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Weaning the Long-Term Ventilator Patient: A Nursing Protocol

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WEANING THE LONG-TERM VENTILATOR PATIENT: A NURSING PROTOCOL

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ABSTRACT

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This study evaluated the effects of implementing a standardized nursing protocol on decreasing the length of time it takes the patient to wean from long-term ventilation using an ex post facto comparison group design. The standard nursing protocol is a set of 10 nursing interventions used to standardize the weaning process. A retrospective chart review was performed on 24 patients who were in the intensive care unit of a community teaching medical center, and required long-term ventilation of six days or more. After nine months of implementation of a standard nursing protocol, allowing for the intensive care nurses to become familiar with the protocol, data were collected from a convenience sample of 22 records of intensive care unit patients who required long-term ventilation and who were weaned for the first time. A weaning flowsheet based on the standard nursing protocol was completed by the nurses at the patient's bedside. A t-test was used to identify differences in the length of time required to accomplish the weaning process between the two groups. Although there was no significant difference, the length of time patients were on the ventilator was decreased by 1.7 days when the standard nursing protocol was implemented.

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CHAPTER 1

INTRODUCTION

The number of patients requiring long-term mechanical ventilation has increased with the advancement of medical technology. The increase in the number of patients on long-term ventilation causes additional demands on health care revenue and occupation of critical care beds. Mechanical ventilation is commonly used as a treatment for a wide variety of health deficits. Often mechanical ventilation is short term (less than 6 days) to assist the patient over the acute phase of the disease process. Patients on long-term ventilation (6 or more days) represent a more severe strain on the health care system dollar. At a time when health care costs are rising and health care dollars are declining, the most efficient and cost effective method of care must be instituted to maximize resources. This may be started with changes in nursing care.

If nursing interventions are standardized using a specific nursing protocol, the length of time for weaning the long-term ventilator patient might be decreased. The standard nursing protocol is a set of 10 nursing interventions that allow the nursing staff to assist the patient during the weaning process in a uniform manner. Mutual goal setting, used in the standard nursing protocol,

between the nurse and patient leaves less room for misinterpretations and the patient may have a sense of being in control of the care received. The standard nursing protocol also allows the patient to become familiar with the weaning process and develop trust in the nursing staff.

It may be possible that using a standard nursing protocol may shorten the length of time needed for weaning. If this could be accomplished, health care costs could be reduced. For this study, the research question is: Can implementation of a standard nursing protocol shorten the length of time required for long-term ventilator patients to wean?

CHAPTER 2

REVIEW OF LITERATURE AND CONCEPTUAL FRAMEWORK

Implementation of a standard nursing protocol may lead to a decrease in the length of time it takes the patient to wean from mechanical ventilation. A standard nursing protocol, using mutual goal setting, will help to satisfy the patient's need to feel in control during the weaning process and thereby increase the possibility of a shorter weaning time. A review of the literature was conducted and will be discussed. The literature review includes both research conducted on weaning from the ventilator and articles that support the implementation of a standard nursing protocol. The literature review focuses on publications which were written by nurses and physicians regarding long-term ventilation. The conceptual framework, based on Levine's (1973) conservation of energy theory, will also be discussed.

Literature Review

The increasing use of mechanical ventilation for long periods of time has brought to attention several areas of concern. The concerns of high costs of required medical care, complications of the disease process, and the length and quality of life after long-term ventilation, have been addressed by the medical literature. Several studies

related to these problems will be reviewed. Studies that deal with the physiological and economical aspects of patient care that have been published in medical journals will be discussed first. The psychological aspect of patient care, which was addressed by nursing articles will be reviewed later.

Medical Literature

McNabb and Hall's (1976) descriptive study indicated that different diseases have different problems associated with the ability to wean from the ventilator. They indicated that common problems to all ventilator dependent patients include: fluids, nutrition and electrolyte imbalances. This study emphasized patients who were weaning from long term ventilation with clinical diagnoses of chronic obstructive pulmonary disease, renal failure and obesity. These are some of the most common disease entities associated with long-term ventilator dependent patients. McNabb and Hall noted that, when dealing with the patients and their primary physicians, adhering to established principles and diplomacy were both required if weaning was to be successful. Nursing interventions were not mentioned. Many authors agree with the idea that weaning is an interdisciplinary function and optimally includes nurses, respiratory therapists and physicians (Morganroth, Nett, & Petty 1984; Nett, Morganroth, & Petty, 1987a, 1987b, & 1987c; Norton, & Neureuter 1989).

Schmidt et al. (1983) conducted a retrospective chart review of 137 patients representing a variety of medical diagnoses (0.27% of the total hospital population for one year). In their study patients who required at least 48 hours of mechanical ventilation represented 3% of the total hospital bill. The average hospital stay was 22 days. Respiratory therapy and intensive care charges for patients on mechanical ventilation represented 47% of the total 3% charge. The diagnostic related groups (DRG) payment covered only 40% of the total cost of care. Schmidt et al. found that health care costs markedly increased for men above 56 years of age and women above 75 years of age after receiving prolonged mechanical ventilation. This study suggests that there is a need to find ways to decrease the time patients are dependent on a ventilator.

As noted by Schmidt et al. (1983) a large proportion of patients requiring long-term ventilation die within 1 year of treatment. In the study by Schmidt et al. (1983) interviews by questionnaire and phone were performed 3 years post-hospitalization concerning the current level of productivity and perceived state of health of the ex-ventilator dependent patient. One hundred and thirty-three of 137 subjects/families responded. Only 38 subjects were alive and of these, only 28 reported no health problems.

Health care team members must actively seek to decrease the cost/benefit ratio for patients requiring long-term

ventilation. Healthcare dollars are becoming more scarce and the need for long-term ventilation is increasing.

