been disconnected from the travel monitor and placed back on the main ICU room monitor. The travel monitor should be returned after use. 2. Assist other team members as needed. 3. Ask team leader questions as needed.
Respiratory Therapist
1. Ensure patient has been disconnected from the travel ventilator and placed back on the main ventilator within the room. The travel ventilator and oxygen tank should be returned after use. 2. Assess patient for any signs/symptoms of respiratory distress and adjust ventilator settings as needed. Report to PI, patient's primary nurse, and physician. 3. Suction patient orally and/or via endotracheal tube/trach if needed. 4. Ask team leader questions as needed.
Physical Therapist
1. Ensure patient has been safely positioned upon completion of the mobilization activity. 2. Return equipment as necessary if/when no longer in use. 3. Ask team leader questions as needed.

Patient Exclusion Criteria Checklist

This checklist is based upon expert guidelines by AHRQ ICU Early Mobility Protocol (Ahrq.gov, 2014), Gaspari et al. (2018), Hester et al. (2017), Hodgson et al. (2014), Moyer et al. (2017), and experts working at the University of Texas Southwestern Medical Center.

Instructions: The nurse leader will lead the multidisciplinary team in utilizing this checklist to assess whether or not the patient meets any exclusion criteria to participate in mobility activity.

A. **If the patient meets any exclusion criteria for the study**, then the nurse-led multidisciplinary team **should not proceed** to utilizing the remainder of the Screening Algorithm.
B. **If the patient does NOT meet exclusion criteria,** the team should **resume the protocol**, which engages patients in mobility activity.

Please assess for the presence of the following in the patient:

Present? (Y for yes; N for no)	**Criteria**
	Neurologic
	Active management of intracranial hypertension with intracranial pressure not in desired range (Hodgson et al., 2014)
	Unstable spine (pre-clearance or fixation) (Hodgson et al., 2014; Hester et al., 2017)
	Uncontrolled seizures (Hodgson et al., 2014)
	Ischemic or hemorrhagic stroke onset within 24 hours (Hester et al., 2017)
	Up to 24 hours after tissue plasminogen activator or endovascular intervention (Hester et al., 2017)
	RASS not 0 to -1.
	Brain swelling with active management for increased ICP including hypertonic saline therapy, barbiturate coma, ICP monitoring with necessitated head of bed positioning at 30 degrees (Hester et al., 2017)
	Signs of active vasospasm including but not limited to (Moyer et al., 2017): • Nausea and/or vomiting • Acute change in mental status • Acute headache • Acute worsening of deficits • Fever • Neck stiffness
	Respiratory
	Use of rescue therapies including prone positioning, nitric oxide and/or prostacyclin (Hodgson et al., 2014)
	SpO2 < 88% (AHRQ)
	Ventilator settings: • HFOV mode (Hodgson et al., 2014) • FiO_2 >0.6 prior to mobility (AHRQ and Hodgson et al., 2014) • PEEP > 10 cmH_2O (AHRQ and Hodgson et al., 2014) • Dysynchrony (Hodgson et al., 2014) • Pressure control ventilation (Hester et al., 2017) • P/F ratio < 300
	Respiratory rate > 30 breaths per minute (Hodgson et al., 2014)
	Arterial pH < 7.25 within the past 24 hours (AHRQ)
	Lobar collapse, atelectasis, excessive secretions
	Circulatory
	Heart rate, blood pressure and/or MAP not within physician parameters per patient chart order.
	Intravenous antihypertensive therapy for hypertensive emergency (Hodgson et al., 2014)
	Bradycardia requiring pharmacological treatment or awaiting emergency pacemaker insertion (Hodgson et al., 2014)
	Unstable or dependent rhythm with transvenous or epicardial pacemaker in place (Hodgson et al., 2014)
	BP/MAP • not within 65-110 mmHg unless otherwise specified per physician order (Gaspari, 2018) • Above 65 mmHg with use of increased vasopressor dose or fluid resuscitation within the past 2 hours (AHRQ) • Continuous use of vasodilator medication (AHRQ)
	Addition of new anti-arrhythmic medication within past 24 hours (AHRQ)
	Unstable arrhythmia within past 24 hours (AHRQ)
	DVT/PE onset within 24 hours (AHRQ)
	HR • Outside of 40-120 bpm unless otherwise specified per physician order
	Shock of any cause with lactate of > 4mmol/L (Hodgson et al., 2014)
	Cardiac ischemia (ongoing chest pain or dynamic EKG changes) (Hodgson et al., 2014)
	Labs • Hgb < 7gm • Platelet count < 20,000

