Development of an Evidence-Based Clinical Practice Guideline for Prone Positioning in Acute Respiratory Distress Syndrome For the Pediatric Patient

By

Jannell Plouffe

A Practicum Project
Submitted to the Faculty of Graduate Studies
In Partial Fulfillment of the Requirements
For the Degree of

Master of Nursing

Faculty of Nursing
University of Manitoba
Winnipeg, Manitoba

THE UNIVERSITY OF MANITOBA

FACULTY OF GRADUATE STUDIES

*****

COPYRIGHT PERMISSION PAGE

Development of an Evidence-Based Clinical Practice Guideline for Prone Positioning in Acute Respiratory Distress Syndrome for the Pediatric Patient

BY

Jannell Plouffe

A Thesis/Practicum submitted to the Faculty of Graduate Studies of The University of Manitoba in partial fulfillment of the requirements of the degree

of

Master of Nursing

Abstract

Research utilization is the critical link in the integration of research and clinical practice. Improvements in care delivery and patient outcomes are among the primary reasons for conducting nursing research, but this scientific knowledge must be translated into practice to be of value (Titler, 1994). Prone positioning for acute respiratory distress syndrome (ARDS) has been described in the literature since 1974 (Froese & Byran), as a low cost, low risk, non-invasive management strategy, yet the implementation of this modality has been slow to enter the care plans in the management of ARDS. This practicum project '*Development of an Evidence Based Clinical Practice Guideline for Prone Positioning in Acute Respiratory Distress Syndrome for the Pediatric Patient*' will examine and critique the research to date and formulate these findings into a practice based document. The clinical practice guideline (CPG) will be examined as to its' fit within the organization and culture of the Pediatric Intensive Care Unit (PICU) at Children's Hospital. Research utilization must be incorporated into the climate of the organization to achieve a successful implementation. Knowledge obtained from research is not 'patient ready'; it must be transformed into clinical innovations specific to the patient population, clinical situation and institutional setting (Leske, Whiteman, Friechels & Pearcy, 1994).

Acknowledgements

I would like to thank each of my committee members for their individual expertise and unique contributions to the practicum project. I thank my chairperson Deb Askin, for her assistance in maintaining my perspective, keeping me focused and inspiring me to the challenge of writing. Dr. Lesley Degner offered her wealth of knowledge on evidence-based nursing practice with an appreciation of the clinical difficulties in this project. Dr. Murray Kesselman provided his clinical expertise on ARDS, and an opportunity to challenge me and foster my growth as Nurse Practitioner in his role as a preceptor throughout the practicum period.

I thank the staff of the Pediatric Intensive Care Unit at Children's Hospital for all the encouragement, support and envisioning the role of a Nurse Practitioner; their contribution to the practicum project extended far beyond the informal evaluation.

Most importantly I thank my family. Geoff whose words in September of 1999, *"You can do it"*, were never far from my thoughts, as well as his tremendous ability to run the house single-handedly over the past two years. To Brett, Courtney and Jocelyn, whose words of encouragement were inspirations. They also allowed me to maintain a balance in my life with daily reminders of what was really important, so I never forgot.

In addition I acknowledge the financial support I received:

- University Of Manitoba Graduate Fellowship
- Child Health Graduate Studentship in Nursing

- Winnipeg General Hospital and Health Sciences Centre School of Nursing Jane A Malcolm Bursary
- Manitoba Association of Registered Nurses Scholarship
- Margaret Elder Hart Graduate Study Award
- Manitoba Nurses Union Bursary

Table of Contents

Appendices

Tables

Chapter One: Introduction

Overview of the Problem

Background

Acute Respiratory Distress Syndrome (ARDS) is a clinical entity found in the pediatric critical care environment. Pediatric patients who develop ARDS suffer substantial morbidity and mortality and with this consume a tremendous amount of health care resources. ARDS is thought to be a uniform expression of a diffuse and overwhelming inflammatory reaction of the pulmonary capillary membrane to a variety of triggers (Pittet, MacKenzie, Martin & Matthay, 1998 and Bernard et al 1994). The American-European consensus conference on ARDS (1994) developed criteria for the operational definition of ARDS. These include: 1.) Acute onset of respiratory signs and symptoms. 2.) Hypoxemia: specifically a Pa02/Fi02 ratio less than 200. 3.) Radiologic evidence of diffuse bilateral pulmonary infiltrates. 4.) No evidence of left atrial hypertension (Bernard et al, 1994).

Pediatric ARDS patients require intubation and mechanical ventilation with maximal life support measures. Care of these infants and children necessitates the use of pharmacologic sedation and neuromuscular blocking agents agents to allow for the optimization of gas exchange and ease of positive pressure ventilation. This population frequently has multi-system organ dysfunction as a result of the primary etiology of ARDS or secondary to the insult of ARDS causing impaired oxygenation and generalized tissue hypoxia.

Prone positioning (PP) for ARDS has been described in the literature as far back as 1961, where Moreno and Lyons noted that the functional residual capacity (FRC) measures in PP were higher than when measured supine. Mellins (1974) and Froese and Byran (1974) later reviewed the effects of positioning on the trans-pulmonary pressure as the means of increasing FRC. The first documentation of improvement in oxygenation occurred in 1976 and 1977 by Piehl and Brown, and Douglas, Rehderi and Beynen et al respectively. Despite almost 40 years of discussion, there are a limited number of primary research studies providing unequivocal support for this intervention. Johnson (1977) has documented that fifty years intervenes before research in any field is properly utilized.

Over the past decade there has been a closer examination of the interaction of PP in ARDS on improvement of oxygenation and the issues pertaining to safety. It is only within the past two years that randomized control trials (RCT's) have been initiated in Europe, Australia, South and North America, with only one study published to date (Kornecki, Fmdova, Coates, Shemie, 2001). The discussion continues as to whether the evidence supports this intervention.

The mechanism of how PP improves oxygenation in the pediatric patient has undergone close examination and thorough discussion in the past decade. Theories include: increased FRC, changes in diaphragm movement, redirection of perfusion to better ventilated areas, increased cardiac output with subsequent increase in arterial partial pressure of oxygen and improved secretion removal

(Albert, 2000; Breiburg, Aitken, Reaby, Clancy and Pierce, 2000; McIntrye, Pulido, Bensard, Shames and Abraham, 2000; Numa et al, 1997; Phillips 1999). Studies have been done which both support and refute each of the aforementioned hypotheses. The most recent research suggests that the gravitational gradient of the pleural pressure is less in the prone compared to the supine position. This is the most likely rationale for the increase in oxygenation (Albert, 2000). The surface area of the lung held above closing volume increases in the prone position, resulting in an improved match between ventilation and perfusion (Mutoch, Guest, Lamm & Albert, 1992).

Local utilization of PP has occurred slowly over the last several years. This form of research utilization is the conceptual change often referred to as 'knowledge drift' (Cronenwett, 1995). This is described as exposure to new knowledge in the literature and the beginnings of critical thinking in relation to the clinical issue, but not a responsive change in the terms of policy or protocol development. In 1999 it was rare to observe an infant or child with ARDS positioned prone in PICU in Winnipeg. As more primary research studies were available and discussion of PP was noted in the review of ARDS management, there was discussion on the incorporation of the PP in these infants and children in the year 2000. There was no formal protocol, guideline or educational component attached to the integration of PP. The impetus was through individual case presentation and plan at the daily multidisciplinary rounds.

The educational-needs assessment completed in PICU (Appendix A), identified positioning of patients as high volume and high need. In addition, staff

described a need to increase their knowledge on ARDS. In the Conduct and Utilization of Research in Nursing (CURN) model (Horsley, Crane, Crabtree & Wood, 1983), this identified need is a facilitating factor of research utilization, relating to successful adoption of practice.

Purposes of Practicum Project

The purposes of the practicum project were to examine and appraise available evidence on PP in ARDS and develop a CPG for integration into clinical practice in the PICU. Members of the multidisciplinary team evaluated the CPG and the results of the formative evaluation will be assimilated into the final CPG. A plan for the introduction of the CPG will be outlined to facilitate the implementation and completion of a pilot project for PP in the PICU.

Significance of the Problem

ARDS occurs in critically ill infants and children usually as a result of severe illness or injury. There are several excellent reviews of the pathophysiology of ARDS in both medical and nursing literature (Curley & Maloney Harmon, 2001; Ware & Matthay, 2000). To determine the significance of the issue of PP in ARDS, the Evidence-Based Care Resource Group (1994a) model for priority problem determination will be utilized.

Frequency of the Problem.

The National Institute of Health panel in 1972 estimated the incidence of ARDS at 150,000 per year in the United States, equaling an incidence of 75 cases / 100,000 population / year. However several more recent prospective studies, with the incorporation of the consensus definition (1994) note the range

of incidence across nations reported between 1.5 in the Canary Islands to 17.9 per 100,000 in Sweden, Denmark and Iceland (Steinburg & Hudson, 2000). Steinburg and Hudson (2000) feel the actual incidence of ARDS in the United States is considerably larger than reports, and current work is being performed to validate this. ARDS occurs as a result of direct or indirect etiologies, which are varied in causation. See Appendix B for etiologies in the pediatric population. The underlying etiologies of ARDS are frequent admission diagnoses in the PICU. According to Curley and Maloney Harmon, (2001) almost 12% of PICU admissions are admitted with an ARDS trigger.

The best description of ARDS in children is from the 41-institution collaboration sponsored by the Pediatric Critical Care Study Group (Timmons, Havens & Fackler, 1995) where 8000 ARDS pediatric charts were reviewed. This review showed that the median age of ARDS patients was1.88 years and median length of stay in the PICU as 26 days (survivors) and 13 days (non-survivors).

In the PICU in Winnipeg in 1998/1999 there were 18 patients reported with ARDS, approximately 3.6 % of the patient population (Mortimer, 2000). They had a mean length of stay of 24 days, which equates to an approximate total of 432 hospital days for the 18 patients. See Appendix C for relevant PICU data. On review of the ARDS patients from December 1, 2000 to March 1, 2001, 9 /109 (8.2% of total) patients met ARDS criteria with length of stay 2 to 70 days in the PICU. It is evident based on these numbers, ARDS is an ongoing clinical

entity in the acutely ill population, thus the investigation of a low risk, low cost intervention to optimize care and potentially improve outcome is appealing.

Magnitude of the Consequences.

In Winnipeg, the average cost per patient day in the PICU is $1200.00 (K. Kristjanson, personnel communication, February, 2001). This cost is felt to be an underestimation of the actual cost of an infant or child with ARDS, due to the fact that these patients consume greater than the average resources. At this average value per day, the cost is $518,400 for the group of 18. (1998/1999). The cost for the months of December (2000) to March (2001) totals $226,800.

The mortality rate of patients who develop ARDS remains high but outcome has improved over the last decade, primarily due to the advances in ventilator management. According to a review by McIntyre et al (2000) the mortality is between 45 – 90 % for the adult population. The Pediatric Critical Care Study Group (Timmons et al, 1995) found a mortality rate of 52%. No therapeutic interventions have convincingly altered the underlying pathophysiology of ARDS, thus the treatment is primarily supportive (Steinburg & Hudson, 2000; Rogers, 1996), and PP is one type of supportive intervention. Currently there is debate as to whether mortality rates in ARDS have actually decreased over time, yet most studies reported a consistent range in the 1990's of 30-40% (Steinburg & Hudson, 2000). The mortality rate in the PICU in Winnipeg has improved in the last decade and currently sits between 12 and 22%.

As previously discussed, these patients experience extended stays in the intensive care environment requiring extensive human and technical resources, without consideration of the social or emotional cost to the family. Despite the advances in ventilation, morbidity in this patient population is uncertain (Rogers, 1996), and it is only through long-term follow-up of the infant and child survivors, that a better understanding of the consequences on a larger health and social scale will be attained.

Practicum Project Questions

Primary Question

Does the current available research support the development of an evidence based CPG for PP in ARDS in the pediatric population?

Secondary Question

Can an evidence based CPG be integrated as a research utilization initiative into the culture of the PICU? This requires an examination of not only the isolated forces within the unit, but on a larger organization as well. In order to successfully incorporate into clinical practice, the entire context of the endeavor must be examined (Stetler, Brunell et al1998).

Assumptions

- The environment of Children's Hospital is supportive of research
- The PICU multidisciplinary team values the research utilization application.
- The allotted time frame is sufficient to perform this project.
- Sufficient evidence is available to support recommendations

- Individual staff nurses are supportive and receptive

Limitations

- One small sample RCT completed to date
- Strength of evidence may not be present
- Fewer available studies in pediatric population
- Concern in relation to the generalizability of findings.

Chapter 2: Critical Review of the Literature

Availability of Research Evidence

As of March 1, 2001 there was one published RCT of PP in ARDS for the pediatric population (Kornecki et al, 2001). There are 2 RCT's completed in Europe (Italy and UK) with the results undergoing analysis at the present time (Albert, 2000; Ball, 2000; Calvin, Noe, Brazzi & Gattinoni, 2000). There are a further two studies in progress, one in United States (Curley, Thompson & Arnold, 2000) and an additional on in Spain (Albert, 2000). It is hoped the results of these studies will provide the level one evidence currently lacking in relation to the PP treatment modality. There are up to 95 primary research studies on PP in ARDS found in the literature (Ball, 2000), of which the majority is either retrospective or prospective quasi-experimental design. The strength of these studies is limited due to absence of a control group and randomization. This weakens the internal validity and causal assertion that the PP maneuver caused the resultant change in the dependent variable. The majority of these studies have reproduced consistent findings, and this builds the strength of the assertion that the findings are valid and not simply chance occurrences. All studies to date are primary small sample size of a homogenous population base. This cautions the generalizability of the results to other settings.

Systematic reviews are considered the 'gold standard' for the assessing the effectiveness of a treatment or intervention (Dickson, 1999). Systematic reviews locate, appraise and synthesize evidence from scientific studies to provide information, empirical answers to scientific research questions (NHS

Centre for Reviews and Dissemination, 1996). There have been several systematic reviews on PP and ARDS (Curley, 1999; McIntyre et al, 2000; Wong, 1999 & Ball, 2000.) and these describe the need for a large sample multi-center RCT. Breiburg et al (2000) and Balas (2000) provide literature reviews on ARDS. Literature reviews do not assess the effectiveness, but are helpful in clarifying current levels of knowledge and in directing the design of future research (Dickson, 1999). Research evidence is present to support PP in the management of ARDS; the level of the evidence may limit the strength of the recommendation.

Search Strategy

A coordinated topic search strategy was completed for this topic. The key words chosen were: acute respiratory distress syndrome, respiratory distress syndrome, acute; acute lung injury and prone positioning. The search years were from 1970 to 2001, with document types; clinical trials and systematic reviews. The Cochrane collaboration was accessed, and linked to the National Research Register (NRR). The NRR was reviewed for completed and ongoing clinical trials to date. Conference proceedings of the International Pediatric Critical Care Conference in Montreal (June, 2000) were reviewed for unpublished work. Data bases electronically searched were: Medline, Cinahl, Embase, Healthstar and Current Contents. Hand searching was performed on key journals: Chest, American Journal of Respiratory and Critical Care Medicine, Intensive Care Medicine, Critical Care Medicine and Pediatric Critical Care Medicine. Reference lists for the studies and articles obtained were reviewed

and cross-referenced to obtain any missing key publications not on the original data base search. Correspondence emails were sent out to several authors.

As described in the CURN model (Horsley et al, 1983), the results of two or more studies are required for any change in practice. The literature search yielded four systematic reviews, two literature reviews, thirty five clinical trials, two case reports, two unpublished studies, three completed trials (not yet published), and six relevant clinical trials in progress. To limit the examination of all individual primary studies, the systematic reviews (secondary studies) were examined for studies assessed, cross-referencing eliminated examination of 25 studies. Case reports were excluded and only trials of PP and with gas exchange as a measured variable were critiqued.

Overview of the Literature

Since 1966 over 8000 ARDS related publications have appeared (Hirvela, 2000). The American-European consensus conference (1994) formed a committee to focus on the issues of outcome, mechanism, incidence, pathophysiology and the international coordination of clinical trials. This committee is active in providing a network for the international approach of ARDS. Current pediatric critical care textbooks all contain sections on ARDS which include pathophysiology and current management strategies of which PP is consistently described (Rogers, 1996; Curley & Maloney Harmon, 2001; Fuhrmann & Zimmerman, 1999). Albert (2000) provides a comprehensive review of PP in the September edition Clinics in Chest Medicine, where the entire journal is dedicated to current research on ARDS. There is an Internet site for

the ARDS network listing through the National Institute of Health@ http://hedwig.mgh.harvard.edu/ardsnet/nih.html. This site provides ongoing clinical trials and associated links. Publications having an overview of ARDS are consistent in providing some description of PP as an intervention related to an increase in oxygenation (van Soren, Diehl-Jones, Maykut, Haddara, 2000 & Phillips, 1999). Following the general review of the clinical entity of ARDS, a precise examination of PP through primary research studies and systematic reviews is necessary.

Primary Study Analysis

Eleven primary studies will be critiqued according to the framework of Stetler, Morsi et al. (1998). Table one provides the summary of critical information from this review. Of the eleven studies reviewed, six had pediatric patients in the sample. Two studies were unpublished and data was extracted from the abstract presentation at the Pediatric Critical Care Conference in Montreal in June of 2000. All studies provided small samples with homogenous populations, which limits the generalizability of the findings. The fact that studies occurred in diverse populations in different countries, Canada, United States, Europe and Australia builds the strength of the generalizability and the causal assertion that the findings are not simply a 'chance occurrence'. The studies ranged from small sample RCTs to quasi-experimental design. The challenge in the examination of these studies is in the discriminate appraisal of the evidence.

Systematic Review Analysis

Systematic reviews of research evidence provide in one source document an efficient integration of existing information, which can assist in provision of rationale to aide in decision-making (Mulrow, 1995). Systematic reviews still require an appraisal of the quality (Dickson, 1999). The model to appraise the systematic reviews has been chosen from Dickson (1999) and with reference to Sackett, Straus, Richardson, Rosenburg and Haynes (2000). See Table 2 for detailed analysis of the systematic reviews on PP in ARDS.

The analysis of the reviews demonstrates each review having a distinct style with certain strengths and limitations. Ball (2000) performs the most extensive described literature search and examination of the primary research studies. Ball poses the most discriminate questions for further research and practice and as well emphasis on the role of the nurse. Ball falls short on the exact description of the level of evidence and recommendation for practice, yet implies a clinical significance based on logic and the intuitive analysis of the studies in combination with the statistics provided. The statistical analysis was not only done, but discerning questions asked regarding parametric or non-parametric testing and statistical suggestions to best maximize future data. This review was complete and inferred that there was no harm in PP in ARDS and PP is clinically significant in improving oxygenation.