Research by Douglass, Rosen, Butler and Bone (1987) indicated the financial impact of 95 Medicare patients who received at least 3 days of mechanical ventilation. These subjects represented 43 different DRGs. The patient care costs were calculated using the Medicare Prospective Payment System. The total cost of care for the health care institution showed an average loss of $23,000.00 per patient. The Prospective Payment System covered only 40% of the total costs. A patient on mechanical ventilation costs an average of $439.00 more per day than a patient not receiving mechanical ventilation. Douglass et al. (1987) state "because there is no specific DRG for ventilatory dependency these patients are classified into DRGs with non-ventilated patients. Thus, when DRG rates were calculated the costs of treating ventilator patients were simply averaged in with the costs of treating all other patients in the particular DRG" (p. 413). The study was based on costs for basic service and does not account for other potential complications common to long-term ventilator patients such as pneumonia, sepsis, and adult respiratory distress syndrome, etc. This study also supports the need to reduce ventilatory dependency time.

The disease process of some patients that require long-term ventilation and complications associated with long-term ventilation consume the DRG payment quickly. Other patients

with similar disease processes not requiring long-term ventilation usually do not exceed the DRG payment. In their study, Douglass and Rosen (1987) noted that the recovery of costs is essential to the financial well-being of the health care system.

Bone (1987) suggested that the weaning process may take a long time. Yet the clinical expectation is that the patients can be free of mechanical ventilation. These patients are long-term, labor intensive, and expensive. In most hospitals, mechanical ventilation requires the patient to be in a critical care unit. However, the patient does not necessarily require this level of specialized nursing care. Bone (1987) suggested that health care dollars were being wasted by keeping these patients in a high-overhead acute care setting when the ventilation problem could be more rationally served in a low-overhead coordinated unit for long-term care. If patients cannot be freed of mechanical ventilation quickly and efficiently to allow transfer from the critical care area then transfer to a long-term care facility should occur as soon as possible to help control costs.

To assess the need for chronic ventilator facilities in the Chicago area, Bone (1987) interviewed key officials from state and local agencies, nursing homes, and hospitals. These officials agreed that there was an inadequate number of beds for chronic ventilator patients. All beds in existing facilities in the Chicago area, specifically

designated for long-term ventilator patients, were occupied and a waiting list existed. There were only 33 beds that were designated for adults and geriatric patients requiring long-term ventilation. The study suggested that as health care technology and life expectancy increase, there is a need for an increase in long-term ventilator beds and facilities. The lack of available beds for the chronic ventilator dependent patient also points to the need to reduce the time spent on a ventilator, i.e., the need to shorten the time required for the patient to wean from a ventilator.

Previously, the only studies addressing long-term ventilation that were published were medically related. The literature published in the medical journals; McNabb and Hall (1976), Bone (1987), Schmidt et al. (1983), Morganroth et al. (1984), and Douglass et al. (1987) dealt primarily with the physiological process of weaning and the economic impact of long-term ventilation. The literature published by nurses tends to deal with the total client. Only recently has nursing addressed the problems associated with long-term ventilation. Much of the nursing research relates to the patient's perceptions and psychological state while on the ventilator. In the last ten years, nursing research has begun to explore methods to assist patients during the weaning process.

Nursing Literature

Nursing can help to prepare and assist the patient to wean successfully. This will reduce the need for low cost, long-term care facilities. A nursing protocol of nursing interventions standardizing the weaning process could help to reduce the length of time it takes the patient to wean from the ventilator. Such a protocol should allow the patient to mutually set goals with the nurse and satisfy the need to feel in control during the weaning process. If this can be accomplished, transfer from high cost critical care units may occur earlier and the need for additional low cost facilities can be reduced.

The recognition by the health care community of the physiological and economic impact of treating patients requiring long-term ventilation is just the beginning. As medical technology advances, the need for prolonged ventilation will also increase, stretching health care dollars to the limit. Intervention by nurses can help to reduce the length of time to wean, thus reducing costs.

A study by Grossbach-Landis (1980) which described how nursing care can impact on the success of ventilator-dependent patients weaning focused on the total human being. She argued that if there is an imbalance in one or more of the systems (psychological, physiological or environment/ equipment), failure to wean is more likely to result than if all systems are in balance. Many problems were found to interfere with the weaning success. Psychological factors

which interfered were identified as inadequate trust, lack of confidence in staff, depression, and giving up hope. Several environmental/equipment factors, including inadequate oxygen source and use of alternative weaning methods, were also delineated. The physiological factors which interfered with weaning included sleep deprivation, incorrect breathing, nutritional status, inadequate position and secretions. Grossbach-Landis suggested that if these potential problems could be recognized and nursing interventions started, then weaning could be facilitated at an earlier time.

As can be seen by Grossbach-Landis' (1987) study, implementation of a protocol might help the patient keep his/her systems in balance. Controlling the psychological, physiological and environment/equipment systems while allowing patient input may establish increased control by the patient. A standard nursing protocol may allow the patient to satisfy the need to feel in control during the weaning process. A standard nursing protocol is a set of nursing interventions that standardizes the weaning process. Collaboration may increase the control by the patient and facilitate a successful weaning process.

It has been reported by Nett, Morganroth and Petty (1987a), using a convenience sample chart review of 422 patients that the more the patient knows about what is happening during weaning the more control is felt. These findings lend support to those of Grossbach-Landis (1980),

that the development of trust is important. The patients were weaned using a specific protocol which emphasized collaboration between patient and nurse. Adherence to the specific protocol, allowing the patient to exercise some control, caused few misinterpretations and allowed the patient to build a trusting relationship. When explanations regarding weaning or daily routines were given one way and then performed differently, misinterpretations occurred. Often the patient experienced uncomfortable shortness of breath and mistrust. According to Nett et al. adhering to a specific protocol develops patient trust in caregivers and assists in successful weaning attempts, avoiding misinterpretation and confusion.

Patient perceptions of mechanical ventilation were explored in a study by Gries and Fernster (1988). Stressors such as physiological, psychosociocultural, interpersonal, and extrapersonal were identified. The study used Newman's Health System model to help understand the total approach to people and environment as well as the relationship of the variables in person and environment. Nine out of 17 potential subjects agreed to be interviewed post extubation. The results identified sources of major stress to the intubated patient such as restriction of activity, lack of information and inability to communicate. These stressors relate to the patients feeling a lack of control. The study results made nurses more aware of patient's perceptions. With this information nurses can be more aware of how to

provide collaborative care, helping to decrease the patient's stress and increase personal control.