	Other
	Known uncontrolled active bleeding (Hodgson et al., 2014)
	Devices • Presence of femoral arterial or venous line (Hodgson et al., 2014; AHRQ) • Intra-aortic balloon pump (AHRQ) • Femoral sheath (Hodgson et al., 2014)
	Unstable pelvic, spinal, and lower limb long fracture
	Patient is febrile with temperature exceeding acceptable maximum despite active physical or pharmacological cooling management (Hodgson et al., 2014)
	Active hypothermia management (Hodgson et al., 2014)
	Traction (Hester et al., 2017)
	CRRT (Hester et al., 2017)
	Palliative care; end of life care
	Patient refusal
	Specific physician order contraindicating patient mobility initiation

Supplemental Digital Table 1

Staff Demographic Characteristics

Characteristic	***n***	**%**
Control group	14	50
Interventional group	14	50
Job Title/Role		
RN	15	53.6
LVN/LPN	0	0
PCT	6	21.4
RT	7	25
PT	0	0
Other	0	0
Gender		
Male	8	28.6
Female	20	71.4
Other	0	0
Age		
Under 25 years old	8	28.6
25-34 years old	4	14.3
35 to 44 years old	7	25
45 to 54 years old	6	21.4
55-64 years old	3	10.7
65 or more years old	0	0
Highest Education Level		
Grade school	0	0
High school graduate/GED [a]	2	7.1
Associate degree	6	21.4
Bachelor's degree	19	67.9
Graduate school degree	1	3.6
Shift		
Day shift	18	64.3
Night shift	8	28.6
Rotate between day and night shift	2	7.1
Other	0	0
Employment [b]		
Full time	24	85.7
Part time	1	3.6
PRN	3	10.7
Weekends only	0	0
Other	0	0
Unit experience		
6 months or less	8	28.6
Greater than 6 months up to 2 years	8	28.6

Greater than 2 years up to 5 years	3	10.7
Greater than 5 years up to 10 years	6	21.4
Greater than 10 years	3	10.7
Neurosurgery Patient Care Experience		
6 months or less	5	17.9
Greater than 6 months up to 2 years	4	14.3
Greater than 2 years up to 5 years	4	14.3
Greater than 5 years up to 10 years	11	39.3
Greater than 10 years	4	14.3

Note: RN=Registered Nurse; LVN/LPN=Licensed Practical Nurse/Licensed Vocational Nurse; PCT=Patient Care Technician; RT=Respiratory Therapist; PT=Physical Therapist

[a] *GED = General Education Development*

[b] *Full time employment = three, 12-hour shifts weekly; Part time employment = two, 12-hour shifts weekly; PRN = as needed/one, 12-hour shift biweekly*