Curley (1999) does a limited single date base literature review and yet excels in the description of the complications and discussion on the prevention of complications. Certain areas are inconsistent and lack clarity; Curley implies further primary studies are required, yet states an implied clinical significance

and recommends PP in clinical practice, with the information in this review providing the basis for a CPG. Curley feels that an RCT is premature at this time. Curley does not state the level of evidence, or strength of recommendation in this review.

McIntyre et al (2000), in an attempt to view 30 years of clinical trials on *all aspects* in the management of ARDS, fell short in the examination of the individual studies and combining results of the findings. McIntyre provides an extensive reference list of greater than 250 clinical trials, yet does not describe exclusion of studies based on methodologic flaws. McIntyre et al provides the level of evidence and strength of recommendation for all interventions. PP in ARDS is described as level three evidence, with a grade D recommendation with no reference to a framework. Clinical and statistical significance findings were not available.

Wong (1999) does a systematic review of three different positions for ARDS. Using the framework of Sackett et al (2000), Wong provides a close examination of the studies and level of evidence. The review is detailed with questions interposed in the text and tables. Individual and combined results are provided in an orderly organized fashion. Wong makes the suggestion of a RCT to support the use of the prone position and determine effectiveness, yet does infer clinical significance based on consistent findings in multiple studies to date. Wong states the level of evidence for improved oxygenation as level five and use of PP is recommended a grade C intervention for ARDS.

Of further note, 75% of the systematic reviews included the same five primary articles that Ball had described as reasonable trials based on methodology (Wong had 80% of the studies). Despite keeping what Ball found as methodologically unsound data, the other systematic reviews had consistent findings, yet differed in style and format. The two reviews (Wong, 1999 and McIntyre, 2000), which quote the level of evidence and strength of recommendation, had different conclusions. This illustrates that critique and analysis of a systematic review must occur, often requiring further review of the primary studies. Jadad, Cook and Browman (1997) discuss an approach to interpret discordant systematic reviews and the impact of this on the data utilization. This will be described further in the CPG development section of the project.

Pediatric Considerations

Some clinical trials included samples of adults, adults and children, and children alone. Twenty studies (systematic reviews and primary research studies) had a sample that included pediatric patients; four of these were pediatric only trials. Concerns arise when adult data applies inferences to the pediatric population, which has different anatomy and physiology (Curley & Maloney Harmon, 2001). These differences must be acknowledged when interpreting the findings. There are several pediatric issues that may impact on the application of PP in ARDS, which relate primarily to airway security and developmental or cognitive level.

The pediatric airway being of smaller diameter, narrowing at the cricoid and shorter length (Hazinski, 1999; Curley & Maloney Harmon, 2001) alters the artificial airway fixation, endotracheal tube type (cuffed vs. non- cuffed) and placement (oral versus nasal). Simply turning the head to an extreme on one side may alter the position of the artificial airway substantially enough to cause an inadvertent displacement. The risk of accidental displacement is a concern not demonstrated as a significant finding in the trials to date. Infants and toddlers, not having full comprehension of language, may not understand the words, 'hold your head still' and thereby potentially require higher levels of sedation and neuromuscular blocking agents to safely maintain the PP.

Of further significance is the known impact of abdominal distension and increased intra-abdominal pressure on limiting diaphragmatic excursion in pediatrics patients and minute ventilation due to decreased tidal volume (Curley & Maloney Harmon, 2001). The free abdomen (the hip and torso are elevated, enabling the hand of the examiner to slide easily between the child's abdomen and the surface of the mattress) described in the application of the PP may further influence the net impact of improved oxygenation (Numa, Hammer & Newth, 1997).

The pathophysiology of ARDS does not differ in pediatrics with the definition, criteria and management as equivalent to adults. The physiology of gas exchange, and interpretation of arterial blood gases is consistent across age groups. However studies based on adult data must be cautiously related to the pediatric population.

Summary of the Literature Review

Findings from the systematic reviews and primary studies substantiate the use of PP and its incorporation into a CPG. Utilizing evidentiary tools from Sackett et al (2000) and Stetler, Morsi, Rucki et al (1998) and Shelkelle, Woolf, Eccles and Grimshaw (1999) the evidence and recommendations are delineated in the CPG (Appendix H). The CPG was divided into sections described by Marck (1995) with each element receiving a level of evidence that was supported by the literature. The evidence was described as: Ib, IIb, and III (Shekelle et al, 1999); with the corresponding strength of recommendations as primarily strong, or credible, two as reasonable and a single recommendation as pragmatic.

Level one evidence from meta-analysis of RCTs is not available for PP in ARDS. This "gold standard" evidence is not always present to support practice. The research question, population studied and variables surrounding the research may not support the use of an RCT as the best methodological approach. Sackett et al (2000) agrees, stating evidence-based practice is not restricted to RCT's, rather the research question dictates the method. However Mead (2000) does question whether lack of RCT evidence may cause harm in the potential utilization of research findings.

An RCT for PP in ARDS in pediatric patients would require a large-scale multi-center study over several years to obtain a large enough sample to develop confidence and certainty of the findings. This would require extensive resources, financial and personnel, for what has been evaluated as a low risk intervention. Are the harms of providing the intervention greater than the awaiting of the level

one evidence? This is question that must be discussed and clarified at the local level with the acceptance of action or inaction by all stakeholders.

Chapter Three: Clinical Practice Guideline

Evidence-Based Clinical Practice Guideline

A CPG can be defined as a systematically developed statement to help practitioners and clients in making decision about care (Institute for Medicine, 1992). Eddy (1990) states guidelines comprise elements that describe different aspects of a patient's condition and the care to be given. McClary and Duff (1997) complete the definition off by relating that a clinical guideline is sometimes called a CPG and it provides information about care in a particular condition, including options and making recommendations based on research evidence, which can be adapted locally to suit a particular situation and patient.

Feutz-Harter (1999) describes eight attributes of a CPG. They are: validity, reliability or reproducibility, clinical applicability, clinical flexibility, clarity, multidisciplinary process, scheduled review and documentation. These attributes are identified by the Agency for Health Care Policy and Research (ACHPR) and Institute for Medicine (IFM, 1990). Sackett et al. (2000) refers to avoiding the "Killer B's" to ensure CPG applicability at the local level. The Killer B's are: burden of illness, beliefs of the individual / agency, and bargains versus barriers. These concepts were applied to the CPG. Summary of the major purposes of a CPG are to:

1. Assist the clinical decision making
2. Educate individuals and groups
3. Assess and assure quality care
4. Guide the allocation of resources for health care

5. Reduce the risk of legal liability for patient care. (Feutz-Harter, 1999).

The intent of the CPG for PP is to link research and practice through the application of the aforementioned concepts.

Advantages

Thomas, Angus and Scott (2000) believe CPGs are based on the best available evidence and provide clinicians with guides to ensure the best practice. Using a well- developed evidence-based CPG, which is valid, can help ensure that the care nurses provide is the most up to date and as effective as possible. Research has demonstrated that guidelines had a positive effect on patient outcomes in 55/59 cases reviewed (Grimshaw & Russel, 1993a). A CPG is not a standard; they are guides, not rules (Mead, 2000). An essential difference between a standard and a CPG is a CPG offers practice a synthesis of evidence-based research findings which can be used when setting a standard, and standards describe the structure and process which will be used to arrive at the outcomes to improve patient care (McClarey & Duff, 1997). Thomas et al (2000) support frameworks such as clinical guidelines as providing the vital link between theory and practice.

Disadvantages

Mead (2000) highlights issues surrounding the use of CPG's. Cost effectiveness does not equal clinical effectiveness, yet cost effectiveness frequently drives institutional decision (Mead, 2000) and the development of CPGs. Klein (1996) suggests many decisions are made based on values and these areas cannot be resolved or solved with scientific evidence. Not all

decisions can be covered in a CPG (Mead, 2000) and having an evidence-based CPG does not ensure practice compliance. The CPG must be suited to the local situation, and if the eight attributes are lacking, such as in a 'quick fix guideline', the net success of such an intervention may be less than outstanding. The time required to develop a CPG may not be supported by the organization and what is identified as a cost saving may not improve patient care nor outcomes.

Likelihood the Problem may be Improved

A CPG, stating the strength of the recommendation and level of evidence is undoubtedly superior to an uncontrolled, inconsistent, random intervention of PP in the care of patients with ARDS. Nursing practice in a critical care environment in 2001 is in a state of rapid transition primarily due to the technological advances that are occurring daily. To keep up with the rapidity of these changes, it is essential to conceptualize, synthesize and categorize the knowledge explosion today in nursing (MacLachlan, 1986). This is the challenge of research utilization.

The treatment of ARDS is supportive (Rogers, 1996) and it is unknown whether PP will alter outcome significantly (Albert, 2000 & Ball, 2000). We may define the PP issue locally as a lack of certainty: of whom to turn prone, how to perform this maneuver and evaluate response to the intervention. The issue is not simply altering outcome of ARDS, but to provide the best possible care for the patient with ARDS, and a CPG provides the needed direction (Stetler, Brunell et al, 1998; Woolf et al, 1999 & Feder et al, 1999). This must include the examination of the potential harms, benefits and costs of the intervention

(Appendix D). The whole premise of research utilization is to provide the best evidence-based care in a timely fashion. We must not ignore the research findings to date while we await the results of the level one evidence.

The PICU educational needs assessment completed in 2000 supports the staff interest in knowledge of issues related to PP in ARDS. For a thorough and comprehensive approach, we must discuss, early in the planning stages, the likelihood for problem improvement, and thereby examine the extensive list of barriers and facilitators for this intervention. In the examination of the nursing practice of positioning, Stetler, Brunell et al (1998) outlines four potential bases of practice, of which PP for ARDS in the PICU is the best fit with type IV: traditional basis for practice. The position of side lying or supine for ARDS is a ritual with no written rules for turning. The patient is turned every two hours, a habit the nurses have chosen to continue. Often nurses turn patients based on experience of what has worked or stories of what did not. Positioning is part of the nursing culture in the PICU. The Evidence Base Care Resource Group (1994b) summarizes evidence based nursing as a mechanism to de-emphasize ritual, isolated and unsystematic clinical experience, ungrounded opinion and traditions the basis for nursing practice. This may imply that in the PICU, where positioning is inherent in the culture, nurses have a fair distance to travel to incorporate research into practice.

The barriers to the innovation can be examined using Grol's work (1997), where the second stage of his model identifies 'obstacles to change'. This is a critical piece in the integration of research utilization that examines the clinical

factors, social context and organization. It crosses the barriers to the innovation with 'stage of the implementation process', as the obstacles at each stage do require close review before the initiative is begun. See Appendix E for the examination of the examination of all probable barriers for this initiative in PICU. Review of the barriers will be part of the discussion section.

The likelihood of adoption of the innovation should be addressed early in the planning process. The CURN project (Horsley et al, 1983) has developed a two-part tool to assist in the assessment and examination of whether a change will be adopted. See appendix F for the scoring in relation to this particular intervention. The score of 95.5 for this innovation indicates some obstacles, but the chance of successful implementation and adoption are good. Both the cost-benefit and ease of implementation subtotal are rated as 'good'.

In summary this chapter describes an innovative research utilization effort to bridge the gap between research and practice. A CPG is supported by the literature as one initiative that may facilitate the successful uptake of research.

Chapter Four: Methodology

Methodology of the practicum project was subdivided into three sections. They include: overview of the problem, CPG development and informal evaluation of the CPG. The clinical innovation model by Leske et al (1994) is the primary framework supporting this research utilization innovation. The CURN model (Horsely et al, 1983) provides additional analytical pieces within the stages of Leske's model. The CPG was developed in the methodological framework for the appraisal of the best evidence by Stetler, Morsi et al (1998) and Sackett et al (2000) and Shekelle et al. (1999). The evaluation of the CPG required an 'Evaluation Research' design to provide the necessary structure and fit into the research utilization project. Polit and Hungler (1995) define evaluation research as an applied form of research that involves finding out how well a program, practice, procedure or policy is working, with the purpose of the evaluation to answer the practical questions of the people who must make decisions.

Practicum Project Model

Examination of the literature surrounding evidence-based practice describes several strategies for the research utilization. Two models (Leske et al, 1994 & Horsley et al, 1983) were used as adjuncts and built upon the strength of each to support this practicum project. Leske et al (1994) describes a research base practice model, which fits nicely into a critical care environment and a CPG intervention. Refer to figure in Appendix G. This innovation model pictorially represents the linkages and the flow of the process for innovation such

as PP. The desired outcome of quality of care is the overriding mandate and it shows the relationship of quality improvement activities, research utilization and conducting research. The CURN model (Horsley et al, 1983) provides foundation to the application process.

The first step is the 'identification of the problem'. The Evidence Base Care Resource Group (1994a) model guided the background questions and priority determination of ARDS and PP in the preceding sections. The next stage of 'seeking solutions' included the review and analysis of the literature.

Development of the Evidence-Based CPG

Based on the evidence and findings within the literature, the CPG was developed. The critique and appraisal of the evidence will be based on Stetler, Morsi et al, (1998), Sackett et al (2000) and Shekelle et al (1999). The American Nurses Association (Marck, 1995) manual to guideline development supplied the foundation for the CPG development. The British Medical Journal (1999) four-part series on clinical guidelines, with methods described by Shekelle et al and Woolf et al, offered additional references.

Sackett et al (2000) recommends that clinical texts on evidence-based practice rate each clinical recommendation with a level of evidence. This must be balanced with the attributes of a successful CPG (Feutz-Harter, 1999) and the avoidance of the Killer B's (Sackett et al, 2000) in the CPG developed for the implementation of PP. See Appendix I for CPG for PP for the PICU.

Understandable language and clarity were guiding principles. A definition of the key elements was provided in the opening section of this project's

guideline. Appendices were added with the description of the levels of evidence and the strength of recommendation. This provided a reference for the staff to review and potentially impart knowledge to the reader. The document was not intended to be 'weighed down', but to remain understandable.

Numeric coded references were provided to demonstrate validity and to decrease the reading burden and allow for quick cross-referencing. The readability was felt to be of primary importance and with the number of references large, the numeric system was paramount in the simplification of the text. The evidence from the research was linked to the local practice environment to assure clinical applicability. The appendices and diagrams were provided for clarity. Specific details were avoided to allow for clinical flexibility. All disciplines involved in the implementation of a PP initiative were involved in the intervention to allow for the multidisciplinary perspective.

The Killer B's were dealt through several strategies. The disease ARDS, was defined to provide consistency of interpretation. The burden was not discussed, as the clinical significance of ARDS is well known in the PICU. The beliefs of the individual were addressed through questions in the intervention. Questions allowed for expression of potential barriers in the implementation of the intervention within a goal free approach. Mead (2000) recommends each guideline may be developed in it's own unique style, according to care and patient condition thereby having a CPG that fits the contextual framework of each setting. This is consistent with the intent of the interactive portion of the practicum project where the project will examine the multidisciplinary team

response to the intervention before the implementation of the PP CPG as a pilot project.

Research Design

The third phase of Leske's model is the 'plan for change', which incorporated the review of the CPG by the key stakeholders in the CPG implementation. The CPG evaluation is described as evaluation research. Evaluation research is defined as the utilization of scientific methods, research methods and procedures to evaluate a program, treatment, practice or policy; it uses analytical means to document worth of an activity (Titler, 1998). The design within this evaluation research project will utilize a goal free approach (Hunger & Polit, 1995). The goal free approach allows examination of other consequences besides accomplishing the official objectives of the program, as the classic design models may handicap the ability to investigate the other effects (Hunger & Polit, 1995). This consisted of the formative evaluation of the CPG by the staff nurses and the multidisciplinary team. This is a formative evaluation as it refers to the assessment of a program as it is implemented, with the focus on process versus outcomes (Titler, 1998) and the aim of improving a new or ongoing program (Polit & Hungler, 1995). Formative evaluation allows us to view the best method of care within a particular location or institutional environment and is linked closely with quality assurance and improvement activities, yet it is ultimately part of the initial research utilization initiative. The formative evaluation consisted of an informal 'group' process where feedback was elicited for integration into the final CPG product.

The strength of this methodological approach relates to the relationship of program development and implementation process; done in concert, they complement the net outcome of participation, group interaction and key educational concepts. This method provides an opportunity to address some of the 'barriers and adoption' issues related to the research utilization innovation. It allows for the accumulation of a substantial amount both quantitative and qualitative data in a low risk, expedient process. By providing for an anonymous written response in addition to group participation, there is an opportunity to comment without concern over peer influence.

The limits of this design relate to the lack of scientific rigor (non random) and inability to control variables such as sample bias and hidden agenda. In addition some individuals are uncomfortable about expressing themselves in front of a group. The experience and trust relationship of the individual leading the groups sessions can facilitate or deter the informal discussion process.

Ethical Consideration

Ethical approval was sought and obtained by the Education / Nursing Ethics Board (ENREB) from the University of Manitoba. An informed consent (Appendix H) was signed prior to the commencement of the group discussion with a copy of the consent kept by each participant. The ethical approval was attached to the CPG as well as a copy of the informed consent for the participants to view.

Target Population

Members of the multidisciplinary team in the PICU were targeted to evaluate the CPG in the 'plan for change' phase in the research utilization. This group comprises the key players involved in the success of the implementation; their feedback and support are valued for the expertise on the clinical aspects of the CPG. The nursing group is a convenience sample, which will provide formative evaluation of the CPG through the group discussion process. The major disadvantage of a convenience sample is the risk for bias. Caution must be used in the analysis of these findings, as vocal individuals will speak up, which may negate other issues that were not presented within this sample population.

A purposive sample was utilized to obtain representation from all disciplines to ensure a multi-disciplinary review of the CPG. Again caution must be used in this sample technique, as there may be a conscious bias in the sample selection. This sample includes the following members: occupational therapy (OT), physiotherapy (PT), respiratory therapy (RT), and pharmacists, attending physicians and nursing managers in the PICU.

Recruitment Methodology

The recruitment was voluntary for the convenience sample. Methods to recruit included: an email to PICU staff, memo in communication book and a notice posting on the educational bulletin board in the PICU. Staff was asked to review the CPG for the discussion, with the dates and time of the informal sessions provided. In addition, individuals could choose to anonymously submit feedback in a comments portion of the CPG on the educational bulletin board.

The purposive sample was recruited primarily through the multidisciplinary PICU management team. The CPG was circulated two weeks prior to the May multidisciplinary meeting to the individual members of the group for their respective disciplines to review and comment on, on behalf of their department. The members not represented, (OT and PT) had a copy of the CPG sent to a representative, with a cover letter asking for written feedback and /or an invitation to the group discussion.

Evaluation process

Copies of the CPG were available in PICU (desk) and attached to the educational board. The objectives of the practicum project were attached. The scheduled sessions were posted and cross-referenced to the daily assignment book. Over a two-week period, six sessions of 30 minutes duration were scheduled, covering a day and evening time slot in an to attempt to reach individuals who work the evening shift in addition to the 12-hour day / night rotation. This method ensured the four nursing teams were contacted.

