CHAPTER II
REVIEW OF LITERATURE

The Desire of knowledge,
like the unit of riches
increases even with the acquisition of it.

Lawrence Sterne.

According to Polit and Hungler (1989) reviewing the literature is important to gain a better understanding and insight necessary to develop a broad conceptual framework in which the problem can be examined. It helps in the formulation of a specific problem; acquaint the investigator to what is already known in relation to the problem underview; provide a basis for assessing the feasibility of research problem and give information on the research approach.\textsuperscript{15}

Critical Review of literature refers to the process in which investigator or reader examines the strength and weakness of the appropriate scholarly publication/literature and online search on Cinhal and Pubmed.

Overall 57 studies are reviewed in this chapter. The studies reviewed were based on the different protocols that were developed to care a patient on ventilator. More emphasis was placed on the studies which would help in identifying the needs of the patient and the nurses and also the problems encountered during caring a patient on ventilator. The reviewed literature is organized and presented in the following headings.

I. Studies related to nursing care protocols.
II. Studies related to communication of nurses with patient and relatives.
III. Studies related to intubation, Extubation, change of twill tape and suctioning.
IV. Studies related to oral care and pressure ulcers.
V. Studies related monitoring and weaning the patient on ventilator.
VI. Studies related to assisting in Arterial blood gas collection.
VII. Studies related to enteral feeding.
VIII. Studies related with ICU staffing.
2.1) **STUDIES RELATED TO NURSING CARE PROTOCOLS:**

Gerald P and Delores P N, (2007) conducted a study on “Empowering critical care nurses to improve compliance with protocols in the intensive care unit” In this study a baseline compliance range was obtained by using a sampling of 9 protocols for a 100% audit of 35 beds in an adult intensive care unit. Nurses were given positive rewards to promote an initiative to improve compliance with protocols. The original audit tool was used to assess compliance at intervals during a trial period and for a follow-up audit three years after implementation of the initiative, results showed that one month after the initiative was started, compliance with protocols increased from a range of 62% to 77% to a compliance of almost 90%. Within four months, the compliance rate increased to a mean of more than 95%. Three years later, the compliance rate was greater than 90%, this showed that Extrinsic rewards improved compliance with protocols and resulted in a change in the culture in the intensive care unit that had a cumulative outcome.¹⁶

“Protocol - directed weaning: a process of continuous performance improvement” by Ramachandran V, Grap M J, Sessler C N (2005) comments that, The use of a nursing-directed and/or respiratory therapist-directed protocol in many intensive care units for weaning from mechanical ventilation is associated with a shorter duration of ventilation and length of stay in the ICU.¹⁷

Flynn and Sinclair. (2005); conducted a study to explore the relationship between nursing protocols and nursing practice in an Irish intensive care unit. This was a d descriptive study in which a case study approach was followed to examine the experiences of nurses in an Irish intensive care unit with a protocol on endotracheal tube suctioning. 17 nurses were interviewed about their insight in relation to policies, protocols and guidelines. Analysis of the data afforded some highly relevant findings, that nurses adapt clinical protocols.¹⁸

**Conclusion:** - The above studies regarding nursing care protocols are reviewed to search about the views and compliances of nurses regarding the nursing care protocols and to know how beneficial they are in ICU. The studies reviewed helped the researcher to know that compliance with protocols can be achieved by motivation in the nurses and driven protocols can have better performance in patient care and reduce the length of stay in the ICU. Protocols are important for the nurses and it will serve them as guidelines while working in ICU.
2.2) STUDIES RELATED TO COMMUNICATION OF NURSES WITH PATIENT, AND RELATIVES

“Nurse-Patient Communication Interactions the Intensive Care Unit” by Happ M B, Garrett K, Thomas D D and et.al (2011) A Descriptive observational study was conducted by them in a medical and a cardiothoracic surgical intensive care unit. Video recorded interactions between 10 randomly selected nurses (5 per unit) and a convenience sample of 30 critically ill adults (15 per unit) who were awake, responsive, and unable to speak because of respiratory tract intubation were rated for frequency, success, quality, communication methods, and assistive communication techniques. Patients self-rated ease of communication. It was found that Nurses initiated most (86.2%) of the communication exchanges. Mean rate of completed communication exchange was 2.62 exchanges per minute. The most common positive nurse act was making eye contact with the patient. Although communication exchanges were generally (>70%) successful, more than one-third (37.7%) of communications about pain were unsuccessful. Patients rated 40% of the communication sessions with nurses as somewhat difficult to extremely difficult. Assistive communication strategies were uncommon, with little to no use of assistive communication materials (e.g. writing supplies, alphabet or word boards). Study results highlight specific areas for improvement in communication between nurses and nonspeaking patients in the intensive care unit, particularly in communication about pain and in the use of assistive communication strategies and communication materials.19