Henneman (1989) conducted experimental research with 26 randomly assigned patients. They were being weaned via T-piece for the first time. A T-piece is an adaptor placed at the end of the artificial airway, allowing the patient to receive humidified oxygen without the aid of mechanical ventilation. The purpose of the study was to determine the effect of direct nursing contact on the stress response while being weaned from mechanical ventilation. Every patient who was assigned to the experimental group had a nurse present continuously in the room during the wean attempt. The nurse was not present continuously with the control group. The stress response was measured by increases in heart rate, blood pressure and respiratory rate. It was found that there was no significant difference between the control and experimental groups. Nursing interventions and the nurse's presence did not have an effect on the stress response of the patient who was weaning from mechanical ventilation. A potential weakness of the study was that of an artificial environment prohibiting any type of interruption or stress. The careful preparation of the patient prior to the wean attempt also could have had an effect on the stress response. The patients were told they would be disconnected from the ventilator and breathing on their own. Instruction on how to breath was also given. Positioning the patient in the upright position and

suctioning took place prior to the wean attempt. As noted by Henneman, nursing interventions have not been subjected to scientific investigation and their effectiveness has not been documented.

Mutual goal setting can help to establish the collaborative relationship between nurse and patient. Involving the patient in goal setting does not result in goals that are less difficult to achieve but, rather, a more committed patient. If the goals are mutually determined the attainment of the goal is completed in less time than when the patient is not involved. Mutual goal setting allows the patient to have some control over the health care environment. Involvement in goal setting encourages the patient to be more motivated, less anxious, and less depressed. Patient satisfaction has also been shown to be higher (Horsley, 1982).

Nielsen (1980) suggested that weaning will be successful only if breathing supplies both baseline oxygen demands and the additional oxygen required by the work of breathing. Tips were given on the best time to minimize the oxygen demand and maximize the successfulness of the wean attempt. These include: when the patient is rested, calm, has no external demands, and minimal nursing interventions take place. Weaning should not be attempted within 30 minutes after procedures or other stressful events. These recommendations by Nielsen have been noted by other nurses

when addressing the process of weaning (Grossbach-Landis, 1980; Burns et al., 1991; Henneman, 1991).

Norton and Neureuter's (1989) discussion of patients who had been mechanically ventilated for at least 5 days suggested that the most important factor in the weaning process is patient readiness. Questions that should be addressed before the weaning process is started are: Is the patient clinically stable, and has the reason for ventilation been corrected? The subjects all had respiratory failure in addition to a chronic disease. Problems common to patients who were difficult to wean were problems that are common to critical care and include dyspnea, infection, pain, nutrition and malposition. The problems encountered by the patient, rather than the technique, resulted in failure to wean. The investigators indicated that the nurse is the primary coordinator of patient care during the weaning process.

Clinical guidelines for assessing the readiness of the patient for weaning were developed by Burns, Fahey, and Slack (1991). The definition of weaning is widely known but the determination of when and how is still unclear. Prolonged ventilation is necessary for only a few patients, but the weaning process can be complicated, costly and time consuming.

Burns et al. (1991) recognized the imperative need to establish trust among the nurses and patient. Other essential needs included adequate sleep, rest periods,

comfort measures, reassurance, and support involving the family. The patient must also be in the best physical condition possible including stable hemodynamics, adequate hydration and nutrition, and infection free or under control.

The Burns Weaning Assessment Program (Burns et al., 1991) is a comprehensive, integrated weaning process. The assessment recognizes both the psychological and physical status of the patient. The program allows the nurse to assist the patient to make maximum progress for a successful wean. Burns suggests that it is not likely any one factor can determine a successful wean attempt. Although the assessment program did experience success, it is also important to study the results of using a specific protocol. The assessment program and protocol together could open a new door for both nursing and patients requiring long-term ventilation.

Successful weaning depends on several factors. Henneman's (1991) discussion emphasized the concept that nurses must consider the overall clinical picture of the patient in addition to the pulmonary parameters. No one parameter, respiratory, non-respiratory or psychological, can be used to predict the outcome of the wean attempt. A combination of clinical judgment and physical assessment allowed the best success in the evaluation of readiness to wean the patient from mechanical ventilation. Although there is no data to report that either intermittent

mandatory ventilation or T-piece weaning is best, a gradual weaning approach is suggested when a patient has received long-term ventilation.

Little research has been done on the role of the nurse during the weaning process. Henneman (1991) suggested that participation in weaning is the major responsibility of the nurse and is very labor-intensive. The nurse must have resources available to monitor and support the patient during the wean attempt. Careful explanation of the weaning process must take place prior to any attempt. The nurse should be in constant attendance and present a realistic optimistic attitude. The patient, if able, should be allowed to have some control over the environment and possibly choose the time to wean. The time chosen for weaning must allow for adequate staff and a calm environment. Distractions can be used, such as family or television. The careful documentation of the weaning process is essential to communicate results to other health care members. Nursing must also evaluate the effectiveness of nursing interventions used during the weaning process to facilitate research.

Summary

The medical literature focused on the patient's actual ability to wean from the ventilator based on the disease process and the increasing health care costs related to patients requiring long-term mechanical ventilation. The authors of the medical literature indicated that long-term

mechanical ventilation stresses the available resources, and alternatives to decrease the length of time required for patients on mechanical ventilation need to be found. This literature suggested a solution for controlling the elevating health care costs for patients requiring long-term ventilation; that is increasing the number of beds in skilled chronic care facilities in which to place these patients. Since skilled care is less expensive than intensive care.

Nursing research that was reviewed highlighted nursing care and the psychological/physiological impact on the patient undergoing the weaning process. It also noted the degree of control the patient maintains when nursing care is received is important. For example: when a patient is knowledgeable about the weaning process, the patient is more likely to respond positively to the interventions. The previously reviewed studies support the need to determine the effects of nursing interventions on total patient care during the weaning process.