For the multidisciplinary team a request for a presentation and question and answer period was submitted in April for the May meeting. The CPG was circulated to the individual members of this group two weeks prior to the meeting. Following a brief presentation, comments on the CPG as well as responses to the four open ended questions were to be collected.

Follow up

The information obtained from all the informal discussions was collated and printed for the staff to review within two weeks of the completion of the

discussion groups. This ensured team members were fairly represented and the bias of the CPG developer was not the pervading influence in the pooled data. This data was kept on record for the subsequent content analysis.

Purpose of the Formative Evaluation

There were several objectives for this evaluation research. They are as follows:

1. Determination of whether the CPG is a viable initiative in the PICU.
2. Examination of pre-existing issues, which may impact on the success or failure of the CPG.
3. Obtain suggestions which may increase the effectiveness, efficacy and efficiency of the CPG

Questions

Four open-ended questions were asked to fulfill the previously stated goals. These were placed on a card with appropriate prompts.

1. What is your initial impression of the CPG?
2. What impact, if any, will the presence of this CPG have on your role and provision of care?
3. What issues make this CPG difficult for you?
4. Can you identify any suggestions for change?

The participants were reminded at the conclusion of the discussion that the comments from all groups would be pooled and then circulated for review. Participants were instructed that if they had further suggestions, a response

sheet was available attached to the CPG on the educational board for the subsequent 2 weeks.

Data Analysis

Following the two-week review period, content analysis of the responses identified several themes. Themes related to the identification of barriers and adoption process was delineated and analysis of these findings will occur in the discussion section of this project. Facilitating ideologies and the supporting impact statements were broken into themes and patterns in the analysis. All responses were interpreted from the theoretical frameworks' perspective of the intervention.

Chapter Five: The Intervention and Findings

This chapter details the data obtained from the intervention described in the methodology section of this paper. The responses are arranged in the order the four questions were posed, with content analysis of the verbal responses identifying the major themes. A findings summary is provided in Table 3.

Clinical Practice Guideline Evaluation Intervention

Six scheduled sessions were held over a two-week period, with each session of 30 minutes duration. Only one session was not attended and this was due to extreme staff shortages on shift. All four nursing teams were contacted, for a total of 31 individual participants representing four disciplines: nursing (staff, education and management), pharmacy, respiratory therapy, and physiotherapy. Written feedback attached to the comments section of the CPG was added to the sum of the responses.

Delay with the ethical approval altered the initial methodological plan, as the multidisciplinary team contact for May could not be performed due to lack of approval at this time. The purposive sample had the CPG distributed and an invitation to the scheduled sessions, but the interactive piece scheduled for the May meeting was not completed. An attempt was made to change the interactive session to the June meeting, but the logistics of changing the time frame was not feasible. The purposive sample did not yield feedback from the medical team: neither residents nor attending physicians.

Formative Evaluation Findings

Initial Impression of the Clinical Practice Guideline

Responses to the question *"What is your initial impression of the clinical practice guideline?"* were subdivided into four major themes: neutral, positive, questioning and negative. The goal of this question was to address the Killer B's related to the individuals beliefs that may oppose the eventual acceptance of a CPG as a research utilization initiative. Examination of the forces and potential subculture issues should be addressed before the implementation of an clinical innovation to foster acceptance and 'buy in' by the members of the team

Neutral. These responses would be described as primary statements of fact that did not lend into overt opposition or support. They may have been pursued further had latitude for this been allowed within the ethical approval framework, but the prompts did not render further information at that time. The statements surrounded a belief that this is not anything new or surprising, we are already doing this.

Questioning. In posing a question the critical analysis begins and further questioning occurs. This shows ongoing evaluation, as the individual attempted to relate the CPG into practice and begin with questions. In addition this demonstrates staff seeking further knowledge and an underlying readiness to learn. The issues identified were the patient and knowledge. 'Patient' related questions were linked to: comfort of the client, positioning, indications and contraindication to the PP intervention. 'Knowledge' questions related to inquiry of the language and terminology.

Negative. Disapproving comments related to two main themes, the length of the document and definitions. The 'length' was felt to be unnecessary and the

number of references large. The 'definitions' of responder and non-responder were confusing to the individuals who spoke of them.

Positive. The vast majority of the feedback was affirmative and supportive. The dialogue appeared encouraging and enthusiastic, "two thumbs up!" In the 50 responses, there were five major themes which link closely to attributes of a good CPG. The themes are as follows: readability, simplicity, organized, informative, and positive reinforcement. Although closely related to each other, these ideologies differed in the information they presented.

'Readability' referred to the information being presented in a style and language that made sense to the practitioners. There was "no research malarkey". 'Simplicity' referred to the ease of use; it was uncomplicated, easy to follow and it did not require additional education. 'Informative' meant that enough information was provided in terms of tables and charts that substantial self-education and growth occurred; "learning from the document". 'Informative' was also described in relation to the diagrams that were helpful in the visualization of the process. The definition of Oxygen Index (OI) was another example of further information attained. The 'Organized' theme meant that it flowed logically, was factual and valid, providing a step-by-step description without being a procedure. The 'positive reinforcing' concept related to the CPG supporting what the staff are doing as *best practice*. Staff shared how PP in PICU had been a topic at a recent multidisciplinary presentation in another clinical area, where PICU was described as a role model for this best practice. There was a strong sense of pride associated with this.

Impact of the Clinical Practice Guideline

The second question, "*What impact, if any, will the presence of the CPG have on you and your role in the provision of care?*" The intent of this question was to force the team members not to view the guideline as a piece of research or evidence, but for them to personify what it meant to them, and in this 'goal free' approach identify potential facilitators or barriers and burdens expected in the course of the implementation process. General overview of the responses provided the same four main groupings: positive, negative, questioning or neutral in quality, with responses in several areas presenting consistent data with relation to the other questions posed.

Neutral. These responses were stated facts, neither challenging nor encouraging and were often unrelated to what it would mean to them in their role. Such as: "PP depends on the severity of the ARDS", "Airway precautions are important", "This is important for skin care" and "Time management may be an issue". They could have been further clarified had the approval process allowed for this. They were generally larger concepts that were not examined at this point in time.

Questioning. Many respondents answered the question with further questions, related to two themes of maintaining the prone position and pharmacologic issues of comfort and sedation. 'Maintaining' questions related to specific issues of the PP and the frequency. 'Medication' questions queried drug choices for sedation and paralysis. This leads to further educational strategies required in the eventual implementation of the intervention.

Negative. The main opposition to the incorporation of the PP into their role surrounded the 'challenges of the turn'. This was subdivided into two components of the actual performance of the turn and maintaining the position. The 'performance' related to technical difficulties, airway loss, time management, organization, staff numbers required and the overwhelming nature of the whole idea. 'Maintaining the turn' referred to the concepts of comfort, skin care, foot positioning, proper devices and emergency protocol if resuscitation was required.

Positive. Impact statements were divided in to four elements: education, consistency, multidisciplinary and impetus. 'Education' was described as the CPG providing a reference for staff to learn from and utilize, a "time savings" as it explained PP. It was a medium to share information. `Consistency' referred to the idea the entire team was performing the same intervention, "on the same page of the book". The CPG provided a standard for practice, as a 'multidisciplinary' team effort. Responses suggested a multidisciplinary approach was the preferred practice. The most inspiring element was the belief the CPG provided a prompt and 'impetus' to discuss PP in the daily plan of eligible patients, serving as a reminder, a dialogue point and a facilitator for best practice.

Difficult Issues with the Clinical Practice Guideline

The third question directed staff to a discussion as clinical experts delineating the potential barriers. *"What issues make the CPG difficult for you?* Six major responses occurred, four of them related to the theme of resources and the second theme related to the CPG itself. Within the resources theme,

four areas were identified as difficulties: staff, patient, equipment and time. Under the CPG theme, the two entities were: evaluation and format.

Resources. Lack of resources was a significant issue, with "insufficient staff" as the most frequent response. In addition, inadequate staff in terms of trained, educated personnel to safely perform prone positioning was also identified. The staff described the perception of PP as an intimidating task, with an associated feeling of panic that a patient may deteriorate and what to do at this point. They also questioned what to do with those individuals who chose to not participate, a significant concern for one group. Significant concerns also relate to the 'patient'; with concerns of patient stability, airway security, patient tolerance, size of the patient, emergency management and proper skin care. 'Time' was cited as a resource with concerns for the practicality, "PP and the CPG sound ideal, but in the real world....". The length of 30 minutes for the described duration of the turn was a concern, and it was questioned how it was known that the duration would be 30 minutes. 'Equipment' was a substantial issue due to a lack of accessibility and availability. Standard equipment may require modification for PP to work effectively, such as length of tubing or monitoring lines. Difficulty with the best mattress choice was described.

Clinical Practice Guideline. The CPG issues were related to the 'format'. A brief protocol or procedure, as quick reference document, for the bedside was suggested. The CPG did not detail all the necessary evaluations required to assess tolerance. They identified a need for specifics of an ongoing patient evaluation, specifically indices and frequency for assessments.

Suggestions for Change

The final question asked *"Can you identify any suggestions for change?"* The responses were expressed in terms of three themes of: nothing, education and future improvements; with nothing being the primary response. Overall the team members had little to offer for revisions and stated they were happy with the document and the PP initiative. Many commented on what they 'learned', citing information on evidence and research, blocking of care in this manner, positioning correctly and the team role. 'Future improvement' was a broad category that ranged from suggestions for physician's order, diagrams of different size patients to strategies to assist with the implementation such as practice education sessions and videotaping of patients. There were requests for more information on the timing of PP, frequency of the turn and development of an emergency turn protocol. They would like to see the document in an abbreviated format that could be used at the bedside. The definitions were an area where they felt the terminology was not as well understood. There was consistent support for the implementation of the CPG and PP in the PICU, with innovative ideas for the education and implementation plan.

Summary of the Findings

The goal free evaluation research design provided sufficient interaction and information from the staff. The responses and attendance at the interventions were positive and possibly related to a show of support for the role of advanced practice nursing and a curiosity of this project. Qualitative interpretation though content analysis demonstrated the evolution of themes

central to the success or failure of the research utilization innovation. The interpretation of these findings in relation to the goals of the project will be discussed in the subsequent section.

Chapter Six: Discussion

Development of an evidence-based CPG for PP in ARDS demonstrated a clinical innovation as a research utilization project in the PICU at Children's Hospital. In the field of knowledge utilization, an innovation is defined not only in relation to new knowledge, but also in the context in which it is being used, as well as the characteristics of the user (Leske et al, 1994). The CPG was intended as an innovation to transmit new knowledge. An innovation is an idea, practice, or object perceived as new by an individual or unit of adoption (Rogers, 1983). The practicum project had two main questions posed. The primary question was *"Does the current available research support the development of an evidence-based CPG for PP in ARDS in the pediatric population?"* The second question explored, *"Can an evidence-based CPG be integrated as a research utilization project into the culture of the PICU?"* These questions led the direction of the practicum project, with final review and analysis providing further recommendations for practice and critical inquiry.

Prone Positioning and ARDS

Through the extensive literature search and critical analysis of primary research studies and systematic reviews, the author developed a style and approach to dissect whether the current evidence supported PP as 'best practice'. Despite not knowing the exact mechanism for the change in the dependent variable (Calvi et al, 2000), PP does improve oxygenation in ARDS. The research demonstrates, from a multitude of quasi-experimental, isolated, small homogenous sample populations a consistent finding across continents,

the assertion there is an improvement in oxygenation. There is a minority of small sample RCT's, of only which one has been published, with some promising preliminary data presented in Dresden conference in September of 2000 (Calvi et al 2000). The level of evidence based on the extensive review is Ib, IIb and III; according to the evidentiary tables in Shekelle et al (1999). The strong recommendation that accompanies the level of evidence is due to the findings of the multiple studies of varied design from differing populations across many countries and continents (Brown, 1999).

Review of the primary research studies proved to be a tremendous challenge. Brown (1999) relates that acquiring the skills to appraise collective evidence requires practice and time. Perfecting a technique to validate the research findings required persistence and detailed inquiry to appreciate all the subtle findings not implicitly stated in the text. The task of determining what was valid pertinent research versus questionable and debatable was a technique requiring constant refinement; Brown (1999) describes this is not appreciated in state of the art summaries.

The analysis of the four systematic reviews on PP in ARDS revealed differing data. Where one would assume the pooled sum of the research would yield similar findings, the results stated were discordant and varied markedly in the stated level of evidence, recommendations and implications for practice. Jadad et al (1997) suggests that the presence of conflict across reviews should be assumed, as there are many sources for discordance and the reviews are likely to differ on many respects and the ultimate importance of the findings

depends on the health care decisions that be based on the differing outcomes of the review. The disparity among reviews produces conflict and difficulty with decision making for individuals relying on the findings of the reviews (Jadad et al, 1997). Analysis of several reviews allows discussion of issues and this is potentially the largest value in the critique. Jadad et al (1997) explains that the systematic reviews that have been promoted for effective decision-making have in fact often confused the situation rather than clarifying it.

The conclusions from research forces individual clinicians and institutions to critically analyze findings and determine whether the research is consistent with their own practice environment and it's unique culture. Following examination of all data, it must be analyzed as to what is known (strength of casual assertion) versus what is subjective (lacking generalization and inherent validity) and the determination made as to whether or not the intervention is in fact 'best practice'. Clinical decision-making is a complex process, informed and influenced by a variety of factors, many of which are not based on empirical evidence (Humphris, 1999). Evidence-based practice is not a cookbook approach or a standard recipe for success. Evidence-base practice is much more of a descriptive analysis that varies between studies and climates, changing in response to research data and organizational needs. The term evidence-based practice is an amalgam of terminology of science and professional practice. The definition of evidence-based implies concepts of scientific rationality, whereas practice equates with behavior; within this definition lies in inherent potential tension (Lockett, 1997).

It is no surprise as to why the integration of research and clinical practice is difficult. The essence of the literature and analysis of the primary research and systematic reviews emphasized the sheer magnitude of making decisions based on the best evidence. Research findings must be approached with caution, as often the critical appraisal differs dramatically from the implied findings and clinical significance.

Despite all the inherent difficulties in the analysis of the literature, the evidence supports PP in ARDS. The PICU must accept the risks, benefits and harms of initiating this best practice and proceed in organized manner to gather prospective data on the intervention to ascertain whether this described evidence-based practice has generalization to this patient population. This forces the clinical setting to not just accept what is stated as best practice, but to continue to determine quantitative and qualitative outcomes measures to support, change or refute this intervention. For evidence-based health care to achieve its initial purpose, the input of decision makers is needed to identify and resolve new challenges (Jadad et al, 1997).

CPG as Research Utilization

The informal evaluation of the CPG done as an evaluation research design provided the individual clinicians contact with a research utilization project in the PICU. Clinical guidelines have a history of providing a mechanism for promoting evidence-based practice and a clear avenue for audit and an instrument of communication between scientific community (research) and practice (Benton, 1999). The informal evaluation linked to the second purpose of

the project; if a CPG could fit into the culture of the PICU. Despite the value of research based knowledge there is a long history of delayed uptake and application of findings into practice (Benton, 1999). Interventions that link research and practice ultimately equate with an increased success of the research utilization initiative (Grimshaw & Russel, 1994). Feder et al (1999) supports the discussion with individual clinicians' perception of barriers to enhance the success of the research utilization.

Utilization of the Findings

The formative evaluation of the CPG had three main objectives: determination of whether the CPG was a viable initiative in the PICU, examination of pre-existing issues which may impact on the success or the failure of the CPG, and obtain suggestions that may increase the effectiveness, efficacy or efficiency of the CPG. The responses to the questions were of no surprise, as the author had previously described all potential barriers consistent with that of the multidisciplinary team, without their knowledge of the previous work. Expected results do not necessarily negate the value of the intervention. The data collected assured that the author had correctly described the potential barriers and fostered an environment that supported participant input, consistent with the work of Grimshaw and Russel (1994) to facilitate the successful outcome of an intervention. The four questions evoked responses that can ultimately be incorporated into the final CPG, in the piloting of the research utilization intervention.

McCormick (2001) examined the experience of qualified ICU nurses when nursing ARDS patients prone. 121 ICU nurses describe the same four issues that were described in this informal evaluation: technical problems associated with the delivery of care, complications of the position itself, financial issues related to increased staff required to perform the turn and the cost of suitable support surfaces for the patients who are prone. There was no CPG in situ prior to this data collection by McCormick and the findings of these interviews was used for the development of the CPG, similar to the process for this practicum project.

Initial Impression. Analysis of the findings of the first question of the initial impression of the CPG was extremely supportive and positive. The climate was one of further questioning and integration versus negativism. The beliefs of the individuals are extremely important in the success of the guideline and the seeking of opinion need not be a waste of time or effort, as understanding the climate and the acceptance are of paramount importance. Thomas et al (2000) stresses the importance of consideration of the nature and beliefs to which the intervention is directed for the success of getting evidence into practice.

The analysis of the questioning responses to the initial impression likely reflects a general knowledge deficit on several supporting pieces of information that need to be applied in the educational component in the formal introduction of the CPG. These include comfort scoring, risk and benefits of the PP and an overall summary of what is evidence-based nursing and the terminology associated with the level of evidence and strength of recommendation. The

negative responses define areas of required change, length and definitions, which will be reflected in the final CPG.

The affirmative and supportive responses reflect the positive attributes of a CPG (Feutz-Harter, 1999), those being clarity, reliability, validity, clinical applicability and a multidisciplinary process. These describe the guideline as benefit versus burden with the belief that it will improve practice. There were statements indicating that learning had occurred reflecting the educational purpose of a CPG. The belief they were doing 'best practice' and a sense of pride associated with this was a powerful message.

Impact of the CPG. Review and analysis of the responses to the question reflecting on the impact of the CPG on an individuals' practice, attempted to examine the barriers of the individual clinician versus the organizational barriers. There were many facilitating factors described providing support that a CPG for PP made a difference; providing information, consistency, a team approach and valuable directive to best practice.

Several responses were statements that require further discussion with the staff, once the decision is made to pilot the research utilization project. The questioning response themes pertain to questions regarding ongoing clinical evaluation of the patient and the assessment of the response. These will be delineated within the precise protocol as part of the implementation phase. The medication questions related to general knowledge and discussion of assessment and comfort, which can be added into the CPG education component.

Negative comments related to the performance of the turn. Through the incorporation of practice sessions, as described in the implementation plan, it is expected a familiarity and expertise will develop and with this confidence and the assertion it can be done. The anxiety associated with the turn can be expected to continue, as one bad experience clouds the picture. It becomes paramount that documentation of adverse events is performed to determine the safety of the intervention with the necessary quantitative and qualitative data, rather than the *perception* PP is unsafe. The resources will be addressed in the difficulties section. The assessment indices for comfort or sedation and skin assessments will be incorporated into the educational strategy.