Supplemental Digital Table 2

Staff Demographic Comparisons Between Control and Interventional Groups

Characteristic	**Control (%)** (n=14)	**Interventional (%)** (n=14)	**χ^2, df**	***p***
Job Title/Role				
RN	6 (42.8)	9 (64.3)	1.292, df=1	0.256
LVN/LPN	0 (0.0)	0 (0.0)	-	-
PCT	3 (21.4)	3 (21.4)	1.000, df=1	1.000
RT	5 (35.7)	2 (14.2)	1.714, df=1	0.190
PT	0 (0.0)	0 (0.0)	-	-
Other	0 (0.0)	0 (0.0)	-	-
Gender			0.700, df=1	0.403
Male	5 (35.7)	3 (21.4)		
Female	9 (64.3)	11 (78.6)		
Other	0 (0.0)	0 (0.0)		
Age			3.643, df=4	0.456
Under 25 years old	3 (21.4)	5 (35.7)		
25-34 years old	2 (14.3)	2 (14.3)		
35 to 44 years old	3 (21.4)	4 (28.6)		
45 to 54 years old	3 (21.4)	3 (21.4)		
55-64 years old	3 (21.4)	0 (0.0)		
65 or more years old	0 (0.0)	0 (0.0)		
Highest Education Level			3.719, df=3	0.293
Grade school	0 (0.0)	0 (0.0)		
High school graduate/GED [a]	0 (0.0)	2 (14.3)		
Associate degree	4 (28.6)	2 (14.3)		
Bachelor's degree	9 (64.3)	10 (71.4)		
Graduate school degree	1 (7.1)	0 (0.0)		
Shift			0.722, df=2	0.697
Day shift	10 (71.4)	8 (57.1)		
Night shift	3 (21.4)	5 (35.7)		
Rotate between day and night shift	1 (7.1)	1 (7.1)		
Other	0 (0.0)	0 (0.0)		
Employment [b]			4.167, df=2	0.125
Full time	11 (78.6)	13 (92.9)		
Part time	0 (0.0)	1 (7.1)		
PRN	3 (21.4)	0 (0.0)		
Weekends only	0 (0.0)	0 (0.0)		
Other	0 (0.0)	0 (0.0)		
Unit experience			1.833, df=4	0.766
6 months or less	5 (35.7)	3 (21.4)		
Greater than 6 months up to 2 years	4 (28.6)	4 (28.6)		

Greater than 2 years up to 5 years	1 (7.1)	2 (14.3)		
Greater than 5 years up to 10 years	2 (14.3)	4 (28.6)		
Greater than 10 years	2 (14.3)	1 (7.1)		
Neurosurgery Patient Care Experience			5.018, df=4	0.285
6 months or less	3 (21.4)	2 (14.3)		
Greater than 6 months up to 2 years	2 (14.3)	2 (14.3)		
Greater than 2 years up to 5 years	0 (0.0)	4 (28.6)		
Greater than 5 years up to 10 years	7 (50.)	4 (28.6)		
Greater than 10 years	2 (14.3)	2 (14.3)		

Note: RN=Registered Nurse; LVN/LPN=Licensed Practical Nurse/Licensed Vocational Nurse; PCT=Patient Care Technician; RT=Respiratory Therapist; PT=Physical Therapist

[a] *GED = General Education Development*

[b] *Full time employment = three, 12-hour shifts weekly; Part time employment = two, 12-hour shifts weekly; PRN = as needed/one, 12-hour shift biweekly*

Supplemental Digital Table 3

Time and Intervention Interaction Effects on Teamwork and Teamwork Subcategories

	Effects from Time 1 to Time 2			Time*Intervention Interaction Effects		
Outcome	***t***	**df**	***p***	***t***	**df**	***p***
Overall Teamwork	-0.392	2	0.736	0.885	2	0.489
Trust	-0.449	4	0.677	1.055	3	0.363
Orientation	0.019	3	0.986	0.045	3	0.967
Backup	-0.069	13	0.946	-1.632	9	0.137
SMM[a]	-0.031	6	0.976	-1.303	4	0.264
Leadership	1.210	2	0.363	2.808	2	0.134

Note: These parameters were controlled for discipline.

[a] SMM=Shared Mental Models

APPENDIX G

Journal Submission Confirmation for Manuscript Two

Journal of Neuroscience Nursing 1:26 PM Hide

NEURONURSE Submission Confirmation for Multidisciplinary Teamwork Perceptions When Mobilizing Ventilated Neurosurgery Patients

To: Adrianna Lall Vinar,

Reply-To: Journal of Neuroscience Nursing

[External]

Mar 03, 2023

Dear Vinar,

Your submission entitled "Multidisciplinary Teamwork Perceptions When Mobilizing Ventilated Neurosurgery Patients" has been received by the journal editorial office.

You will be able to check on the progress of your paper by logging on to Editorial Manager as an author.

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Journal of Neuroscience Nursing

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