Conclusion

Nurses have recognized that the care and knowledge provided to the patient by the nurse has an effect on patient outcomes. Whether the effect is achieving short-term mutually set goals or a shorter length of stay, nursing interventions guide the patient's hospital stay. As previously discussed by several authors, (Horsley, 1982; Nielsen, 1980; Norton and Neureuter, 1989; Burns et al.,

1991; and Henneman, 1991) allowing for adequate rest and nutrition, keeping the patient comfortable, and selecting suitable distractions may help to shorten the weaning process.

Conceptual Framework

Levine's (1973) Conservation Theory is used to explore the process of weaning the patient who requires long-term ventilation. Levine developed a nursing theory that is compatible with the patient in the acute care setting. The purpose of the Conservation Theory is to maintain the unity and integrity of the patient while in an altered state of health. This theory assumes that nursing and the patient will participate together but the patient is in a dependent role.

In Levine's (1973) framework, the family is only considered from the perspective of how their interactions might help or interfere with the patients' well-being. The family needs are not considered in relation to the patient. Promotion of health is limited to areas directly associated with the present state of altered health. The focus is totally on the patient and the present time period. This is appropriate for the critical care patient who is attempting to be weaned. The nurse is an active participant in the patient environment and the interventions performed support the patient's adjustment to the illness. Levine's Conservation Theory can be related to the ventilator

dependent patient because the patient is in constant interaction with nursing care and the environment.

Levine (1973) defines conservation of energy as the balance of energy output and energy input to avoid excessive fatigue. This is essential for the weaning patient. An over expenditure of energy can cause major set backs and make the weaning process more difficult. The balance of stress, nutrition, rest and sleep must be achieved before, and maintained during, the weaning process. This balance influences patient behavior and response to nursing interventions. Mutually determining the time of the wean attempt with the patient enables the patient to make use of high energy times and enables the patient to conserve energy during low energy times.

Conservation of structural integrity is defined by Levine as maintaining or restoring the structure of the body. This principle can be related to the long-term ventilator patient who is attempting to wean. The weaning process for a long-term ventilator patient is a series of progressively longer attempts to assist in strengthening weakened diaphragm muscles and increasing lung compliance. Structuring the interventions to allow for progressive strengthening of weakened muscles used for respiration, conserves structural integrity.

The principle of conservation of personal integrity refers to the maintenance or restoration of self-worth and identity. This can be associated with the ventilator

patient and the implementation of an individualized plan of care based on a standard nursing protocol. The nurse and patient jointly determine specifics for a standard intervention designed to facilitate the weaning process. The ultimate goal is to be free from mechanical ventilation. A structured protocol may help to restore the personal integrity of the patient by making progressive steps towards being free from mechanical ventilation.

Conservation of social integrity is acknowledged by Levine as recognizing the patient as a social being. This principle realizes the need for the patient to have interaction with others, especially the family. Patients react differently to the presence of family members during the weaning process. Some patients find that a familiar face is comforting while others become anxious when family is present. This could be because of the fear of failing the wean attempt in the attendance of a significant other. The nurse and patient together should determine the most appropriate time for family interaction. Distractions are encouraged during the weaning process but the family may not be the most suitable distraction and alternatives should be mutually agreed upon.

A standard nursing protocol, mutually agreed upon between patient and nurse, may help to satisfy the patient's need to feel in control over conservation of energy, structural integrity, personal integrity and social

integrity. It may also assist the patient to obtain the mutual goal of being free from mechanical ventilation.

Nursing plays a major role in assisting the long-term ventilator patient being weaned from mechanical ventilation. The relationship between Levine's theory and the standard nursing protocol (Appendix A) can be seen in the conceptual framework for this study (Figure 1). The decision to start weaning from mechanical ventilation is made based on the assessments of the nurse, physician, and respiratory therapist. This decision is communicated to the patient. During this communication mutual goals are agreed upon. This allows the patient to feel a sense of control during the weaning process. The patient may pick the time of day to be weaned thus utilizing high energy times. The patient may select distractions to be used during the weaning process. The feeling of control that the patient gains using mutual goal setting during the implementation of the standard nursing protocol will help to decrease the patient's anxiety level. Conservation of energy, conservation of social integrity, conservation of structural integrity and conservation of personal integrity facilitate the patient's favorable response to the weaning process. It is assumed that Levine's conservation principles utilized in the implementation of a standard nursing protocol may lead to decreasing the length of time required by the patient to wean from mechanical ventilation.