Positive impact statements related to the quality attributes of the guideline, primarily the reliability and consistency as advantages of having a CPG. Responses described the CPG as serving as an educational medium for information, implying a standard of care. The validity and presumed strength of the data promotes a discussion on a daily basis, with an individual risk benefit analysis of placing a patient prone. This is the hope in a research utilization innovation.

Difficulties and the CPG. Analysis of the barriers described in the responses to the 'difficult issues' question provides similar data to that described by McCormick (2001), in which three of the four potential resource deficits are the organizational barriers identified in the analysis format by Grol (1994) appendix E. The assumption that the PICU multidisciplinary group supports the pilot initiative must be affirmed, seeking the appropriate institutional approval for

the funds to meet program needs. The commitment from the unit and organization must be present for the research initiative to succeed and these needs must be presented prior to the initiation of the pilot program. The environment at Children's Hospital is supportive of nursing research, with current emphasis on evidence-base practice, providing optimal timing for a research utilization request.

The issues pertaining to the patient will be dealt with in the educational sessions preceding the pilot program implementation and through the development of standard care plans. The discussion of emergency protocols must be done individually for each patient, as circumstances and treatment regimens vary tremendously across age groups and diseases. The barriers described by the participants are consistent with those in Appendix E. The implementation plan directs several strategies for the linking of barriers to resources.

Suggestions. Analysis of the final question pertaining to 'suggestions for change', related valuable information for the educational component of the implementation phase. Overall staff describe the document as achieving the education and assisting in the decision making purpose of a CPG. Suggestions will be incorporated into the recommendations for the pilot project, which are not necessarily part of the CPG but should be included within a care plan or care map. Often the specifics of a situation cannot be dealt with until an individual patient response is evaluated and this will occur will the continued education and learning of PP. A quick bedside reference guide, in addition to the CPG, an

abbreviated form of a CPG intended for quick bedside use (Feutz-Harter, 1999), will be developed.

Effectiveness

The effectiveness of the CPG refers to the ability of the CPG to promote the utilization of the prone position. Benton (1999) describes the effectiveness of the intervention is to cause something to happen, a positive or negative effect, which is observable and measurable. The participants supported this intervention, with several individuals relating the CPG reinforced they were already performing 'best practice'. A question was posed; "What about those individuals who chose to not participate?" This relates to much work that has shown just because a CPG is present does not infer compliance (Mead, 2000). This issue surrounds all nursing practice and it is hoped individual team member's role modeling best practice will create a supportive and encouraging environment to foster an atmosphere of acceptance and hopeful participation. The reality of 'choice' will depend on the implementation plan and presence of physician orders for the PP intervention.

The effectiveness of PP to improve oxygenation of the pediatric patients in the PICU be determined as part of a pilot program for the CPG. This will require observable and measurable results to quantify the clinical effectiveness.

Efficiency

The efficiency of the CPG and PP refers to the ability of the system issues of the PP to be dealt with so that the resources of people, time and equipment are used as efficiently as possible. Benton (1999) described efficiency as the

ratio of a system's output to its input, explaining you can have a very efficient system that may not be effective. With the eventual outcome of incorporation of the CPG, the education and practice of the PP initiative may in fact balance out and potentially provide a savings in resources. Why turn a child every two hours, just because it has been done before? This would be a minimum of 12 turns per day. With the PP there would be only be two turns per 24-hour period, which considerably decreases the frequency of the resource demands on the system. Many of the issues brought up in the informal evaluation as difficulties related to resources must be addressed to impact the success of the initiative. The cost of the CPG, including the materials and equipment, must be endorsed by the PICU, with the necessary budget requests identified.

The initial cost of the education, staff development and the learning curve must be factored in the net efficiency in the completion of a pilot project. On a larger scale the net efficiency of the system could potentially be improved if PP decreased morbidity, mortality, complications of ventilation and length of PICU and hospital stay. These are potential outcomes and it will require large-scale studies, such as the one by Calvi et al (2000), to support the premise that PP in ARDS does make a difference in terms of net economic gain. Efficiency does not imply effectiveness (Benton, 1999).

Efficacy

The efficacy of the CPG relates to the specific PP intervention that has been adopted as described in the CPG and has produced the desired effect of improved oxygenation with no increase in adverse events. Benton (1999)

explains efficacy as a narrow term related to a specific treatment having been adopted for a particular purpose and has the ability to produce the desired effect. The evaluation research sessions dealt with many questions that relate to the efficacy and potential complications, and it is the pursuit and follow-up of this issues that will have an impact on the efficacy when the CPG is implemented. The ongoing evaluation will need to monitor the adverse event occurrence rate and benchmarks to gauge whether the length of stay and ventilator complications has been affected as a result of the PP CPG. The strategic implementation plan will have to deal with issues surrounding this.

Analysis of Models

Several frameworks were incorporated and used in synergy to optimize the format for this practicum project. The Clinical Innovation model by Leske et al (1994) provided the framework and ideology for the initiative as the innovation process. The Evidence Based Resource Group publication in CMAJ (1994a) provided an excellent overview for the problem identification phase, which promoted an in-depth analysis and questioning to occur for the issues surrounding ARDS, PP and the CPG. The work of Grol (1997) provided the model for change implementation and the understanding of the barriers at the different stages of the change process and from perspectives of the individual and the organization. The Conduct and Utilization of Research in Nursing (CURN) model provided the detailed analysis and scoring system that allowed for in-depth review of the elements involved in the successful adoption of the intervention.

Clinical Innovation Model

Leske et al (1994) describes the clinical innovation process as complex and often difficult, thus the utilization of a model to conceptualize the process and inter-relationships assists in the progress and direction of the initiative. An appealing characteristic of this model is that it is a critical care-nursing framework. Clinical innovations are intended to improve or validate outcomes (Leske et al,1994). Clinical innovations are considered the key to excellence in critical care nursing practice (Tyler, Clark, Winslow and White, 1990), and there is extensive discussion at the present time on the factors affecting uptake of research innovations. The clinical innovation model links the transfer of information derived from quality improvement activities or research to a clinical innovation initiative in critical care nursing practice. This provides a unique blend of a reality-based process with system strategies that are functional and operational within an acute care setting. It networks with existing systems so the model does not stand-alone.

The first step is the asking of the questions or problem identification, which correlates with the initial phases of the practicum project. Step two seeks out answers and solutions to the questions asked, as it examines the existing research and validates its' soundness, which is consistent with the approach of this initiative. The third step, the plan of change, describes the questions, problems and the benefits of the change, examining what is required to modify current practice. Clinical innovation protocols are developed to address the needs. This provided the approach for the practicum project. At this stage, steps

are developed for the implementation and systematic evaluation, with the practicum project providing a summary of the recommendations.

The clinical innovation model provides a map for the direction of a clinical innovation, in an understandable achievable system, consistent with many practice bases operating in the health care system of today. It lacks a detailed description of stages and thus additional models were chosen to fill the gaps. The strength of this model lies in the linkage of nursing practice, research, research utilization and quality improvements to provide the best evidence-based care.

Evidence Based Resource Group

The Evidence Based Care Resource Group acknowledges the presence of important gaps between research evidence and clinical practice. In an effort to narrow the gap, they describe the first step in evidence-based practice as the setting of priorities by utilizing explicit criteria to ensure the time and resources are invested where there is significant benefit. These criteria were the basis for the description of the problem in the practicum project. The elements are as follows: frequency of the problem, magnitude of the consequences, availability of research evidence addressing the problem and the likelihood that the management of the problem can be improved. Owing to the development of medical technology and finite resources explicit or implicit choices must be made in the allocation of staff time and funds.

The incorporation of a strategic plan for the examination of the problem provided a strong foundation and description of what the issues and possible

solutions in ARDS. It allowed the problem of ARDS with PP as an alternative treatment to be examined with the solution of a CPG as a means to provide research utilization. It focused the efforts of the initiative and clearly defined the issues.

CURN Model

The CURN project was developed inductively to bridge the gap between research and practice in the late 1970's with the underlying goal of changing nursing practice. The stimulus was problem focused with a perspective on organizational focus and response. It had several assumptions that correlate nicely with the underlying assumptions of the practicum project. Guidelines for the delineating safe parameters of nursing research utilization were established to guide their projects, which are consistent with the research driven focus of today. They stipulate the research should have one instrument available for measurement in the evaluation of the suggested practice change. The primary goal of the CURN project was to produce research based practice changes through the use of research outcomes, research methods and planned change process. The practice changes were to be implemented by the staff nurses in the acute care settings. There were seven steps in the completion of this model. The CURN project suggests consultation with academic colleagues, fostering a vital link between research and practice.

The practicum project utilized the strength of the detailed analysis of forces impacting the probability of adoption, described as the factors: 'easing the transition' and 'cost benefit'. This provided an objective measure to quantitate

the probability of success and the impetus to drive a project. The steps one through three were followed closely, with the fourth stage, the clinical trial or evaluation, based on the data from the previous stages, which will be the recommendations in this practicum project. Using the format for change outlined by this model with the tools it recommended, lends itself nicely to a clinical utilization strategies within an acute care setting. Linking the CURN project model with facets from several other theoretical concepts adds to the applicability within Canada for the 21st century.

Grol's Change Theory

Grol's model describes a theoretical change strategy to influence clinical practice. By determining the best approach(s), the innovation proceeds in the direction best suited to the change and the organization. The epidemiologic and the educational approach best describe the practicum project and the PICU culture. The epidemiologic approaches assumes humans as rational human beings who make decisions based on a balanced rational agreement. The main strategy in this approach is to examine the evidence and develop a clinical practice guideline, consistent with the project. The emphasis of this approach is the 'soundness' as well as summarizing the evidence for the busy practitioner. In this project the epidemiologic overlaps with the educational approach, where the internal striving for professional competence drives the change. The main strategy of this approach is stimulating the motivations of the participants, with small group interactive learning where participants feel they own the change. Strength lies in linking improvements to actual problems. Theory of change

provides rationalization and support for decisions in the PP CPG research utilization project.

The 'obstacles for change' section provided a large amount of constructive data for the eventual implementation. Grol describes the obstacles to change as multifaceted, related to the individual clinician (knowledge, skills, attitudes and habits), social context (reaction of patient colleague and authorities), or organizational context (available resources, organizational climates and structures). Different obstacles present at different stages of the change process thus the approach must recognize the stage and respond appropriately. The understanding and application of change theory impacts the entire research utilization initiative and make the difference in the success and prevention of failure for the innovation.

Chapter Seven: Recommendations

The primary recommendation of this practicum project *Development of an Evidence-Based CPG for PP in ARDS for Pediatric Patients* is to initiate a pilot project for trial of this intervention over a one-year period. There are several core elements that must be addressed prior to the intervention implementation, which are supported by the informal evaluation of the CPG and the detailed analysis of barriers and facilitators of the intervention by the author. Four major areas are identified, they are as follows:

1. Finalize the CPG with an additional abbreviated version.
2. Develop and formalize the educational approach strategy.
3. Identify and request necessary equipment and resources.
4. Implementation plan for the pilot project.

Clinical Practice Guideline

The main recommendation is to revise the CPG incorporating suggestions from the informal evaluation. The first revision is the definition of responder and non-responders. Secondly, develop an adjunctive short version of the CPG, *quick reference guide*, with the abbreviated necessary information, references and definition. Thirdly, a diagram of the PP intervention of infants as well as children would be included.

Educational Plan

There are several key pieces to be incorporated into the educational plan for the multidisciplinary team, derived from the four questions directed to the participants. Necessary core elements must be addressed simultaneously with

the intervention plan, as it was apparent that key assessments required would benefit from the use of existing tools. The skin assessment and pressure sore rating scale are currently utilized at the Health Sciences Centre, reintroduction of this information would be an asset to the staff. There is several pediatric comfort and/or sedation scoring systems available in the literature and choice of an appropriate validated reliable tool is suggested for use in the application of PP. A sedation assessment scale is present on the PICU flow sheet, which could be applied to this population. These elements would be presented in reference material and as a learning package for the staff.

Additional education would be incorporated through on site, on shift in-service sessions and with printed information available on the same topics in an educational binder. The following concepts would be included: review of evidence-base nursing and medicine, including definitions and terminology, pathophysiology of ARDS, proposed mechanism of action of PP and a review of commonly used sedatives and neuromuscular blocking agents. Knowledge deficits were consistently cited in the evaluation research and fulfilling this deficit has the potential to increase confidence, competence and capacity to perform the PP intervention.

The educational plan will also include practice sessions for the turning of infants, children and adolescents. The various indwelling lines and tubes will be simulated with the appropriate positioning devices available. The 'hands on' experience is suitable for the novice through expert level nurse (Benner, 1984).

A videotape of the PP intervention would be utilized to assist with the performance in the practice session.

Resources Required

The success of the intervention is dependent on resource availability. These resources comprise: correct positioning devices and personnel. The PICU management team must support this initiative and request funds for the pads, positioning wedges and supports possibly through a submission to the Children Hospital Research Foundation as a proposed research utilization initiative. The allotment of additional paid staff time would not be feasible and it would be suggested a multidisciplinary plan be initiated to perform PP at a time with optimal staff numbers.

Implementation Plan

The implementation plan for the pilot project would be developed in collaboration with the PICU multidisciplinary team, utilizing the existing data from this project to provide the background work and structure. Confirming the research questions, evaluation design and outcomes measures are the initial steps in the implementation plan. The plan will be developed for the eventual presentation to the PICU team.

Research Questions

The first objective, the primary research question, is to evaluate if the introduction of an evidence-based CPG improves the utilization of the PP in ARDS? The research questions as secondary objectives may include:

- Does the PP improve oxygenation in the pediatric patient population with ARDS in the PICU of Children's Hospital Winnipeg?
- Is the use of PP intervention safe in pediatric ARDS patients?

There may be additional questions selected based on the needs as determined by the PICU multidisciplinary team.

Evaluation Design

The primary objective is a simple dichotomous response for patients with ARDS, were they turned prone or not after the CPG introduction? This is described as a quasi-experimental design, a single group post-test only. Prone positioning or not is quantitative data, with the examination of the rationale for this decision providing qualitative interpretative data to understand the forces impacting on the intervention. This would supply data for the process evaluation describing the inherent difficulties.

The second question 'to examine if the PP improves oxygenation within this population' is quasi-experimental single group time series design, with intervention withdrawn and re-instituted, as the intervention would be repeated on a daily basis until the patient exits the program. There would be tremendous difficulty in the utilization of the historical control group due to concerns of equivalence and the inability to accurately collect the retrospective data. In addition there is no database available and a decision was made to *not* utilize a non-equivalent control group design.

The 'safety' of the PP would be based on the presence or absence of the reports of critical incidents, and if an incident occurred it would then be

described. The design, suggested with caution, would be quasi-experimental non-equivalent control group post-test only. Baseline data previously collected in terms of critical incidents would provide the historical control group with a trend reference for comparator results. There is concern whether the use of the historical control group may present significant confounding variables, which may skew or nullify the validation of results. Quarterly trend results from the previous year will serve as a benchmark for comparison.

Outcome Measures

Instruments or Approaches. The main objective is 'the implementation of an evidence-based CPG will support the use of the PP in patients with ARDS as a consistent standard of care'. "Consistent" is defined as *all of the time* with the exception of ineligibility criteria providing the exemption (relative contraindications). The outcome measure is either affirmative or not. This would be reviewed daily as part of the multidisciplinary rounds and the findings documented (See Appendix K for sample data base). The outcome of interest also relates to the qualitative data, a description of why or why not PP was utilized through a tape-recorded interview with the nurse while the patient was still managed in the PICU. Several open-ended questions completed within a ten-minute time frame would be transcribed verbatim and analyzed. This would require the necessary ethical approval.

The second goal of the program validating if 'the use of PP in ARDS improves oxygenation' is an attempt to confirm the research findings in the PICU. Primary data collected is the PaO2/FiO2 as measure of the oxygenation status.

The measure is done by the performance of an arterial blood gas, as described in the critical care policy and procedure manual. The amount of the inspired oxygen the patient is on is recorded on the blood gas sheet and once the PaO2 is determined the necessary calculations are performed. A response can be described as an increase in 10 mmhg in the PaO2 (Langer, 1988), improvement of 20% or more in the PaO2/FiO2 (Chatte et al., 1997) or Oxygen Index change greater than 10-20% (Johannigman et al, 2000; Curley et al, 2000). The multidisciplinary team must determine the indicator for determination of response. The reliability and validity of these measures will not be assessed in the program but are a consistent with the research studies to date.

The oxygen saturation will provide additional data related to the physiologic parameter of oxygenation. This is measured as a continuous external skin-sensing device and is subject to poor reliability and questionable validity and thereby will only used in a trend format. Other physiologic indices of heart rate (HR), and blood pressure (BP) will be obtained. HR is collected by standard three lead ECG bedside monitor. The BP is obtained through an indwelling arterial line and enters the monitor data bank. These do not necessarily correlate with the indices of oxygenation, but they relate to the patient response and can be affected by a decrease or increase in oxygenation. (They are also related to patient safety).

The final goal of determining if the PP intervention is 'safe' is determined through the absence of critical events. A critical event is defined in Appendix J. Data collected is related to the occurrence, with a description of the event as in

Appendix K. Critical incident occurrence is an essential measure, as you want to ensure the PP is a low risk intervention with no significant increase in critical events. The reliability of reporting critical incidents must be reviewed, as in current practice all incidents are documented on the standard hospital reporting form, with no cross-reference record in the patient chart. A mechanism will need to be instituted to allow the pilot program to review critical incidents in relation to PP, as the current practice has the Unit Manager analyze occurrences.

Data Collection Procedures. As a patient meets ARDS criteria and is identified by the clinical resource nurse or respiratory therapist on shift, a database will be initiated. A pilot program team member will be notified of an ARDS patient in the PICU. The pilot program team will follow up daily with the patient to ascertain if the patient was positioned prone or not. An interview will occur with the nurse, whether the patient was turned prone or not, within 48 hours of meeting the eligibility criteria. The interview will be taped to limit interview bias with the data transcribed verbatim and coded to maintain anonymity. At the completion of the program, themes will be identified and any necessary revisions and recommendations in relation to the CPG and PP will be identified.

The oxygenation parameters will be collected in a scheduled format onto a bedside database, where the indices measured with the corresponding time period recorded. Refer to the sample Appendix L for data collection chart and schedule sheet. The respiratory therapy department would be notified of the schedule in advance, this would ensure measures are obtained at the designated

intervals for consistency. No special training for the measures would be required as these are part of routine PICU monitoring.

Critical incident data would be entered into a patient database available at the bedside. A member of the pilot program team would verify the event for consistency and accuracy through direct communication with the team member who initiated the documentation. If the initiator(s) were unknown, the charge nurse for that shift would be consulted for the confirmation of the information.