Manojlovich M, Antonakos C L and Ronis D L (2009), conducted a study on “Intensive Care Units, Communication between Nurses and Physicians, and Patients’ Outcomes”. A cross-sectional survey design was used. Information on ventilator-associated pneumonia, bloodstream infection associated with a central catheter, and pressure ulcers was collected from 25 intensive care units in southeastern Michigan. Simultaneously, 462 nurses in those units (response rate, 53.3%) were anonymously surveyed. The Conditions for Work Effectiveness Questionnaire-II and the Practice Environment Scale of the Nursing Work Index were used to measure characteristics of the practice environment. The Intensive Care Unit Nurse-Physician Questionnaire was used to measure communication between nurses and physicians. Unit response rates varied from 6% to 100%. Together, variability in understanding communication and capacity utilization were predictive of 27% of the variance in ventilator-associated pneumonia. Timeliness of communication was inversely related to pressure ulcers (r= –0.38; P=.06), and workplace empowerment and scores on the Acute
Physiology and Chronic Health Evaluation III were positive predictors of ventilator-associated pneumonia ($R^2=0.36; P=.005$). It was found that there were specific elements in the work environment that nurses need to prevent adverse outcomes and provide good care. When hospital leaders provide nurses with opportunities, information, support, and resources and when nurses are involved in decision making for patients care patients outcomes improves.

In (2007) Curtis R J conducted a study on “Communication between ICU Nurses, Patient Families” Family members in the intervention group underwent family conferences based on end-of-life research conducted. The study included the families of 126 patients in 22 intensive care units. Results determined that family members receiving intervention had reduced symptoms three months after the patient’s death. Curtis explained the benefits of this intervention for ICU nurses. “Using this VALUE approach to communication with families can help reduce the burden on family members during the process of shared decision making in the ICU by allowing them to express their emotions, providing them with emotional support and supporting them through the decision-making process,” he said. “This approach also reduces family member symptoms of anxiety, depression and post-traumatic stress disorder months after the ICU stay, probably through the same mechanism.” “Offering families the opportunity to talk about their experiences and emotions is a very important role for ICU nurses to play,” he concluded. “It is important for nurses to share information obtained from family members with the physicians and the ICU team. It is also important that the entire ICU team communicate well with each other and provide a consistent message to family members.”

A study on “Communication Board Can Ease Frustration Intubated Patients Feel When Trying to Convey Their Needs” by Rivero E in (2006) states that mechanically ventilated patients are unable to express their feelings and needs through verbal communication because the endotracheal tubes running through their vocal cords make speech impossible, contributing to their frustration and anxiety. As a result, the caregiver is forced to interpret the patient's non-verbal communication such as mouthing, gesticulating, nodding and writing — which can be difficult for the critically ill patient. He found that 69 percent of intubated patients surveyed said that a communication board would have helped them to better express their needs to hospital health care workers. This study shows that there
is a need for nurses to use different modes of communication while communicating with the ventilated patients.\textsuperscript{22}

Hupcey J E. in (2004) conducted a study “Feeling Safe: The Psychosocial Needs of ICU Patients’ the study described the psychosocial needs of critically ill patients, including descriptions of patients' experiences when their needs are not met, and behaviors of families, friends, and ICU staff that help or impede meeting their needs.\textsuperscript{22}A qualitative research design was used. Participants were 45 adult critically ill patients in the medical or surgical ICU for a minimum of three days data collection and analysis was conducted using methods of grounded theory, including theoretical sampling and constant comparative process. Unstructured tape-recorded interviews were conducted with patients once they were stable in the ICU or immediately following their transfer to a general unit\textsuperscript{22}. It was found that the overwhelming need of ICU patients was to feel safe. The perception of feeling safe was influenced by family and friends, ICU staff, religious beliefs, and feelings of knowing, regaining control, hoping, and trusting. ICU patients in this study said that feeling safe was their overarching need. Patients described feelings of distress when they did not feel safe and stated how family, staff, and religion could both positively and negatively affect this feeling. Nurses can intervene in numerous areas to foster the feeling of safety in critically ill patients.\textsuperscript{23}