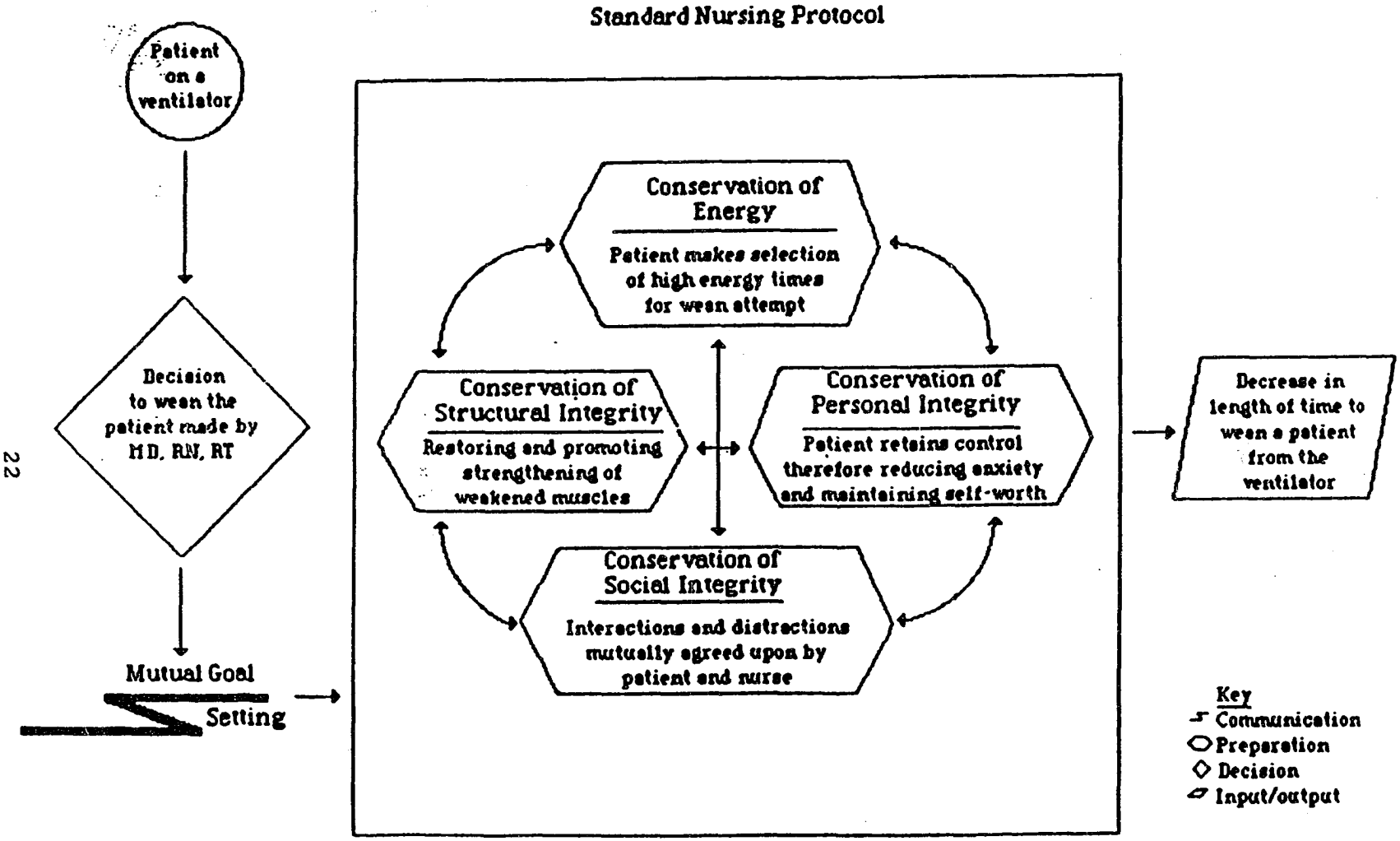

Figure 1. Conceptual Framework: Application of Levine's Conceptual Model to the Implementation of a Standard Nursing Protocol.

Hypothesis

There is limited research by nurses dealing with the weaning process. This study evaluated the effect of a standard nursing protocol on the length of time it took patients who were dependant on mechanical ventilation long-term to wean. The research hypothesis tested was: It will take a shorter period of time for the long-term ventilator patient to wean when the standard nursing protocol is used then when the non-standard nursing protocol is used (see Table 1 for definitions).

Table 1

Definition of Terms

Term	Definition
Weaning	The progressive decrease in the amount of mechanical ventilation that the patient receives. Weaning is initiated with a physician's order and concludes with discontinuation of the ventilator.
Long-term	Any patient who requires artificial ventilation for six or more days.
Length of time	The total number of days required by a patient to wean from artificial ventilation.
Standard nursing protocol	A set of 10 nursing interventions that standardizes the weaning process (Appendix A).
Non-Standard nursing protocol related to weaning	The nursing interventions performed during the weaning process, but inconsistently prior to implementation of the standard nursing protocol.

CHAPTER 3

METHODOLOGY

An ex post facto group comparison design was used for this study. It was conducted in the general intensive care unit of a 405 bed community teaching medical center. Approval of the Human Subject Committee and Nursing Research Committee was obtained. The study evaluated the effect of a standard nursing protocol on the length of time required by the long-term ventilator patient to wean. The independent variable was the nursing intervention as manifested by either the standard nursing protocol or the non-standard nursing protocol. The dependent variable was the length of time (in days) it took the patient to wean from the ventilator.

The non-standard nursing protocol group was studied using a retrospective chart review. The chart review was performed on the records of 24 patients who were weaned prior to the implementation of the standard nursing protocol. Subjects who were ventilated for six or more days and did not have a "do not resuscitate" order were selected.

The standard nursing protocol group was represented by a convenience sample of 22 intensive care unit patients who had been on the ventilator for at least six days and were being weaned for the first time. The standard nursing

protocol had been adopted by the medical center and was based on nursing decisions in order to provide the most consistent quality of care. The only long-term ventilator patients who were eliminated from the study were those who had a "do not resuscitate" order.

Instruments

Two instruments were used for this study. They were a weaning flowsheet (see Appendix B) and a data collection tool (see Appendix C). They are described below.

The weaning flowsheet used for this study was an indicator that the standard nursing protocol was implemented. It was completed by the registered nurse at the bedside at the time of implementing the standard nursing protocol. The weaning flowsheet organized the data in a logical manner so that progress could be monitored at a glance. Documentation of the standard nursing protocol was done on the weaning flowsheet by the nurses in the intensive care unit, and reflected data before, during, and after the weaning attempt. The weaning flowsheet followed the standard nursing protocol so that as the protocol was implemented the data were recorded. The information needed to fill out the weaning flowsheet came from the weaning process. The recording of data on the weaning flowsheet indicated that the nurse implemented the standard nursing protocol as stated. If the data were not recorded, it was assumed that the intervention was not completed. The weaning flowsheet was adapted from Grossbach-Landis (1980).

A letter for permission to use the tool was obtained (see Appendix D).

The data collection tool was used to determine the number of days required for weaning. The data collection tool included: medical diagnoses, age, gender, date of initiation of ventilation, beginning date of the weaning process, last day of ventilation, and total number of days on the ventilator. Demographic data were collected to describe the sample.

Procedure

Mechanical ventilation is maintained only in the critical care units of the medical center. The standard nursing protocol was introduced to the unit and was implemented as the new procedure for a patient weaning from the ventilator. Any patient weaning from the ventilator was to be placed on the standard nursing protocol. Data were collected from 22 intensive care unit patients meeting the criteria. These subjects were of various medical diagnoses, age, sex, and did not have a "do not resuscitate" order.

The nurses in the intensive care unit were instructed on how to complete the weaning flowsheet by the nurse researcher prior to data collection. The weaning flowsheet was presented and questions answered. The weaning flowsheet was kept at the patient's bedside for easy access.