Summary

The practicum project can be described as an attempt to make research 'come alive' within the culture of an acute care unit. Through an in-depth review of the problem and subsequent critical appraisal of the literature an evidence-based guideline was developed to provide a link between research and practice. An effort was made to evaluate the plan for change and a research utilization initiative within the culture of the unit. It was apparent the climate was overwhelmingly supportive of the innovation. The final step in the practicum project was to provide further recommendations based on the data to date to allow the remainder of the program to succeed.

References

Agency for Health Care Policy and Research. (1995). Using clinical guidelines to evaluate quality of care. U.S. Department of Health and Human Services, Vol. 1. Public Health Service.

Albert, R. K. (2000). Prone ventilation. Clinics in Chest Medicine, 21(3), 511-517.

Balas, M. C. (2000). Prone positioning of patients with acute respiratory distress syndrome: Applying research to practice. Critical Care Nursing, 20(1), 24-36.

Ball, C. (2000). Use of prone positioning in the management of acute respiratory distress syndrome. Intensive and Critical Care Nursing, 12(1), 192-203.

Benner, P. (1984). From Novice to Expert: Excellence and Power in Clinical Nursing Practice. Menlo Park: Addison-Wesley.

Benton, D.C. (1999). Clinical Effectiveness. In S. Hamer and G. Collinson (Eds.) Achieving Evidence-based practice: A handbook for practitioners (pp87-107). Edinburgh: Baillere Tindall.

Bernard, G. P., Artigas, A. Brigham, K. L. et al. (1994). The American-European consensus conference on ARDS: definition, mechanism, relevant outcomes and clinical trials coordination. American Journal of Respiratory and Critical Care Medicine, 149, 818-824.

Blanch, L., Manecebo, J. & Perez, M. et al (1997). Short-term effects of prone positioning in critically ill patients with ARDS. Intensive Care Medicine, 23, 1033-1039.

Borelli, M., Lampati, L., Vascotto, E., Fumagalli, R. & Pesenti, A. (2000). Hemodynamic and gas exchange response to inhaled nitric oxide and prone positioning in ARDS patients. Critical Care Medicine, 28(8), 2707-2712.

Breiburg, A. N., Aitken, L., Reaby, L., Clancy, R. L. & Pierce, J. D. (2000). Efficacy and safety of prone positioning for patients with acute respiratory distress syndrome. Journal of Advanced Nursing, 32(4), 922-929.

Brown, S. J. (1999). Knowledge for Health Practice: A Guide to Using Research Evidence, (pp.97-146). Philadelphia: W. B. Saunders Company.

Bryan, A. C. (1974). Pulmonary physiotherapy in the pediatric age group: Comments of a devil's advocate. American Reviews of Respiratory Disease, 110, 143-144.

Calvi, E., Noe, E, Brazzi, L. & Gattinoni, L. (2000). Prone position in ARDS. Proceedings of Dresden ARDS Symposium. @http://www.tu-dresden.de/medkai/gattinoni.pdf.

Chatte, G., Sab, J. M., Dubois, J. M., Sirodot M., Gaussurques, P. & Robert, D. (1997). Prone position in mechanical ventilating patients with severe acute respiratory failure. American Journal of Respiratory and Critical Care Medicine, 155, 473-478.

Cronenwett, L. R. (1995). Effective methods for dissemination of research findings to nurses in practice. Nursing Clinics of North America, 30(3), 429-438.

Curley, M. (1999). Prone positioning of patients with ARDS: A systematic review. American Journal of Critical Care Nursing, 8(6), 397-404.

Curley, M., Thompson, J. E. & Arnold, J. H. (2000). The effects of early and repeated prone positioning in pediatric patients with acute lung injury. Chest, 118(1), 156-163.

Curley, M. & Maloney-Harmon, P. (2001). Critical Care Nursing of Infants and Children. (Second Ed.) Philadelphia: W.B. Saunders.

Dickson, R. (1999). Types of Evidence. In S. Hamer & G. Collinson (eds.) Achieving Evidence-based practice: A handbook for Practitioners, (pp. 41-57). Edinburgh: Bailliere Tindall.

Douglas, W. W., Rehderi, K. Beynen, F. M., Sessler, A. D. & Marsh, H. M. (1977). Improved oxygenation in patients with acute respiratory failure: The prone position. American Reviews of Respiratory Diseases, 115, 559-566.

Dupont, H., Mentec, H., Cheval, C. Moine, P., Fierobe, L. & Timsit, J. (2000). Short-term effect of inhaled nitric oxide on gas exchange in patients with severe acute respiratory distress syndrome. Critical Care Medicine, 28(2), 304-369.

Eddy, D. (1982). Clinical policies and the quality of clinical practice. New England Journal of Medicine, 307, 343-347.

Evidence-Based Care Resource Group. (1994a). Evidence based care: Setting priorities: How important is the problem? Canadian Medical Association Journal, 150(9), 1249-1254.

Evidence-Based Care Resource Group. (1994b). Evidence-based care: Setting guidelines: How should we manage this problem? Canadian Medical Association Journal, 150(9), 1417-1423.

Feder, G., Eccles, M., Grol, R., Griffiths, C. & Grimshaw, J. (1999). Clinical guidelines: Developing guidelines. British Medical Journal, 318, 593-596.

Feutz-Harter, S. (1997). Clinical practice guidelines. Journal of Nursing Law, 4(2), 51-57.

Froese, A. B. & Bryan, A. C. (1974). Effects of anesthesia and paralysis on diaphragmatic mechanics in man. Anesthesiology, 41, 242-255.

Fridich, P., Krafft, P., Hochleuthner, H. et al. (1996). The effects of long term prone positioning in patients with trauma induced adult respiratory distress syndrome. Anesthesia Annuals, 83, 1206-1211.

Fuhrmann, B. P. & Zimmerman, J. J. (1998). Pediatric Critical Care. 2nd. ed., Toronto: Mosby Yearbook Inc.

Grimshaw, J. M. & Russel, I. T. (1993a). Effect of clinical guidelines on medical practices: A systematic review of rigorous evaluations. Lancet, 342, 1317-1322.

Grimshaw, J. M. & Russel, I. T. (1994). Achieving health gain through clinical guidelines. Quality in Health Care, 2, 243-248.

Grol, R. (1997). Beliefs and evidence in changing clinical practice. British Medical Journal, 315, 418-421.

Hazinski, M. F. (1999). Manual of Pediatric Critical Care. St. Louis: Mosby.

Hirvelo, E. R. (2000). Advances in the management of ARDS. Archives of Surgery, 135, 126-135.

Hormann, C., Benzer, H. & Baum, M. (1994). The prone position in ARDS: A successful therapeutic strategy. Anesthesiology, 43, 454-462.

Horsley, J., Crane, J., Crabtree, M. K. & Wood, D. J. (1983). Using Research to Improve Nursing practice: A Guide. New York: Grune & Stratton.

Humphris, D. (1999). Types of Evidence. In S. Hamer & G. Collinson (Eds.) Achieving Evidence-based practice: A Handbook for Practitioners, (pp. 13-28). Edinburgh: Baillere Tindall.

Institute for Medicine. (1990). Clinical Practice Guidelines: Directions for a New Program. Washington: National Academy Press.

Institute for Medicine. (1992). Guidelines for Clinical Practice: From Development to Use. [M. Field and K. Lohr. Eds.] Washington: National Academy Press.

Jadad, A. R., Cook, D. J., Browman, G. P. (1997). A guide to interpreting discordant systematic reviews. Canadian Medical Association Journal, 156(10), 1411-1416.

Johannigman, J. A., Davis, K., Miller, S. L. Campbell, R. S., Luchette, F. A., Frame, S. B. & Branson, R. D. (2000). Prone positioning for ARDS in the surgical ICU: Who, when and how long? Surgery, 128(4), 708-716.

Jolliet, P. N., Bulpa, P. & Chevrolet, J. C. (1998). Effects of the prone position on gas exchange and hemodynamics in severe acute respiratory distress syndrome. Critical Care Medicine, 26(12), 1977-1985.

Johnson, J. E. (1977). Nursing research impact vital for profession. American Nurse, 9(15).

Klein, D. G. (1999). Prone positioning in patients with ARDS: The Vollman prone positioner. Critical Care Nurse, 19(4), 66-71.

Kornecki, A., Frndore, H., Coates, A. & Shemie, S. (2001). 4A Randomized trial of prolonged prone positioning in children with acute respiratory failure. Chest, 119(1), 211-218.

Lamm, W. J., Graham, M. M. & Albert, R. K. (1994). Mechanism in which the prone position improves oxygenation in acute lung injury. American Journal of Respiratory and Critical Care Medicine, 150, 184-193.

Langer, M., Mascheroni, D., Marcolin, R. et al (1998). Dramatic effect on oxygenation inpatients with severe acute lung insufficiency treatment in the prone position. Critical Care Medicine, 25, 1539-1544.

Leske, J. S., Whiteman, K., Friechels, T. A. & Pearcy, J. (1994). Using clinical innovations for research-based practice. AACN Clinical Issues, 5(2), 103-114.

Lockett, T. (1997). Traces of evidence. Healthcare Today, July/August, 16.

MacLachlan, L. W. (1986). General considerations about the utilization of research by clinicians. In L. R. F. Phillips, A Clinician's guide to the critique and utilization of nursing research (pp.381-405). Norwalk: Appleton-Century- Crofts.

Marck, K.D. (1995). Manual to Develop Guidelines. Washington: American Nurses Press.

McClary, M. & Duff, L. (1997). Clinical guidelines and evidence-based practice. Nursing Standard, 11, 31-35.

McCormick, J. (2001). The experience of qualified ICU nurses when nursing patients with adult respiratory distress syndrome who require mechanical ventilation in the prone position. Dissertation abstract Scholl of Nursing and Midwifery at the Queen's University of Belfast@ http://www.qub.ac.uk/nur/research/mccormic.html

McKinley, D., Hutchinson, A., & Butt, W. (2000). Efficacy of prone body position of ventilated children with respiratory illness: A prospective study. Paper presented at the meeting of the International Pediatric Critical Care Conference, Montreal, Canada.

McIntyre, R.C., Pulido, E. J., Bensard, D. D., Shames, B. D., Abraham, E. (2000). Thirty years of clinical trials in ARDS. Critical Care Medicine, 28(9), 3314-3331.

Mead, P. (2000). Clinical guidelines: Promoting clinical effectiveness or a professional minefield? Journal of Advanced Nursing, 31(1), 110-116.

Melins, R. B. (1974). Pulmonary physiotherapy in the pediatric age group. American Reviews of Respiratory Disease, 110, 137-142.

Moreno, F. & Lyons, H. A. (1961). Effect of body position on lung volumes. Journal of Applied Physiology, 16, 27-29.

Mortimer, T. (2000). Review of ARDS in PICU. Manuscript submitted for publication.

Mulrow, C. D. (1995). Rational for systematic reviews. In Systematic Reviews. London: British Medical Journal Publishing Group.

Mutoch, T., Guest, R. J. Lamm, W. E. & Albert, M. K. (1992). Prone patterns effect of volume overload on regional perfusion pressure and improvements in hypoxia in pigs in vivo. American Reviews Respiratory Disease, 146, 300-306.

Mure, M., Martling, C. R., & Lindahl, S. G. (1997). Dramatic effect on oxygenation in patients with severe acute lung insufficiency treatment in the prone position. Critical Care Medicine, 25, 1539-1544.

Nakos, G., Tsangaris, I., Kostanti, E., Nathanail, C., Lachana, A., Koulouras, V. & Kastani, D. (2000). Effect of the prone position on patients with hydrostatic pulmonary edema compared with acute respiratory distress syndrome and pulmonary fibrosis. American Journal of Respiratory and Critical Care Medicine, 161, 360-368.

Numa, A. H., Hammer, J. & Newth, P. (1997). Effect of prone and supine position on functional residual capacity, oxygenation and respiratory mechanics in ventilated infants and children. American Journal of Respiratory and Critical Care Medicine, 156, 1185-1189.

Offner, P. J., Haenel, J. B. Moore, E. E. Walter, B. L., Francoise, R. J. & Burch, J. M. (2000). Complications of prone ventilation in patients with multisystem trauma with fulminate ARDS. The Journal of Trauma: Injury, Infection, and Critical Care, 48(2), 224-228.

Pappert, D., Rossaint, R. & Salma, K. (1994). Influence of positioning on ventilation perfusion relationships in severe adult respiratory distress syndrome. Chest, 106, 1511-1516.

Phillips, J. K. (1999). Management of patients with ARDS. Critical Care Nursing Clinics of North America, 11(2), 233-247.

Piehl, M. A. & Brown, R. S. (1976). Use of extreme position changes in acute respiratory failure. Critical Care Medicine, 4, 13-14.

Pittet, J. F., Mackenzie, R. C., Martin, T. R. & Matthay, M. A. (1997). Biological markers of acute lung injury: Prognostic and pathogenic significance. American Journal of Respiratory and Critical Care Medicine, 155, 1187-1205.

Piva, J., Bruno, F., Celiny, P., Einloft, P. & Menna-Barreto, S. (2000). Response of prone positioning children is more pronounced in reduced pulmonary compliance versus lower airway obstructive diseases. Paper presented at the meeting of the International Pediatric Critical Care Conference, Montreal, Canada.

Polit D. F. & Hungler, B. P. (1995). Essential of Nursing Research: Methods, appraisal, and utilization. (Fifth edition). New York: Lippincott.

Rogers, E. M. (1983). Diffusion of Innovations, (Third ed.) New York: Free Press

Rogers, M. (1996). Pediatric Intensive Care. (Third Ed.) Baltimore: Williams and Wilkins.

Sackett, D. L., Straus, S. E., Richardson, W. S., Rosenburg, W. & Haynes, R. B. (2000). Evidence-Based Medicine: How to Practice and Tech Evidence Based Medicine. Toronto: Churchill Livingston.

Shekelle, P. G., Woolf, S. H., Eccles, M. & Grimshaw, J. (1999). Clinical guidelines: developing guidelines. British Medical Journal, 318, 593-596.

Steinburg, K.P. & Hudson, L. D. (2000). Acute lung injury and ARDS: The clinical syndrome. Clinics in Chest Medicine, 21(3), 401-417.

Stetler, C. B., Morsi, D. Rucki, S. Broughton, S., Corrigan, B., Fitzgerald, J., Giuliano, K. Havena, P. & Sheridan, E. A. (1998). Utilization-focused integrative reviews in nursing science. Applied Nursing Research, 11(4), 195-203.

Stetler, C. B., Brunell, M., Giuliano, K., Morsi, D., Prince, L. & Newell-Stokes, V. (1998). Evidence-based nursing practice and the role of leadership. Journal of Nursing Administration, 28(7/8), 45-53.

Stocker, R., Neff, T., Stein, S. (1997). Prone positioning and low volume pressure limited ventilation improve survival in patients with severe ARDS. Chest, 111, 1008-1017.

Thomas, P., Angus, N. J. & Scott, J. (2000). Building a framework for getting evidence into critical care education and practice. Intensive and Critical Care Nursing, 6(1), 28-34.

Timmons, O. D., Havens, P. & Fackler, J. C. (1995). Predicting death in pediatric patients with acute respiratory failure. Chest, 108, 789-797.

Titler, M. J. (1997). Research utilization: necessity of luxury? Current Issues in Nursing, (pp. 104-117). St. Louis: Mosby.

Titler, M. G. (1998). Use of research in practice. In Nursing Research: methods, critical appraisal and utilization, (fourth Ed.)(pp.467-498). Toronto: Mosby Company.

Voggenreiter, G., Nevdeck, F., Aufmkok, M., Fabinder, J., Hirche, H., Obertacke, P. & Schmit-Neuerburg, K. (1999). Intermittent prone positioning in the treatment of severe and moderate posttraumatic lung injury. Critical Care Medicine, 27(11), 2375-2382.

Vollman, K. M. & Bander, J. J. (1996). Improved oxygenation utilizing a prone positioner in patients with acute respiratory distress syndrome. Intensive Care Medicine, 22, 1105-1111.

Vollman, K. M. (1997). Prone positioning for the ARDS patient. Dimensions in Critical Care Nursing, 16, 184-193.

Ware, L. B. & Matthay, M. (2000). Medical progress: The acute respiratory distress syndrome. The New England Journal of Medicine, 342(8), 1339-1348.

White, J. M., Leske, J., & Pearcy, J. M. (1995) Models and processes of research utilization. Nursing Clinics of North America, 30(3), 409-420.

Woolf, S. H.,Grol, R., Hutchinson, A., Eccles, M. & Grimshaw, J. (1999). Clinical guidelines: potential benefits, limitations, and harms of clinical guidelines. British Medical Journal, 31(7/8). 527-530.

Wong, W. P. (1999). Use of body positioning in mechanically ventilated patients with acute respiratory failure: Application of Sackett's rules of evidence. Physiotherapy Theory and Practice, 15(1), 25-41.

Ullrich, R., Lorbei, C., Roder, G., Urak, G., Faryniak, B. Salden, R. N. & Germann P. (1999). Controlled airway pressure therapy, nitric oxide, inhalation, prone positioning and extra corporeal membrane oxygenation as components of an integrated approach to ARDS. Anesthesiology, 91(6), 1577-1586.

van Soren, M. H., Diehl-Jones, W. L. Maykutt, R. J. & Haddara, W. (2000). Pathophysiology and implications for treatment of ARDS. AACN Clinical Issues, 11(2), 179-197.

Appendix A

Summary of PICU Educational Needs Assessment

The following is the summary of the educational needs assessment as defined by a survey conducted of the nursing staff and attending physicians completed in August of 2000. Bolded italicized items are needs impacting on practicum project and implementation plan.

High Risk	***Nursing care of the trauma patient***	Spinal cord injury: nursing care and assessments in
	Pain assessment & documentation	acute and chronic stages
	Trouble shooting transducers & waveforms	Procedural sedation
	analysis	Epidural
	Temperature control & measurement	ICP monitoring
	Rapid Sequence Intubation	Shock: nursing assessments and treatment
	Nursing assessment of ventilated patient	Thermodilution CO
	Advanced modes of ventilation	External trans-thoraic pacing
	Electrolyte abnormalities	Chest tubes
	CBC/***diff ABG*** interpretation	Peritoneal dialysis
	Prevention of skin breakdown	***Pathophysiology of lung injury, ARDS &***
	Pharmacological knowledge	***appropriate management***
Low Risk	***Sedation: assessment***	Dealing with the families of a dying child
	Starting of peripheral IV's	Glucometer
	ETCO2 measurements	Acute renal failure, nursing care and assessments
	Skin care: general principles of	Rhythm identification
	positioning	Cardiac defects
		PCA
		Burn wound care
	High Volume	Low Volume

Data compiled by author of this project (August, 2000).

Appendix B

Etiologies of ARDS in Pediatric Patients

Direct Injury	Indirect Injury*
Chest / Thoracic trauma	Severe Sepsis
Aspiration	Burns
Diffuse pulmonary infection (bacterial, viral, fungal, mycobacterium)	Non-thoracic trauma (severe) Multiple long bone fractures Hypovolemic shock
Near-Drowning	Multiple blood transfusions
Toxic inhalation (smoke, corrosive chemicals and high concentration oxygen)	Reperfusion injury: Post lung transplantation Cardiopulmonary bypass
	Fat Embolism

- Caused by activation of an acute, systematic inflammatory response with hematogenous delivery of inflammatory mediators to the lungs

Adapted from Steinburg and Hudson, (2000)

Appendix C

Population Description of Infants/ Children with ARDS in PICU

	1998/99			2000/01		
Patients (N)	18			9		
% Total Population	3.4 %			8.2%		
Mortality rate NS/total ARDS	22%			11%		
	Mean	S*	NS**	Mean	S	NS
Length of stay PICU	24	18	36	21	23.62	2
Ventilator days	18	13	36	16.8	18.75	2
Cost / pt	28,800			25,200		
Total cost	518,400			226,800		

2000/2001 data is from December 1, 2000 to March 1, 2001 (not all chart reviews yet complete for this time period)

S* refers to the survivors

NS** refers to the non-survivor group

Data provided by T. Mortimer (Personal communication, March 26, 2001)

Appendix D

Summary of Potential Harms, Benefits and Costs of Prone Positioning

Harms	Benefits	Costs
Skin breakdown	Increased oxygenation	Human resources (4-5)
Facial edema	Decreased FiO2	Time to turn
Increased oral/nasal secretions	Decreased VALI	Turning device
Feed intolerance	Decreased ventilator days	Increases in sedation / NMBA
Risk of airway loss	Non-invasive	Pressure relief devices
Risk of central catheter loss	Decreased mortality	In-service time personnel
Chest tube loss	Staff motivation	Guideline dev. Cost
Hemodynamic instability	Evidence based care	Data collection

VALI + ventilator associated lung injury

NMBA+ neuromuscular blocking agents

The above information was determined by the author with consideration by the multidisciplinary team to determine the issues and supports required within the system to facilitate the practice of prone positioning.

Appendix E

Description of Barriers to Implementation of Prone Positioning

These barriers were hypothesized as potential / probable elements to be examined prior to the implementation phase of the pilot project. They are broadly categorized and do not necessarily reflect the current practice.

Individual Clinician

This refers to the knowledge, skills and social habits of the staff.

Barriers

Knowledge

- Lack of knowledge of research integration into practice
- Physiology of prone position
- Pathophysiology of ARDS
- Skin assessment
- How to perform thorough chest assessment and assess effectiveness of ventilation when a infant/child lies prone

Skills

- Turning an intubated critically ill patient prone
- Securing the airway when prone
- Correct positioning technique
- Use of pressure relief devices

Attitudes

- Why change when what we are doing works?
- Increased workload

- Concerns re airway security and stability and patient safety
- Overall low staff morale
- Numerous changes occurring over the past six months, contributing to a lack of energy to further learning

Facilitators

- Several new staff, having practiced in other institutions with different practices, will be open to change
- Staff want to provide the best care
- Staff appreciate being a valued member of a multidisciplinary intervention
- Staff are excellent advocates for adequate sedation and neuromuscular blocking agents, necessary for safety when prone
- Staff are vocal and will express their concerns and then these can be dealt with
- A small group of staff are interested in nursing research and these individuals need to be targeted as leaders in the change process.

Social Context of Prone Positioning

This refers primarily to the reactions of the patients and families, co-workers and management authority figures

Barriers

- How will families accept we are now turning infants prone, this is contrary to 'back to sleep' guides
- Families will have limited view of their child's face

- Some infants will not settle prone
- We have never had guidelines on this topic and we still have none
- Management (supervisors) show no interest in this and do not care to know
- X-ray technicians may refuse to do x-rays prone

Facilitators

- We get to work as a team
- Nurses are important member of the team
- Unit manager and Physician support
- Other units in the hospital will hear about a research based practice
- Write an article for the local hospital newspaper
- Do a poster presentation at 'Nursing week" on this topic
- Keep statistical data on the successes and issues, share these with team
- Incorporate the Family Advisory Committee into the educational piece by the way of pamphlets, (they sit on the PICU multidisciplinary team.)

Organizational Context

Barriers

- We are short staffed and there is no hope of more staff and we need 5 people to turn, where I only needed two before.
- We need proper positioning devices as there is none
- Back injuries. how can we do this?
- The HFOV tubing is short and rigid, this seems impossible

Facilitators

- Supportive Respiratory therapy department
- PICU and Hospital goals and mission statement support ongoing nursing research
- Medicine supports this

Dissemination Process

This is the phase where you want to get the information out.

Barriers

- Staff are disinterested
- They have no time in work schedule to attend in-service sessions
- Refuse to come in on a day off for a paid in-service day
- Don't have time to read the required information at work and don't want to take it home

Facilitators

- Clinical teacher and special project nurses are available to in-service small groups
- Resource nurses willing to in-service on shift
- This counts as continuing education for performance appraisal
- Staff generally want to learn why they are doing what they are doing
- Staff do want feedback on their performance

Adoption Process

Barriers

- Old habits die hard

- Negative attitude as it is perceived as too complex
- Interferes with existing routines, such as CXR as 0600, when staff numbers are down
- One failure clouds the picture

Facilitators

- Continuing ongoing support from multidisciplinary team
- Having research evidence posted in visible areas

Implementation

Barriers

- How and when do we start
- Anxiety of causing harm
- How to deal with an arrest or acute patient deterioration
- Requirement to recruit assistance for turn not always practical

Facilitators

- Progress reports on how the process is going
- Provide staff with data on how it is working and when it is not working, comparing our experience to the research. Be honest and critique if we have difficulties
- Modify the plan and resources if it is not working
- Reward staff on their success
- Take pictures of good positioning
- Have an action plan ready for arrest and practice this before an event

Continuation of Prone Positioning

Barriers

- Staff not satisfied with the results, they see no difference
- Old habits return
- Resources in terms of people not sustained
- Resist being told how to practice what they feel is independent nursing care

Facilitators

- Feedback is continuous and ongoing
- Staff provided with data on perceived and actual difference
- Staff nurses involved in the ongoing issues and process

Team continues to support prone positioning

Appendix F

Probability of Adoption Assessment Guide

Questions to Consider	Score
1. Factors Affecting Ease of Transition	
a) How tangible (technological/material) or intangible (interpersonal/nonmaterial) is the innovation? 1= very intangible 5= very tangible	5
b) How much change in current nursing function(s) would this innovation require? 1 = extensive 5 = no change	3.5
c) To what extent does this innovation address a relevant nursing practice problem or need in your hospital? 1= there is little concern by anyone 5= there is concern by a great many	4
d) Would this kin of practice change be acceptable to you and others on your unit? 1= not acceptable at all 5= highly acceptable by all	4
e) To what extent is nursing in your hospital free to decide to carry out this innovation? 1= Requires hospital wide approval 5= Requires no other group's approval	4
f) To what extent would this innovation fall under the control of nursing in your hospital? 1= nursing would have no control 5= nursing would have clear control	4
g) To what extent does nursing staff have to be involved in implementing the innovation? 1= entire nursing staff must be involved 5= small group of nurses need to be involved	3
h) To what extent are the patients to whom the innovation is directed available on one unit or spread across many units? 1= many units with small numbers of patient 5= few units with large numbers of patients	4
i) To what extent would this innovation require changes in staffing patterns for nursing personnel? 1= substantial change required 5= no change required	3
j) To what extent can the innovation be divided into separate phases the can be implemented one step at a time? 1= complex and not divisible 5= easily divisible or not necessary	5
k) To what extent can the innovation be stopped if it does not prove desirable? 1= very difficult to stop 5= stopped without any difficulty	5
l) To what extent would a trial of this innovation disrupt or interfere with the way nurses currently function? 1= would be very disruptive 5= would not interfere or disrupt	4

m) What length of time would be required to carry out this innovation, considering the need for training, material staff? 1= along time 6 months 5= A short time; 2 weeks to 1 month	4
n) How difficult would it be to demonstrate that this innovation has had an effect on patient care? 1= very difficult 5= Easy	3
o) How difficult would it be to get appropriate staff (or others) involved in collecting evidence that the innovation is effective? 1= Very difficult 5= Easy	3
p) What length of time would be required to evaluate the benefits? 1= long time (several months) 5= short time	1
2. Cost –Benefit Factors	
a) To what extent would the benefits derived form the innovation is visible? 1= intangible and not obvious 5= highly visible and obvious to all	3
b) To what extent would the benefits of the innovation affect the physical and emotional well being of the patients? 1= minimal improvement inpatient well being 5= major improvement in patient well being	5
c) To what extent would this innovation facilitate or interfere with the work of nurses in your hospital? 1= it will interfere with their work 5= it will facilitate their work	4
d) To what extent are the materials required by this innovation currently available in your hospital? 1= not ala all available 5= readily available to nursing	3
e) To what extent would personnel require specialized training in order to implement the innovation? 1= extensive training 5= little or no special education	3
f) To what extent would the benefits support the time and energy involved in implementing the innovation? 1= take months to implement and benefits are obscure for a long time 5= takes a limited time and the benefits are readily felt	4
g) How costly would it be to start this innovation? 1= requires extra staff and costly materials/equipment 5= requires no additional staff, materials/equipment	3
h) How costly would it be to maintain the innovation once it was started? 1= requires ongoing budgeting 5= requires no additional staff, materials etc	4
i) To what extent would the monetary cost of nursing care (or costs of other aspect of hospital care) be altered by implementing this innovation? 1= increased costs per patient day 5= major savings per patient day	3

j) To what extent would the benefits of the innovation be proportional to al the difficulties inherent in implementing this innovation? 1= difficulties outweigh any benefits 5= benefits outweigh any difficulties	4
Cost benefit Subtotal	**36**
Ease of Implementation Subtotal	**59.5**
Combined total Score	**95.5**

Ease of Implementation (16 items)

64-80 Very good
48-64 Good
Below 48 Questionable

Good

Cost Benefit Factors (10 items)
40 –50 Very Good
30-40 Good
Below 30 questionable

Good

Combined Total Score
104-130 *Very Good the average score is between 4-5, indicates high estimates of ease of implementation and a favorable cost-benefit ratio.*

78-104 *good the average score is between 3-4, indicates in that there are some obstacles but that the chance of successful implementation and adoption are good.*

XX

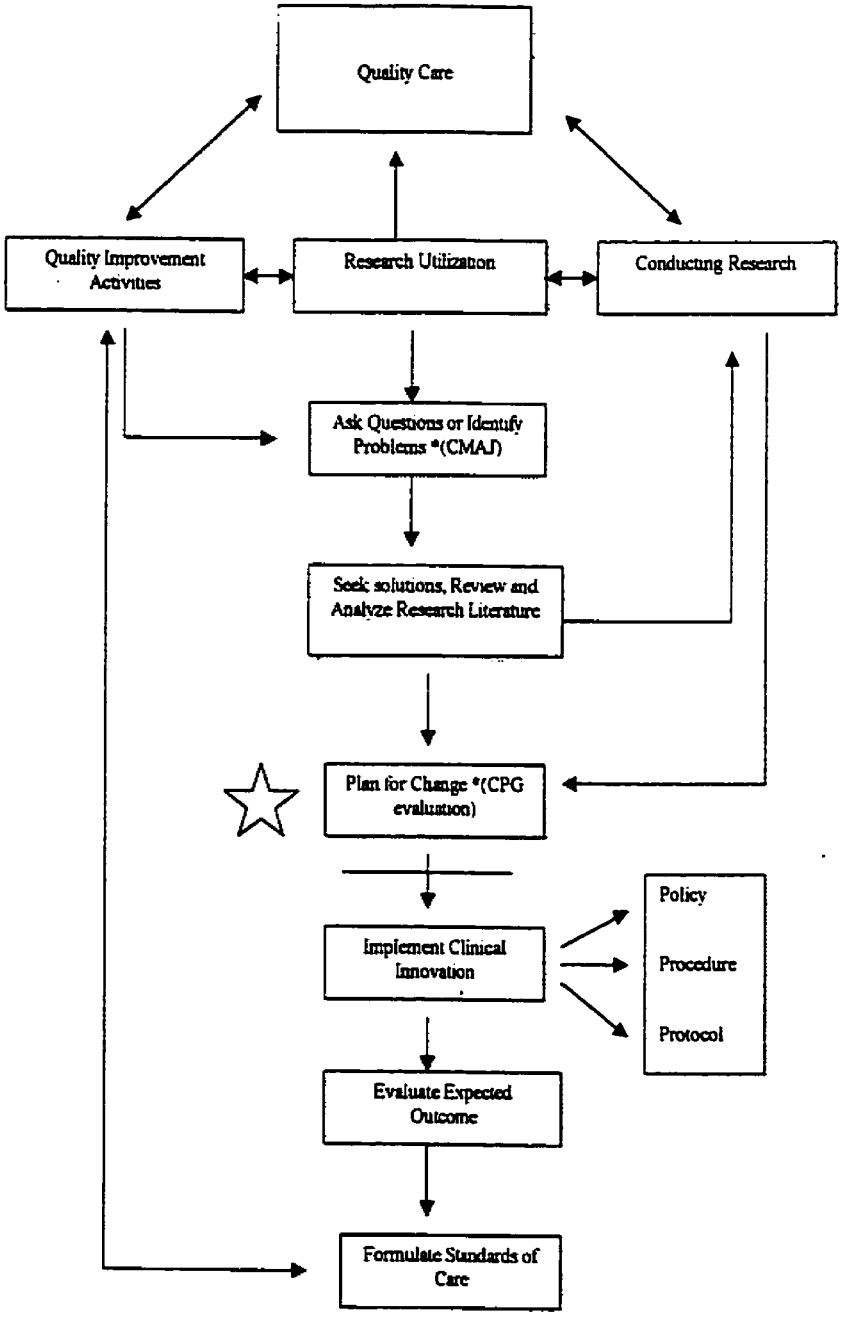
Below 78 *Questionable too many questions have been scored 1-3, indicating that there are many obstacles to successful implementation and adoption.*

- From " Using Research to Improve Nursing Practice: A Guide" (1983)

CURN Project

Appendix G

Research Based Practice Model



From Leske et al., 1994

Appendix H

Consent Form

This Practicum project is the research utilization initiative providing the scholarly paper in the fulfillment of the Master of Nursing in the Advanced Practice Major. The purpose of this stage of the project is to obtain voluntary feedback from the multidisciplinary team involved in the provision of care in relation to this area of clinical practice. Your expert opinion, as well as the barriers surrounding this intervention, will be reviewed in a goal free approach so the eventual piloting of this project can be performed.

As a participant, you will be asked to voluntarily review the clinical practice guideline and provide written and or verbal feedback. Six group discussion sessions, led by Jannell Plouffe, will be available for your participation. The sessions will be of 30 minutes duration. At any point during the sessions you are free to voluntarily withdraw or refrain from answering. There will be no names recorded or comments linked with the discipline you represent. The comments of all sessions and the written feedback will be pooled and number of participants will be recorded. Confidentiality will be respected and none of the written comments or group session's discussions will be identified on an individual basis. Data will be aggregated and the individual will not be identified in the project. Disciplines involved in the review will be noted to ensure all areas of the team are represented. The handwritten comments will be typewritten with the original destroyed in the confidential waste to ensure no recognition of handwriting. The summary of the group discussion will be reviewed with the group at the end of each session to allow for the correct interpretation and clarity of the comments. Only Jannell Plouffe and her faculty chairperson will have access to the written comments and the group discussion notes.

All comments obtained from the group sessions and written feedback will be pooled with themes identified. and posted for participant review for a two weeks period. At the completion of the successful defense of the practicum

project, the final copy of the clinical practice guideline will be available to all team members participating.

The University of Manitoba Education Nursing Research Ethics Board has approved this project and any complaints regarding this project can be reported to the Human Ethics Secretariat at 474-7122.

Participant Name: _____

Date: _____

Witnessed by: _____

Date: _____

Please indicate if you like to receive a final copy of the Clinical Practice Guideline.

Please Circle: Yes or No

Address you would like it sent to:

Jannell Plouffe RN, Master of Nursing Student
University of Manitoba
Home: 488-9701
Email: umplouf1@cc.umanitoba.ca
Project Chairperson: Professor Debbie Fraser Askin (474-9927)

Appendix I

Draft Clinical Practice Guideline for Prone Positioning

Purpose

Provide an evidence-based interdisciplinary clinical practice guideline to promote oxygenation through utilizing prone positioning for pediatric patients with Acute Respiratory Distress Syndrome (ARDS).

Definition of Key Terms

Evidence-Based refers to an approach to decision making in which the clinician uses the best evidence available in consultation with the patient, to decide upon the option that suits the patient best [1,5]. The practice of evidence-based medicine means integrating individual clinical expertise with best available external evidence for the systematic research [2].

Clinical Practice Guideline (CPG) is the systematically developed statement to help practitioners and clients make decisions about care [3]. It is a guide, not a rule [4].

Promote Oxygenation refers to the desired increase in partial pressure of arterial oxygen (PaO2). A *responder* has an increase in oxygenation defined as a minimum increase in PaO2 of 10mmHg, or an increase in PaO2 divided by fraction of inspired oxygen of 20% or greater [15, 20]. Responders are subdivided in relation to their response to the intervention.

Immediate responder is the patient who has the improvement within 30 minutes of the turn [7,10,16,25,28,37,38,39,42].

Late or Slow responders are those patients who increase their oxygenation indices over the period of the turn, exceeding the values assessed pre-turn [7,16,28,37,39,42]. This is usually seen as a slow gradual improvement charted against time.

Non-responder is the patient who does not experience an increase in saturation or improvement in oxygenation during the first 30 minutes or duration of the turn [7,10,16,28]. A non-responder may require returning to the supine position if deterioration is associated with the prone position; this is rare [6,8,9,10,11,44].

Prone Positioning (PP) is the turning of the patient onto their abdomen with the use of appropriate pressure relief devices, where the abdomen is free from pressure contact with the mattress surface below it. A hand should easily slide between the abdomen and the mattress [10,11,13,15].

Pediatric Patients are defined as infants, children and adolescents who are beyond one month of age and up to and including the sixteenth year.

Interdisciplinary is described as the shared responsibility from multiple disciplines in the provision of care, in an overlapping scope of practice [49].

ARDS is defined by the consensus document [21]:

1. Acute onset of respiratory signs and symptoms
2. Hypoxemia: specifically a Pa02/FiO2 ration of less than 200
3. Radiologic evidence of diffuse bilaterally pulmonary infiltrates
4. No evidence of left atrial hypertension.

Patients at Risk

Pediatric most likely to benefit from PP are those patients identified early in the development of ARDS, from direct or non-direct etiologies [6,7,8,9,10,11,12,13,14,15,18,19,20,22,27,28,36,37,39,40,41,42,44,45,46,47,48].