The nurses in the intensive care unit were instructed to complete the weaning flowsheet demonstrating the implementation of the standard nursing protocol. They were

instructed to use patient identification numbers on the weaning flowsheets, and not to use patient names, in order to maintain confidentiality of the patient.

The nurses in the intensive care unit completed a weaning flowsheet for each weaning attempt with patients meeting the established criteria for the study. The researcher was available in person or by phone on a daily basis to answer any questions related to completing the weaning flowsheet. The study was concluded when weaning flowsheets from 22 patients were completed.

The ventilator flowsheets were collected routinely by the nurse researcher. All of the completed flowsheets were kept filed according to hospital identification numbers until the patient was off the ventilator. Then all the flowsheets for that particular patient were tabulated and analyzed.

Implementation of the standard nursing protocol for each attempt was considered to have taken place if at least 7 out of 10 interventions on the protocol were documented. Implementation of the standard nursing protocol for each patient was considered to have taken place if at least 80% of the daily weaning flowsheets were completed.

All data collected were kept confidential. Hospital identification numbers, rather than names, were used to maintain accuracy and to assure anonymity.

CHAPTER 4

RESULTS

The data analyzed and interpreted for this study were from the completed weaning flowsheets done by the intensive care unit nurses and the data collection tools completed by the nurse researcher. The flowsheets used by the nurse to collect the data at the bedside during the weaning process were reviewed for completion. In order to demonstrate that the standard nursing protocol was implemented, the flowsheets needed at least 70% of data completed on a daily basis. Weaning flowsheets needed to be completed for 80% of the total length of time (in days) required to complete the wean cycle in order to show that the standard nursing protocol had been implemented with consistency during the weaning process. The standard nursing protocol was followed at the 80% level in 22 cases. The standard nursing protocol was an attempt to have nursing interventions performed with consistency. The standard nursing protocol had been adopted by the medical center prior to the collection of the data. The retrospective review of 24 charts for the non-standard nursing protocol group was completed on patients' charts for the year of 1989. Data collection for the standard nursing protocol group occurred from October 1990 to December 1991.

The independent variable was the nursing intervention, either non-standard or standard nursing protocol, and was nominal in measurement. The dependent variable was interval in measurement and was the number of days required to wean a patient from the ventilator.

A t-test was used to evaluate if there was a significant difference in the number of days required to wean the patient from the ventilator between using a non-standard nursing protocol or using a standard nursing protocol. Data from 24 patients on the non-standard nursing protocol and 22 patients on the standard nursing protocol were processed using the SPSS PC+. The t-test revealed a probability of > .05. There was no statistical significance between the two groups. The research hypothesis that a change in nursing interventions using a standard nursing protocol versus a non-standard nursing protocol shortens the length of time required for long-term ventilator patients to wean was not supported.

In comparing the subject groups in age, gender and overall range of length of time to wean from long-term ventilation, much similarity was found (see Table 3). The male and female ratio was well balanced given that both the non-standard nursing protocol group and the standard nursing protocol group were conveniently selected. Age range was also similar. Although the average age for the standard nursing protocol group was five years older, the range was close.

Table 2

Differences Between Means of Non-Standard Nursing Protocol and Standard Nursing Protocol

Nursing Intervention	Number	Range of time to wean from the ventilator (days)	Mean
Non-Standard Nursing Protocol	24 (11 male) (13 female)	6-114	21.7
Standard Nursing Protocol	22 (13 male) (9 female)	6-103	19.5

Note: $t = .30$, $p = > .05$

This study only included patients who were on mechanical ventilation for six or more days. The sixth day is the starting point for all patients who weaned from the ventilator. Both nursing protocol groups had at least one patient who required long-term ventilation for 100 days or more. These extreme cases were present in the male and female non-standard nursing protocol group and in the female standard nursing protocol group.

The most frequent amount of time in days needed to wean from long-term ventilation for the non-standard nursing protocol group was seven days, required by four patients. Three patients required eleven days to wean from mechanical ventilation in the standard nursing protocol group. The ranges for each group are documented in Table 3.

Table 3

Comparison of Non-Standard and Standard Nursing Protocol Data

	Non-Standard Nursing Protocol	Standard Nursing Protocol
Total Sample	24	22
Male	11	13
Female	13	9
Age Range	31 - 88	32 - 81
Average	55.3	60.6
Male Range	31 - 88	32 - 80
Female Range	31 - 74	41 - 81
Length of time to wean from the ventilator		
Total		
Range	6 - 114	6 - 103
Average	21.7	19.5
Male		
Range	7 - 101	6 - 44
Average	21.7	14.9
Female		
Range	6 - 114	7 - 103
Average	21.7	26.2

The range for the non-standard nursing protocol group, excluding the two extreme cases was 6-44 days. The standard nursing protocol group range, excluding the extreme cases

was 6-44 days. Deleting the extreme cases from statistical analysis did not change the results.

Each patient had a specific medical diagnosis. The specific diagnoses were grouped into six general categories. They were: pulmonary, surgical, cardiac, neurological, renal and other. The majority of the sample groups fell into the pulmonary category. The surgical group was the next most prevalent (see Table 4).

Table 4

Frequency of Medical Diagnosis

	Non-Standard Nursing Protocol	Standard Nursing Protocol
Pulmonary	12	9
Surgical	5	6
Cardiac	0	3
Neurological	5	2
Renal	0	0
Other	2	2
Total	24	22

In summary, between 1990-1991, 22 patients who required long-term ventilation (6 days or more), were placed on the standard nursing protocol. The implementation of the standard nursing protocol was evidenced by the completion of the weaning flowsheets by the intensive care unit nurses. The length of time these patients required to wean from mechanical ventilation was 2.2 days less than the 1989

sample of patients who were weaned from the ventilator when the non-standard nursing protocol was implemented. When the three extreme cases were deleted the standard nursing protocol group required 1.7 less days for the weaning process. Both samples were similar when factors of age, gender and discharge diagnosis were compared. The two tailed t-test documented a result of $p = .05$, which was not statistically significant. There was lack of support for the research hypothesis that a change in nursing interventions, using a standard nursing protocol versus a non-standard nursing protocol, shortens the length of time required for long-term ventilator patients to wean.

CHAPTER 5

DISCUSSION

The standard nursing protocol implemented for this study required nurses in the intensive care unit to apply 10 nursing interventions with patients who were weaning from mechanical ventilation. The protocol was used daily from the initiation of the weaning process through, and including, discontinuation of mechanical ventilation.

From the time that the standard nursing protocol was introduced, no new staff were added to the intensive care unit. The education that took place prior to the implementation should have provided a consistent knowledge base. It must be noted that each nurse is an individual and nursing practice may vary. This individuality may have altered the implementation of the standard nursing protocol. A part of the standard nursing protocol may have been already implemented in the intensive care unit, but not formally documented, however this was unknown. The nurses of the intensive care unit have assisted patients to wean from both short-term and long-term mechanical ventilation in this setting for at least 10 years. Numerous patients have successfully weaned from the ventilator prior to the implementation of the standard nursing protocol as evidenced by the chart review. This suggests that some of the nursing

interventions of the standard nursing protocol may have been employed by the nursing staff all along. It is likely that not all of the interventions were used and the sequence of the interventions used were not followed exactly. With the design and implementation of the standard nursing protocol, the nursing interventions, which possibly had been inconsistently employed, became a step by step process for every intensive care unit nurse to follow.

The weaning flowsheet needed to have at least 7 out of 10 interventions documented on for the standard nursing protocol to be considered successfully implemented. Two of the 10 nursing interventions used during the weaning process lacked documentation more frequently than the others. The two interventions were: documentation of sedation prior to starting the weaning process and suctioning the patient's artificial airway 15 minutes prior to the wean attempt.

The last time of sedation prior to starting the weaning process was not consistently documented on the weaning flowsheet. It was, however, documented consistently in the nursing notes. One possible reason why documentation of sedation prior to the weaning process was inconsistent could be because the nurse who gave the sedation was not the same nurse who implemented the weaning process and began the weaning flowsheet. Documentation of sedation given during the weaning process was consistent.

The lack of documentation of suctioning the patient 15 minutes prior to the beginning of the weaning process could

be related to the fact that respiratory therapy frequently administered a respiratory treatment prior to the wean attempt. The respiratory therapist suctions the patient's artificial airway after the treatment, not the nurse. Even though the intervention had been performed, according to the standard nursing protocol, it was done by someone other than nursing and therefore may not have been documented. This supports the fact that the weaning process is a multidisciplinary function including the patient, physicians, respiratory therapy and nursing.

Although the findings were not statistically significant, any reduction in the length of stay will reduce health care costs. A shorter length of stay of 1.7 days would represent a dollar savings of approximately $1200 per day. This saving benefits the health care system and the consumer, but the savings cannot be totally based on a dollar amount.

Even though no statistical significance ($p > .05$) was found between the non-standard nursing protocol and the standard nursing protocol there is some clinical significance. Consistency and knowledge of the events allowed the patient to be less anxious, have some control over the environment, and focus energies on the weaning process. Nurses also indicated that they were comfortable assisting patients to wean using the standard nursing protocol because the protocol was a step by step smooth process that every nurse followed. Thus, the patient knew

what to expect each day when it was time to begin weaning from the ventilator, and was not resistant to the wean attempt or the nursing staff. The patient is the ultimate beneficiary with the average decrease of 1.7 days of mechanical ventilation. Through implementation of the standard nursing protocol, the patient's self-esteem, motivation and sense of accomplishment would possibly be increased. Also, being transferred earlier from the critical care unit to the general floor allows for more control over the environment and is the next step prior to discharge.

The purpose of this study was to determine if a standard nursing protocol would shorten the length of time required to wean patients from mechanical ventilation. Levine's (1973) Conservation Theory was the conceptual framework used to develop the standard nursing protocol for this study. All four principles of conservation (energy, structural integrity, personal integrity, and social integrity) provided the basis of the standard protocol and were reflected in the weaning flowsheets used to determine if the protocol had been implemented. The study was focused on the shortening the weaning time and not on measuring the principles of conservation, therefore the data collection tool did not reflect these principles.

Although the data collection tool did not measure Levine's (1973) conceptual framework, the principles were reflected on the weaning flow sheets. Conservation of

energy was implemented when the time to begin the weaning protocol was mutually agreed upon by the patient and the nurse, but the degree of participation was not measured. Conservation of structural integrity (i.e., restoring and promoting strengthening of weakened muscles) was reflected by gradually increasing the length of time the patients were able to stay off the ventilator on each succeeding attempt, but it was not directly measured by the data collection tool. Conservation of personal integrity was not measured statistically, but in the clinical environment patients placed on the standard nursing protocol indicated they felt more in control over the environment, thereby maintaining their self-worth and identity. The conservation of social integrity principle (i.e. distractions mutually agreed upon by patient and nurse) was not measured on the data collection tool, however it was part of the standard nursing protocol, and distractions that were identified were mutually determined by the patients and the nursing staff.

Levine's (1973 conservation theory was not evident in the final analysis because it was not reflected on the data collection tool even though it was reflected in the standard nursing protocol and weaning flowsheets. It would be helpful to be able to determine the effectiveness of Levine's model in weaning patients from long-term mechanical ventilation and therefore future studies could reflect each of the four principles as well as on all four principles on the data collection tool.

Limitations

All research has limitations. Some of these have been previously discussed. Limitations, when recognized, can help to strengthen further research. Three of the limitations of this study are: (a) small sample size, (b) limited mix in medical diagnoses of the population, and (c) three extreme cases.

The small sample size of both the non-standard nursing protocol group and standard nursing protocol group is because only the general medical/surgical intensive care unit was used for data collection. This limits the ability to generalize these findings. Future studies should include more than one critical care unit.

The limited mix of medical diagnoses was reflected in Table 4. The large pulmonary population was not surprising since 80% of the patients with pulmonary disease requiring critical care were admitted to the medical/surgical intensive care unit. The small cardiac and neurological populations requiring long-term ventilation in this study may have been because separate critical care units exist for these patients in the same hospital. The medical/surgical intensive care unit, which was used for this study, receives only the overflow population of the two groups. The categories in which the patients were placed were based on the diagnosis at discharge. Follow-up studies should include a wide variety of medical diagnoses.