Level of Evidence: Ib, IIb, III. (See Appendix A for description of levels of evidence).

Strength of Recommendation: Strong (See Appendix B)

Assessment

The following indices indicate pediatric patients with ARDS most likely to respond to the PP intervention, summarized as those who require increasing levels of Positive End Expiratory Pressure (PEEP) and fraction of inspired oxygen (FiO2) and yet remain hypoxemic [6,10,11,15,16,17,18,22,31,34,35,36,39,40,43,46,47]. Assessment indices may reveal several of the following:

- FiO2 > .60
- PEEP > 10 cmH20
- PaO2/FiO2 < 200
- PaO2 < 80 mmHg
- Oxygenation saturation < 85%
- Oxygen Index (OI) > 20, [OI = FiO2 x Paw / PaO2 x 100]

Level of Evidence: Ib, IIb, III

Strength of Recommendation: Credible

Exclusionary Criteria

There is no evidence supporting absolute contraindications, but relative contraindications exist [22,26,29,34,44]. The net gain versus the potential risks must

be weighed to ascertain the best risk benefit ratio for a particular patient. Inherent risks are often offset by the need to provide increase oxygenation without causing further barotraumas, volutrauma and oxygen toxicity. Relative contraindications include:

- Unstable spinal fracture [7,10,28,29,34,35,43,44].
- Increased intracranial pressure [7,23,28,29,30,34,35,39,43,44,47,48].
- Hemodynamically unstable patient [7,23,28,29,37,39,40,44,48].
- Unstable long bone fractures [39,44,48].
- Cranial facial surgery in the last month [39].
- Recent abdominal surgery [23,34,39,43,44,48].
- Patient on extracorporeal membrane oxygenation [34,39].

Level of Evidence: IIb, III

Strength of Recommendation: Credible

Articles Needed

Pressure relief devices, ranging from gels pads, foam pads, and egg crate cushions. For the child / adolescent a pressure relief bed is recommended [34,39].

Level of Evidence: III

Strength of Recommendation: Pragmatic

Description of the Practice

Preparation:

1. **Patient and Equipment:**

Preparation of the patient and the equipment must precede PP [10,39,44]. All vascular access catheters, monitoring lines, chest tubes and ventilator tubings

must be arranged to the head or the foot of the bed and secured to prevent tension in the turning process [10,22,32,33]. ETT security and external markers are identified [32,37,39]. Occurrence of adverse events, extubation and loss of lines during the turn is an infrequent event [18,44]. Preparation also includes the removal anterior ECG leads, eye care and mouth care; ensure the tongue is safely placed in the oral cavity [44].

Level of Evidence: IIb, III

Strength of Recommendation: Reasonable

2. Personnel

Patients are turned from supine to prone with three to five members of the multidisciplinary team [10,14,18,22,29,33,36,41,43,44,48]. The duration of the complete turning process (preparation to completion of repositioning) is approximately 30 minutes; with the actual turn taking less than five minutes [34,48]. One team member assumes airway control with another responsible for all other lines and three individual performing the turn [10,22].

Level of Evidence: Ib, IIb, III

Strength of Recommendation: Strong

Scheduling Frequency

Scheduling of the frequency and duration of the turn is based on the patient's ability to sustain improvements in arterial oxygenation in the PP [2,6,7,10,14,18,22,25,36,43,44,47]. Responders and non-responders are determined by the assessment of increased oxygen saturation, decreased Fi02 and improved oxygenation in the arterial blood gas indices [10,18,34,39]. Initial non-responsiveness

with no noted deterioration, may indicate the patient is a slow responder and will have gradual improvement over 12 to 18 hours [18,39]. If an immediate or acute deterioration occurs, the patient should be immediately returned to the supine position [15,32,34]. There are case reports of CPR being performed successfully in the PP [24]. The initial response does not predict subsequent responses to the PP [6,15,22,39,44]. The definitive duration of the PP has not been determined [2,18,39]. Plan to return to the supine position daily for care and thorough skin assessment [6,18,39].

Level of Evidence: IIb, III

Strength of Recommendation: Credible

Turning Procedure

When turning prone always turn the patient in the direction of the mechanical ventilator [34,39,42]. Slide the patient to the edge of the bed away from the ventilator, and rotate to side and then turn prone [32,33]. See attached diagram in appendix C. Small infants can be lifted directly up off the bed and then turned [39]. Additionally a pancake method is described, where the patient is sandwiched between the two sheets [34]. A flannel is laid on top and the sheets are rolled together and patient rolled within this tube and held tight during the turn.

Level of Evidence: IIb, III

Strength of Recommendation: Reasonable

Assessments

The assessments that should occur pre and post turn include: [6,7,8,9,10,11,13,15,22,28,32,33,34,36,37,39,41,43,44].

- Hemodynamic indices [As above]
- Ventilator settings [as above]
- Oxygen indices: ABG, O2 saturation, air entry, and chest wall movement [as above]
- Comfort Score [18,22,34,38,39,48]
- Patient Safety: all lines, tubing and monitoring equipment. Potential complications are an infrequent event [26,36,44,45]

Level of Evidence: Ib, IIb, III

Strength of Recommendation: Credible

Positioning after the Turn

The patient should be positioned with pressure relief devices [39]. At the head, a gel pad may be inserted with an area for the ETT / ventilator tubing to exit with the head turned to the side [15,32,34]; some studies report placing the head face down [18]. The shoulders should be positioned with the arms flexed above the head, yet maintaining alignment or altering one arm flexed upward and the other extended along the torso [15,32,34,36,37,39]. The shoulders / chest and hips / pelvis are elevated off the bed on egg crates or foam pads so that a hand can freely move below the abdomen [10,11,13,15,18,32,33,34,36,37,39,40,42,48]. The legs and feet are positioned to prevent the development of pressure points [18,22,32,40]. Minor repositioning of the head should occur every two hours, with all other areas having slight positional rotation a minimum of every four hours [9,32,34,36,39,43]. Skin assessment for pressure points and breakdown should occur daily [7,34,39].

Level of Evidence: Ib, IIb, III *Strength of Recommendation*: Strong

CPG References

1. Muir Gray, M. (1997). Evidence-Based Healthcare: How to make Healthy Policy and Management Decisions. Churchill Livingston: Edinburgh, pp9.
2. Sackett, D. L., Straus, S. E., Richardson, W. S., Rosenburg, W., Haynes, R. B. (2000). Evidence-Based Medicine: How to Practice and Teach Evidence-Based Medicine. Churchill Livingston: Toronto.
3. Institute for Medicine. (1990). Clinical Practice Guidelines: Directions for a new Program. National Academy press: Washington.
4. Mead, P. (2000). Clinical guidelines: Promoting clinical effectiveness or a professional minefield? Journal of Advanced Nursing, 31(1), 110-116.
5. Closs, S. J. & cheater, F. M. (1999). Evidence for nursing practice: A clarification of the issues. Journal of Advanced Nursing, 30(1), 10-17.
6. Jolliet, P., Bulpa, P. & Chevrolet, J. C. (1998). Effects of the prone position on gas exchange and hemodynamics in severe acute respiratory distress syndrome. Critical Care Medicine, 26, 1977-1985.
7. Fridich, P., Krafft, P., Hochleuthner, H. & Mauritz, W. (1996). The effect of long term prone positioning in patients with trauma induced ARDS. Anesthesia Analgesia, 83, 1206-1211.
8. Langer, M., Mascheroni, D., Marcolin, R. et al. (1988). The prone position in ARDS patients: A clinical study. Chest, 94, 103-107.
9. Blanch, L., Mancebo, J., Pereze, M. et al. (1997). Short-term effects of prone position in critically ill patients with acute respiratory distress syndrome. Intensive Care Medicine, 23, 1033-1039.
10. Chatte, G., Sab, J. M., Dubois, J. M. et al. (1997). Prone position in mechanical ventilated patients with severe acute respiratory failure. American Journal of Respiratory and Critical Care Medicine, 155, 473-478.
11. Mure, M., Martling, C. R., Lindahl, S. G. (1997). Dramatic effect on oxygenation in patients with severe acute lung insufficiency treated with the prone position. Critical Care Medicine, 25, 1539-1544.
12. Phiel, M. A. & Brown, R. S. (1976). Use of extreme position changes in acute respiratory failure. Critical Care Medicine, 4, 13-14.
13. Stocker, R., Neff, T., Stein, S. et al. (1997). Prone position and low volume pressure limited ventilation in improving survival in patients with acute respiratory distress syndrome. Chest, 111, 1008-1017.
14. Voggenreiter, G., Neudeck, F. & Aufmkulk, M. (1999). Prone position in treatment of severe and moderate posttraumatic lung injury. Critical Care Medicine, 27, 2375-2382.
15. Douglas, W. W., Rehder, K. & Froukhe, M. B. (1977). Improvement in oxygenation in patients with acute respiratory failure: The prone position. American Reviews of Respiratory Disease, 115, 559-566.
16. Albert, R. K. (2000). Prone ventilation. Clinics in Chest Medicine, 21(3), 511-517.

17. Brocarrd, A. F. Shapiro, R. S., Schmitz, L. L. et al. (1997). Influence of prone position on the extent and distribution of lung inflation in high tidal volume oleic acid model of ARDS. Critical Care Medicine, 25, 16-27.
18. Calvi, E., Noe, E., Brazzi, L. & Gattinoni, L. (2000). Prone ventilation in ARDS. Proceedings of the Dresden ARDS Symposium. @ http://www.tu-dresdan.de/medkai/gattinoni.pdf
19. Pappert, D., Rossaint, R., Stama, K., Gruing, D. & Falke, K. J. (1994). Influence of position on ventilation perfusion relationships in severe ARDS. Chest, 106, 1511-1516.
20. Lim, C. M., Kim, E. K., Lee, J. S., Shim, T. S., Lee, S. D., Kohl, Y., Kim, D. S. & Kim, W. D. (2001). Comparison of the response to prone position between pulmonary and extra pulmonary acute respiratory distress syndrome. http://www.link.springer-ny.com/link/service/
21. Bernard, G. R., Artigas, A. et al. (1994). The American-European Consensus Conference on ARDS. American Journal of Respiratory and Critical Care Medicine, 149, 818-824.
22. Pedrosa, J. & Dominquez-Cherit, G. (2000). The future of prone position in ARDS. Respiratory Therapy Magazine @http://www.rtmagazine.com
23. Kiran, S., Gombar, S., Chadbra, B. et al (1997). Hazards of prone positioning. Anesthesia Analgesia, 85, 949.
24. Sun, W. Z., Huana, F. Y., Kung, K. L. et al. (1992) Successful cardiopulmonary resuscitation of two patients in the prone position using revised precordial compressions. Anesthesiology, 77, 202-204.
25. Ball, C. (1999). Use of the prone position in the management of ARDS. Clinical Effectiveness in Nursing, 3, 36-46.
26. Thomas, C. (1997). Use of the prone position: The ventilation perfusion relationship in ARDS. Care of the Critically Ill, 13, 96-100.
27. Pelsoi, P., Tubiollo, D., Mascheroni, D. et al. (1998). Effect of the prone position on respiratory mechanics and gas exchange during acute lung injury. American Journal of Respiratory and Critical Care Medicine, 157, 387-393.
28. Vollman, M. K. & Bander, J. J. (1996). Improved oxygenation in utilizing a prone positioner in patients with ARDS. Intensive Care Medicine, 22, 1105-1111.
29. Breiburg, A. N., Aitken, L., Reaby, L., Clancy, R. L. & Pierce, J. D. (2000). Efficacy and safety of the prone position for patients with ARDS. Journal of Advanced Nursing, 32(4), 922-929.
30. Gentilello, L., Thomson, D. A. & Tonnesen, A. S. (1988). Effect of rotating a bed on the incidence of pulmonary complications in critically ill patients. Critical Care Medicine, 16, 783-786.
31. Mutoch, T., Guest, R. J., Lamm, W. J.E. & Albert, R. K. (1992). Prone position alters effect of volume overload on regional pleural pressure and improve hypoxia in pigs in vivo. American Reviews of Respiratory Diseases, 146, 300-306.
32. Klein, D. (1999). Prone position in patients with ARDS: The Vollman prone positioner. Critical Care Nurse, 19(4), 66-71.

33. Phillips, J. K. (1999). Management of patients with ARDS. Critical Care Nursing Clinics of North America, 11(2), 233-247.
34. Balsa, M. C. (2000). Prone positioning of patients with ARDS: Applying research to practice. Critical Care Nurse, 20(1), 24-36.
35. Hirvela, E. R. (2000). Advances in the management of ARDS. Archives Surgery, 1356, 126-134.
36. Johannigman, J. A., Davis, K. et al. (2000). Prone position for ARDS in the SICU: Who, when, and how long? Surgery, 128(4), 708-714.
37. Kornecki, A., Frndova, H., Coates, A. & Shemie, S. D. (2001). 4A Randomized trial of prolonged prone positioning in children with acute respiratory failure. Chest, 119(11), 211-218.
38. Murdoch, I. A. & Storman, M. O. (1994). Improved arterial oxygenation in children with ARDS: The prone position. ACTA Paediatric, 62, 1023-1026.
39. Curley, M., Thompson, J. E. & Arnold, J. H. (2000). The effect of early and repeated prone positioning in pediatric patients with acute lung injury. Chest, 118, 156-163.
40. Mure, M., Martling, C. R. & Lindahl, S. G. (1997). Dramatic effect on oxygenation in patients with severe acute lung injury treated in the prone position. Critical Care Medicine, 25(9), 1539-1544.
41. Dupont, H., Mentec, H. et al. (2000). Short-term effect of inhaled inhaled NO and prone position on gas exchange in patients with severe ARDS. Critical Care Medicine, 28(2), 304-308.
42. Nakos, G. & Tsangaris, I. (2000). Effect of the prone position on patients with hydrostatic pulmonary edema compared with patients with ARDS and pulmonary fibrosis. American Journal of Respiratory and Critical Care Medicine, 161, 306-368.
43. Offner, P. J., Hanel, J.B. et al (2000). Complications of prone ventilation in patients with multi-system trauma with fulminate ARDS. Journal of Trauma, Injury, Infection and Critical Care, 48(2), 224-228.
44. Curley, M. (1999). Prone positioning of patients with ARDS: A systematic review. American Journal of Critical Care, 8(6), 397-405.
45. McKinley, D., Hutchinson, A. & Butt, W. (2000). Efficacy of prone body position on ventilation of children with respiratory illness: A Prospective study presented at the third world congress in Pediatric Critical Care, Montreal, Canada. In abstract submitted to Pediatric Critical Care Medicine, 1(1), 97.
46. Piva, J., Bruno, et al. (2000). Response of the prone position in children is more pronounced in decreased pulmonary congestion versus lower airway obstruction disease. Abstract presented at third world congress in pediatric critical care, Montreal, Canada. Abstract submitted to Pediatric Critical Care Medicine, 1(1), 112.
47. Ullrich, R., Lorber, C. et al. (1999). Controlled airway pressure therapy inhaled NO and the prone position and ECMO in a component of the integrated approach to ARDS. Anesthesiology, 91(6), 1577-1586.

48. Borelli, M., Lamparte, L. et al. (2000). Hemodynamic and generalized response to inhaled NO and prone position in ARDS patients. Critical Care Medicine, 28(8), 2707-2712.
49. Hickey, J. V., Ouimette, R. M. & Venegoni, S. L. (2000). Advance Practice Nursing: Changing Roles and Clinical Applications. 2nd ed. Lippincott Williams & Wilkins: Baltimore.

CPG *Appendix A**

Strength of Reviewed Evidence

From Individual Research or Other Sources

Level of Evidence	Source of Evidence
Level 1a	Evidence from meta-analysis of randomized controlled trials
Level Ib	Evidence from at least one randomized controlled trial
Level IIa	Evidence from at least one controlled study without randomization
Level IIb	Evidence from at least one other type of quasi-experimental study.
Level III	Evidence from non-experimental descriptive studies, such as comparative studies, correlation studies and case control studies.
Level IV	Evidence from expert committee reports or opinions or clinical experience of respected authorities.

Evidence classification table from Shekelle, P. G., Woolf, D. H., Eccles, M. and Grimshaw,
J. (1999). Developing guidelines. British Medical Journal, 318, 593-596.

*CPG Appendix B**

Strength of Recommendation

Strength of a Guideline Recommendation per Overall Level and Amount of Evidence

Level of Recommendation for Use	Type of Recommendation
Strong Recommendation per well established research findings (A)	A strongly based recommendation grounded in level I evidence or consistent findings from multiple studies in Levels II, III or IV
Credible recommendation per promising research findings (B)	A moderately based recommendation grounded in generally consistent findings in Level II, III, IV
Reasonable recommendation per limited but suggestive research-based evidence of low risk for example (C)	A recommendation made in light of limited research-based evidence of levels II, III, IV including inconsistent findings
Pragmatic recommendation in light of high need, expert opinion (local or national) (D)	Recommendation made in light of limited evidence, primarily of level IV

Table from: Stetler et al. (1998). Utilization-focused integrative reviews in nursing science. Applied Nursing Research, 11(4), 195-206.

*CPG Appendix C**

Diagram of Prone Positioning

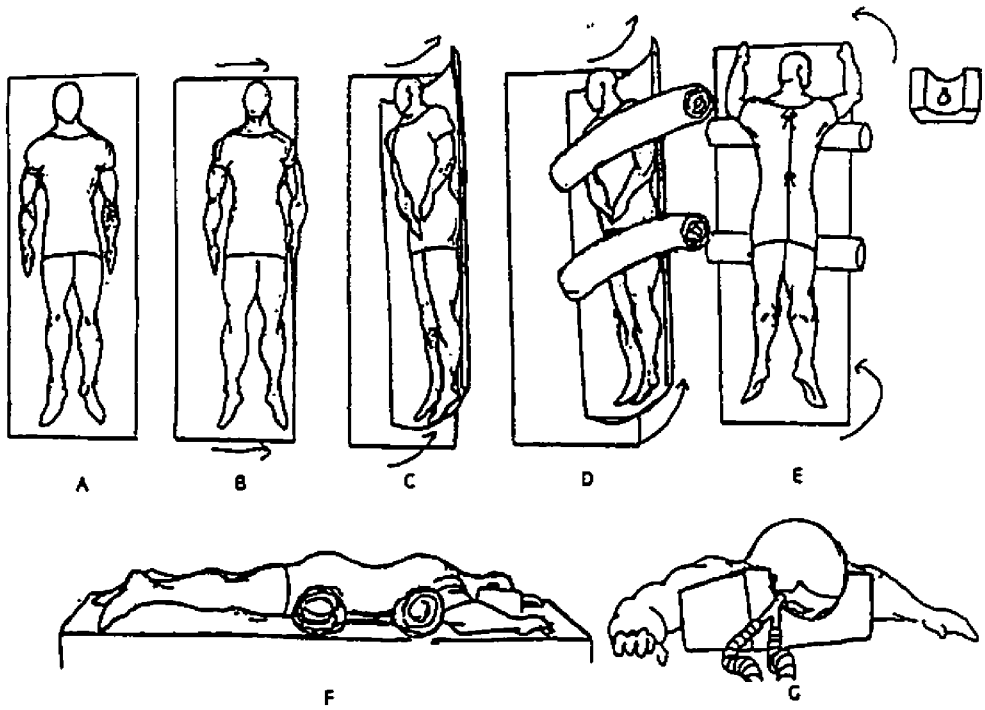


Figure 2 Steps 17 through 22 of the procedure for positioning patients prone: A, patient uncovered in supine position; B, patient slid toward side of bed farthest from ventilator; C, patient tilted on side toward ventilator; D, rolls placed under patient's chest and pelvis; E, patient turned toward ventilator and moved into prone position onto rolls and head cushion; F, proper body alignment when patient is prone (view from side); G, placement of head support when patient is prone (patient's head can then be turned to side every 2 hours).