Although the standard nursing protocol did decrease the length of time to wean from the ventilator by 2.2 days overall, the three extreme cases may have skewed the results due to the excessive length of time needed for mechanical ventilation. When the extreme cases were removed, the actual time to wean from the ventilator was decreased by 1.7 days. The extreme cases are a very small group but a very expensive one. It would be interesting to determine if there is a difference in the effectiveness of the standard nursing protocol between patients requiring less than and more than 50 days of weaning time.

Recommendations

Recommendations from this study include revision of the weaning flowsheet and education of respiratory therapy personnel on the standard nursing protocol and documentation. When revising the flowsheet for future studies the documentation of the last time of sedation prior to the weaning process could be deleted because this information could be found in the patient's chart at the bedside. The weaning flowsheet was double charting for the time-stressed nurse so the nurse might have elected to chart on the required legal record only. In future studies using the standard nursing protocol, respiratory therapy personnel should be included in the education prior to implementation. The respiratory therapist should be required to document suctioning of the patient on the weaning flowsheet.

Future studies using the standard nursing protocol should first examine the conceptual framework. A framework should be developed to measure each specific component of the protocol, not just the total protocol, as Levine's (1973) Conservation Theory did. The data collection tool must also fit the conceptual framework.

Suggestions for future studies of the standard nursing protocol include:

1. Increasing sample size to enable generalization.

2. Multi-unit implementation to decrease bias from using only one unit.

3. Diagnosis specific implementation, i.e., chronic obstructive pulmonary disease, acute respiratory failure, pneumonia. It may be important to know if a specific medical diagnosis has an impact on the ability for the patient to wean from long-term mechanical ventilation.

4. Intra-disciplinary studies, including respiratory therapy, to determine how different departments influence and impact the weaning process.

5. A study of the influence of respiratory treatments and suctioning of the patient prior to the wean attempt to evaluate if respiratory treatments and suctioning increase the oxygen level during the weaning attempt.

6. A study of the effects of sedation, prior to and during the weaning process on the patient, to evaluate if sedation has any effect on patients' psychological or physical ability to wean from the ventilator.

7. Empirical studies to validate the trusting relationships between the nurses and patient based on familiarity and consistency the standard nursing protocol provides.

In summary, a standard nursing protocol may help shorten the length of time required for mechanical ventilation even though it was not demonstrated by this study. Nursing interventions are an integral part of the nursing care provided to the patient during hospitalization. Although no statistical significance was found, the clinical significance must be considered.

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APPENDICES

Appendix A

Standard Nursing Protocol

---

1. Encourage patient to jointly determine the time of day to wean - based on prior routines before illness. Time to wean _____.
2. Full explanation of weaning prior to each attempt and before respiratory parameters are obtained. The explanation needs to include: who will be present, what will happen when it will take place, why it is being done and how it is to be done.

   For example: Mrs. X, we are going to start weaning you from the breathing machine today. This means that you are getting better and you are ready to begin to breathe on your own. The machine and I will be right here during the procedure. I will be checking your heart rate and blood pressure quite often to help keep a close check on your progress.

   Do you have any questions? Answer these with a honest, positive non-threatening, clear, concise manner. The respiratory therapist should also use this dialogue.
3. No activities or stressful events (bathing, line placement, occupational therapy, or physical therapy) one hour before or 1/2 hour after wean attempt.
4. Wean in high fowlers position or position of comfort nearest to high fowlers. Position_____ HOB_____

5. Suction patient 15 minutes prior to wean.
6. Vital signs: baseline, every fifteen minutes times three, every thirty minutes times two, then, once an hour until wean is completed. Changes in blood pressure + or - 30mm Hg from baseline, heart rate + or - 20 beats per minute from baseline, change in respiratory rate above 10 breathes per minute require that mechanical ventilation be restarted. Notify physician if attempt failed.
7. Assess mental status and behavior throughout entire wean with vital signs.
8. Stay with patient during weans of less than 30 minutes. Keep call light within reach of patient. Maximize time spent in patient room during weaning.
9. Encourage distractions - TV, radio, family - but do not allow energy requiring activities such as occupational therapy, physical therapy, and bathing.
10. Monitor and coordinate sedation schedule with activities, procedures and wean.

Appendix B

Weaning Flowsheet

Medical Diagnoses _____

Hospital I.D. _____

Directions: Get baseline V.S., ABGs before weaning started: V.S.q. 15 x 3., when weaning started then q.-1/2 hour until stable, then q. 1 hour.

Date	Baseline	15	15	15	30	30	1"	1"	1"
Time									
Off/On Ventilator									
Type of Wean Classical or IMV									
IMV Rate/FIO_2	/	/	/	/	/	/	/	/	/
Explanation									
Activity									
Pt Position									
Suction 15" before									
B.P.									
Pulse									
Resp.									
Mental St.									
Behavior									
Distractions									
Time of Sedation									

MENTAL STATUS: 1 = Alert, Oriented, 2 = Lethargic, Drowsy, 3 = Unable to Concentrate, 4 = Confused
5 = Comatose
BEHAVIOR: A = Anxious, Restless, B = Calm, Comfortable, Relaxed, C = Diaphoretic,
D = Gasping for breath, E = Headache, F = Cyanotic, Dusky.

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Appendix C

Data Collection Tool

I.D. Number: _____ ___ ___ ___
1 2 3

Age: _____ ___ ___
6 7

Nursing protocol Yes [ ] No [ ] ___
1 2 4

Sex: F M ___
1 2 8

Primary Medical Diagnoses: _____ ___
5

_____

_____

_____

Start on vent: _____ ___ ___ ___ ___
9 10 11 12

Wean Started: _____ ___ ___ ___ ___
13 14 15 16

Last day on vent: _____ ___ ___ ___ ___
17 18 19 20

# of days on vent: _____ ___ ___ ___ ___
21 22 23 24

Appendix D

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