From: Balas, M. C. (2000). Prone positioning of patients with acute respiratory distress syndrome: Applying research to practice. Critical Care Nurse, 20(1), 24-36.

Figure 1. When prone, patients ought to be supported by foam rubber pads under the upper thorax and pelvis. The head should be supported under the chin, cheeks, and forehead. It is essential that pressure on the eye bulbs be avoided at all times.

From: Mure, M., Martling, C. R. & Lindahl, S. G. E. (19897). Dramatic effect on oxygenation in patients with severe acute lung insufficiency treated in the prone position. Critical Care Medicine, 25(9), 1539-1544.

*CPG Appendix D**

Summary of Potential Complications

Complication	Prevention Strategy
Skin Breakdown	Low pressure mattress Gel padding at pressure points Daily skin assessment (supine) using validated scoring tool with documentation of findings Head re-position q2h and extremities q4h Pad lines/catheters at pressure points Ensure tongue in oral cavity Eyes are protected, lubricated, taped; Consider saran cover Foam/egg crates under hips and torso
Hemodynamic instability	Ensure CV stability prior to turn Ensure isotropic lines free of pressure/kinking prior to turn Monitor before, during and after Prepare and discuss emergency turn protocol for each patient
Facial Edema	Head repositioning q2h Slight elevation of the bed; 10 to 15 degree incline.
Increased oral/nasal secretions	Suction prn, consider inline catheter for ETT Soaker pads below face, changed q2 h
Feed intolerance	Consider nasojejuneal tube Prokinetic agents prn Small volume continuous feeds
Risk of airway loss	Ensure ETT in good position on CXR and validate external markers before and after turn ETT taped secured with ETAD, tape Retape ETT as necessary prior to the turn while in the supine position
Risk of indwelling lines and catheter/tube loss	Devices sutured and taped before turn Assess immediately after
Patient Discomfort	Sedation assessment, validated scoring tool (COMFORT tool) Continuous infusion versus bolus dosing must be assessed Neuromuscular blocking agents may be necessary, but along with sedatives and /or analgesic

Appendix J

Critical Incidents

Critical Incidents are those occurrences that are unplanned for and are unexpected which have potential risk or pose a threat to life. They are described in several studies in the literature as not present or infrequent (Curley 1999, Curley et al 2000, Nakos et al 2000, Dupont et al 2000).

The following would be described as critical incidents:

- Accidental extubation
- Vascular access device lost
- Inadvertent chest tube removal
- Cardiopulmonary arrest
- Hemodynamic instability, primarily hypotension
- Profound deterioration in oxygenation or hypercarbia

Appendix K

Data Base for Prone Positioning Clinical Practice Guideline

Patient ID number:	Date PICU:	Date Discharge PICU:

Date of Birth:_____

Gender: M F

Ethnicity:

Previous Health:

Presenting Illness:

Met ARDS criteria: (date/time)

Met eligibility criteria: (date/time)

Turned Prone: (date/time)

If not turned Prone, Positions used:

Critical Incidents: Check all that apply

Accidental Extubation	
Vascular Access Device lost	
Inadvertant chest tube removal	
Cardiopulmonary arrest	
Hemodynamic instability, primarily hypotension	
Profound deterioration in oxygenation / elevation CO2	
Other: please describe	

Appendix L

Data Collection Tool (Draft)

Cycle number

	1				2			
	PaO2/fiO2*	HR	BP	O2 Sat	PaO2/FiO2	HR	BP	O2 Sat
Pre-prone								
30 minutes post								
2 hours post								
19 hours post								
30 minutes supine (pp)								
Duration prone		N/A	N/A	N/A		N/A	N/A	N/A

- *Numbers are the result of the PaO2/FiO2
- HR, BP and O2 saturation are mean values.

Example of Prompt Card

Time		Time	Done
Time O	Turned prone at	1432	X
Time 1	Measure 30 minutes post at	1502	
Time 2	Measure 2 hours post at	1632	
Time 3	Measure 19 hours at	0932(day2)	
Time 4	Measure 30 minutes after supine	1050	

The bedside nurse would enter the times in for the measures and then tick them off as done.

These would be at each bedside as part of the kardex / care plan to allow ease of Planning care

Table 1 Critical Appraisal of Primary Research Studies

Source	Purpose/ research question	Sample size/ Setting	Independent Variable	Dependent variable	Research Design/Statistical tests	Signif. level	Results	Implications
McKinley, D. et al, 2000	-Long term efficacy of PP - Identify problems -Are the hours of ventilated altered with PP?	Current data N=28 11 in control 17 in study Australia, PICU	Control received side to side Study supine to prone every 4 hours	Hours ventilated Associated problems	Prospective randomized control	Not stated	Turing patients prone is possible No increase in # patient problems To soon to determine effect on hours of ventilation	Not published Data not complete Pediatric study
Pira, J. et al, 2000	Evaluate the effectiveness of PP on arterial oxygenation in pediatric patients who are mechanically ventilated with sever hypoxia of different etiologies	N=18 age 11.5 month+/-11.5 mo. 6 decreased compliance 12 lower airway disease Brazil	2 hours prone	Pa02/fi02 (response defined) Duration ventilation PIP Fi02 Outcome	Prospective non-randomized, patient own control Student t test Chi square	P<0.05 defined as significant	Improvement in oxygenation better inpatients with reduced pulmonary compliance (CI 4.3-77.7%) versus patients with lower A/w obstruction p=0.038	Not published Pediatric study
Komecki, et al, 2001	Compare the effectiveness of prolonged PP to supine on oxygenation	N=10 Age 5 (+/-3.6 years) Canada	Random assignment to supine to prone or prone to supine (12 hours each position) INO for 40 minutes in each position	ABG/OI (significant response defined) ventilation hemodynamic indices Compliance Resistance	Prospective randomized control Cross over study design	Signif. OI p=0.002 OI in PP >SP, analysis of variance p=0.0016	All responded Dramatic increase oxygenation in PP within2 hours No change in lung mech. No change in response iNO Increase in urine output No significant complications	Pediatric study Small sample Support PP for improved oxygenation ? Re only 12 pts in 12 mos. In 36 bed unit?
Curley et al, 2000	Describe the physiologic changes and evaluate the safety of PP in the pediatric population	33 met criteria 20/33 completed study Boston, USA	Turned prone within 24 hr of ventilation and 20/24 hours per day kept prone Detailed description	Pt. Tolerance Skin breakdown Physiologic indices: HR, RR, BP Pa02/Fi02, OI Responses classified	Quasi-experim., prospective non random, time series design with treatment withdrawn & re-instituted Student t test Chi square Man Whitney	Paired sample test/ Wilcoxon P< 0.05 (2 sided)	No critical incident described, (not defined) Iatrogenic complication24% stage 2 pressure sores Increased oxygenation Tolerated position without significant physiologic changes, HR, RR, BP	Pediatric Small sample Participation dropout Generalizability

Source	Purpose/ Research question	Sample Size/ setting	Independent variable	Dependent variable	Research Design/ Statistical tests	Signif. level	Results	Implications
Nakos et al, 2000	Examine the effect of PP on three different respiratory entities, ARDS, pulmonary fibrosis and hydrostatic pulmonary edema	Need to find the paper Ioannina, Greece	PP, interval not clearly defined 18 - 48 hours? Unclear if there is removal, reinstitution	Comparison with the 3 different groups and a control group of hemodynamics, Pa02/Fi02 Exact points of measures were not clear? Consistent	Quasi-experimental prospective design with non equivalent control group ANOVA Nonparametric t test	P<0.05	PP has no major side effects	Small sample, feel they impacted mortality based on predicted scores- higher mortality than actual Data on number of clinical events was not provided Control group was confusing
Voggenreiter et al, 2000	Evaluate the effect of intermittent PP and outcomes of patients with severe ARDS and Moderate LI. Provide rational for further intervention trials	N=22 3 pediatric patients Mean age 40.3 +/- 36yr. 11/22 = ARDS 11/22 = ALI Essen, Germany	8 hours PP/ day Described position and intervention	Hemodynamic indices Pa02/Fi02 Static lung compliance Frequency of measures & exit criteria well described CT before first & after last prone	Prospective non random Observational study Multifactorial analysis of variance Regression to the mean addressed (removed data from day 1) Paired & unpaired t tests	P<0.05	Hemodyname stability Significant improvement in oxygenation with PP Does not depend on previous position, static lung compliance improved p<0.001 Only Minor complications	Few differences: no enteral nutrition, bronch. @ end of each prone cycle? No effect on ABG Can't discuss mortality as no control, no random, 22.5%
Dupont et al., 2000	Compare short tem effect of iNO and PP for increased oxygenation in ARDS	N= 27 Mean age 42 +/- 17 years 5 ICU's Over 2 years data collected on possible 4634 patients Paris, France	INO and PP, PP occurred 30 minutes after the iNO and of 4 hours duration	Hemodynamic indices Pa02/Fi02 30 minutes before the trial and 2 hours after	Retrospective quasi experimental design, (1 group before after) Mean +/- SD Wilcoxon value by pair iNO/PP Spearman rank correlation for rel'n b/w iNO & PP	P<0.05	Significant increase in pa02/Fi02 iNO p<0.001 PP p<0001 No significant hemodynamic changes No major complications	Mortality 63%,? Why (> than predicted) PP response greater than response to iNO Response to one, does not predict the response to the other

Source	Purpose/Research Question	Sample Size/ Setting	Independent variable	Dependent variable	Research Design/Statistical Tests	Signif. level	Results	Implications
Ulrich et al (1999)	Evaluation of a combined therapeutic approach on survival.	N=84, 75 received the PP Over 2.5 years Vienna, Austria	Multi-interventional PP was applied 12 hour duration, occ. supine decreased to 4 hours due to decrease patient tolerance	Hemodynamic indices ABG Pa02/Fi02	Quasi-experimental design: non-equivalent control group, time series with trt withdrawn & reinstituted Retrospective analysis, Non-parametric- Mann-Whitney Qual. - Chi square Multivariante analysis Survival: log rank test Historical control group	P<0.05	Overall 80% survival rate, compared to 50% in control 71/84 responded significantly to conventional treatment plan	Data interpretation of PP alone difficult, presented as part of a package. Findings show increase survival compared to the historical control Issues of selection bias
Johanigman e: al, 2000	Evaluate the safety and efficacy of PP. Determine the duration of time PP might be effective	N=27 (eligible) 7 excluded based on exclusion criteria Cincinnati, USA SICU	PP minimum 5 hours Sp maximum 5 hours SP/PP till PEEP <8, Fi02 < .5 of Pa02/Fi02 > 300	Hemodynamics Pa02/Fi02 Static compliance	Quasi-experimental, prospective non randomized, time series with trt withdrawn and re=instituted Mean +/- SD T test	P<0.05	Pa02/Fi02 significantly increased in the PP 90% of the patient responded with an >20% increase in oxygenation Few clinically significant comp Min. HD changes	Early response to ARDS, few complications defined periods in position (max/min) 78% of all changes to PP = improvement. PP being accepted positively
Offner et al, 2000	Critically evaluate the experience of PP in patient with severe multisystem trauma	N= 9 Over 12 months Level 1 trauma center Age 29 +/- 4.5 yr Denver, Colorado Refractory ARDS-rescue therapy	Prone position , # necessary to turn No time delineated, but late in the course of the ARDS	ABG Complications	Prospective non-random sample Continuous data-before/after Paired t test	Pa02/Fi02 significance p= 0.03 T test significance p<0.05	77% improved their oxygenation significantly despite PP late in the course of the illness. 4 major complications: facial, chest wall necrosis, dehiscence, cardiac arrest No lost lines/tubes	? Re total number of turns and duration in PP Tool for skin assessment Small sample, mainly rescue therapy, meds that impair skin circulation & severe edema. Exact position & change frequency not described
Borelli et al, 2000	Examine the single effect & interaction of PP & iNO on lung function & hemodynamic variables	N=14 16 years 38.6+/- 16.6 yr Monza, Italy	Supine iNO off Supine iNO on Prone iNO off Prone iNO on Applied randomly within SP & PP	Hemodynamic indices ABG: Pa02, c02, saturation	2X2 factorial design Mean +/- SD linear regression analysis	P values of 0.05 significant (.05) very significant (.01)	Significant improvement in oxygenation with PP & iNO (8/14) PP &iNO have an additive effect, not synergistic or antagonistic	Advantage as multiple hypothesis in 1 experiment Examine main effect & interaction effect Concerns: ? Time prone & on Fi02 1.0

Table 2 Part 1 Critical Appraisal of Systematic Reviews on Prone Positioning in ARDS

Study	Question(s)Stated	Literature Search	Inclusion Criteria	Exclusion Criteria	Quality of Studies in Review Assessed	Sufficient Information re: Individual Studies	Combined Studies Appropriately
Pong Wong, 1999	Review current evidence for ease of body positioning to improve oxygenation in mechanically ventilated patients	Medline CINAHL Embase Key words defined	All published English intubated and ventilated patients with acute respiratory failure/ARDS	Neonates Kinetic therapy	Not stated	Yes Total of 12 studies N=160	Yes, commented on the consistency of the + findings despite varied definition
Curley, 1999	4 questions: -Current practice of PP in ARDS -How do patients respond -Complications -Recommendations to prevent complications	Medline Key words defined	English Published Human: adults and children Clinical research, specifically primary studies	Neonatal	Scientific rigor of each study was evaluated, no study was rejected for failing to meet the minimum scientific standards for prospective non-randomized study (no reference)	Yes 17 studies N= 297 14 Non randomized 3 randomized control, (comparison to add'n intervention to increase O2)	Yes Compared and contrasted and pooled data as necessary. Summary of studies given
McIntyre, et al 2000	Systematically review Clinical trials in ARDS	Computerized bibliographic search, no data base stated Published data Citation review of relevant articles	Clinical trials of therapies for ARDS	None stated	Not stated	Reference provided, and some brief commentary in text.	Brief comparison per section.
Ball, 2000	Does PP result in: Increased 02 as measured by Fi02/pa02 Increased % survival to end of study, discharge or 6 months	Cochrane NHS Centre Medscape Medline Cinahl Mesh terms	15 years English Human studies	< 15 years Trials preceding 1994 Multi-interventional; Cardiac surgical etiology	Of 95 relevant citations, reviewed & decreased to 5 based on strict evaluation criteria	5 studies N=113 3 follow-up studies 2 prospective non random Complete tables	Yes, thorough and complete

Table 2 Part 2 Critical Appraisal of Systematic Reviews on Prone Positioning in ARDS

Study	Methods	Findings in Clear Manner	Level of Evidence	Clinical Significance Stated	Recommendations for practice	Strengths and Limitations
Pong Wong, 1999	Findings included relevant trials The validity of the individual studies not discussed Results consistent.	Magnitude of the treatment effect, all findings were statistically significant. (no #) Benefits of PP, mechanisms for improvement, other benefits, and risks	Level V for improvement in oxygenation Level IV is compared vs. similar groups for mortality Grade C recommendation for PP	Alluded to, no definitive statement	Need prospective randomized control trial, looking for the optimal duration and frequency	Strengths: Extensive Search, findings clear Limitations: individual studies not evaluated, ARF and ARDS together. Looked at greater than one position, but did not compare and contrast.
Curley, 1999	Findings & data related to relevant trials were included in the text and table format. Unsure if only 17 articles were found or if there was some rejected due to issues about the study methodology. Results were described as consistent and inconsistent findings with rationale provided for some of the differences	Current practice findings difficult to follow. Sections on complications, patient response and interventions to prevent complications were clear with applicable comments & questions of the precise treatment effect or not.	Not stated	Alluded to, not stated.	RCT is premature, until phase I clinical trial on the safety and efficacy of PP are completed. This review illuminates current practice. This data presented can be used to design evidence-based protocols and phase I safety and efficacy studies to determine the care requirements.	Strength: Descriptive conclusions, not a lot of statistics to interpret Limits: one database of published data. Statements 'no difference' yet no test provided to support statements.
McIntyre et al, 2000	Not described	Mechanism of PP reviewed Numerous studies support + findings with PP & ARDS in rel'n to 02. Complications mentioned.	Level 3 data Grade D recommendation	Not mentioned	PP cannot yet be recommended as a therapy, needs a PRT should be carried out	Strength: level of evidence described Specifics of analysis and findings not provided. Summary only.
Ball, 2000	Thorough job on methods analysis, validity and statistical test analysis	Conclusion stated for each study	Not stated	Appears to be clinically significant	Small convenience sample precludes generalization Severity of illness scores allow for comparison between ICU's Recommend power analysis Suggests statistical testing strategies, discussion of risks and benefits thorough	Strengths: Excellent recommendations for future research Suggest nurses take an active part in the investigation and safe utilization of PP

Table 3: Summary of Findings of Informal Evaluation of the CPG

Question	Main Theme	Description
1. What was your initial impression of the CPG?	Neutral	Statements of fact
	Questioning	Patient related: comfort, positioning, indications / contraindications Knowledge ?'s: language & terminology
	Negative	Length: long & # of references large Definitions: responders & non responders
	Positive	Readability Simplicity Organized Informative Positive reinforcing
2. What impact will the CPG have on your practice & the provision of care?	Neutral	Statements of fact
	Questioning	Maintaining the PP: specifics & frequency Medication ?'s: drug choices for sedation / paralysis
	Negative	Challenges of the turn: performance & maintaining
	Positive	Education Consistency Multidisciplinary Impetus
3. What issues make the CPG difficult for you?	Resources	Insufficient Staff: # needed & training Equipment; appropriate and available Time: enough and organized Patient: stability, airway, size, ER
	CPG	Evaluation: indices & frequency of assessments Format: brief procedure & bedside document
4. Can you identify any suggestions for change?	Nothing	Satisfied with document
	Education	Reflected what was learned
	Future Improvements	MD orders Diagrams of different size patients Practice sessions Abbreviated bedside document definitions