Johansson G W (2000) conducted a study on “Communication between nurse and patient during ventilator treatment: patient reports and Registered Nurse Response”. Twenty-two consecutive patients treated in an intensive care unit (ICU) were interviewed three times over a 2-month period about their experiences of changes to their communication during ventilator treatment. Structured questionnaires, including open-ended questions were used on each occasion. The registered nurse incharge of each patient evaluated the extent of communication during the ventilator treatment in a nurse protocol. Thirteen out of the twenty-two patients reported that the registered nurse were able to understand their needs and wishes during the ventilator treatment. The registered nurse, however, reported functional communication, in nineteen patients. A functional communication was typically related to the use of effective communication methods, while a lack of communication was associated with compromised medical status of the patients. The results suggest the need for detailed examination of patients’ potential for effective communication, evaluation of the communication skills of the registered nurse, and further investigation of devices that can
A descriptive and exploratory study on “Patient's experiences of communication during the respirator treatment period in the intensive care unit” by Hafsteindóttir T B (1996) was designed to answer the questions regarding experience on respirator. Eight individuals, who had experienced being treated with a respirator in two ICUs in Iceland, took part in audiotape-recorded, open interviews. They described their subjective experiences of communication during the respirator treatment period. The descriptions were analyzed phenomenologically. The results revealed 57 themes within four categories, namely ‘the patients’ experiences of communication during the respirator treatment period’, ‘problems of communication experienced’, additional problems of communication experienced ‘and nursing interventions experienced’. The participants remembered their experience of communication clearly. The patients' experiences of communication were generally described as negative. They experienced communication as impaired, which evoked various negative emotions, and sometimes they had the feeling of giving up. Participants generally described being tired or exhausted during the intubation period. They emphasized the importance of the information and explanation provided by the nurses. The presence and support provided by family members was also valuable to them. The results add to the cumulative knowledge base of communication between nurses and patients by generating new meanings of the nature and essences of communication during the respirator treatment period from the patients' perspectives.

A study on “Research Stresses between ICU Nurses, Patient Families” by Christina Orlovsky (2011) states that Family members of patients in intensive care often suffer from the grief associated with a loved one’s illness. Recent research has found that clinicians can ease the pain of a patient’s passing by communicating with their family. Researchers in France conducted a study sponsored by the National Institutes of Health’s National Institute of Nursing Research and determined that family conferences held by clinicians with members of families of ICU patients help lessen the post-traumatic symptoms of the death of their loved one. The study included the families of 126 patients in 22 intensive care units. Results determined that family members receiving intervention had reduced symptoms three months after the patient’s death. “Looking for opportunities to let families talk about their experiences, what they are perceiving in the ICU, and their emotions, can be helpful, encouraging them to bring in photos or other things that personalize the patient and help the
ICU staff to understand who the patient is, as that person can also be helpful. Family members are also appreciative of the efforts of staff members who care for their wellbeing, as well as that of the patients. Offering families the opportunity to talk about their experiences and emotions is a very important role for ICU nurses to play. It is important for nurses to share information obtained from family members with the physicians and the ICU team. It is also important that the entire ICU team communicate well with each other and provide a consistent message to family members.” Lack of Inservice education nonformal orientation program on coming in ICU lacking interest in self-study because of personal responsibilities, wide nurses patient ratio. Inadequate supply of material, lack of knowledge leading to lack of interest. The formal orientation program for the nearly joined staff nurses is needed to teach them the complete procedures technical competencies which they will have to use and that would help them. The research recommended that nursing intervention guideline should be distributed to all the nursing personal in ICU to acquaint them with the requirement of therapeutic communication with family members.  

Magnus V S and Turkington L. (2006) conducted a study on “Communication interaction in ICU--Patient and staff experiences and perceptions”. Patients on intensive care units (ICU) have difficulty with communication. Factors related to the emotional responses of intubated patients to being unable to speak. Feelings of anger and low mood have been reported, which can lead to reduced participation in rehabilitation. For members of the multidisciplinary team breakdown in communication with patients may be frustrating and related to a limited knowledge of strategies and resources to facilitate communication. The NHS Modernization Agency Critical Care Programme (2002) identified speech and language therapists (SLTs) as having a role in the assessment and management of patients with communication difficulties on ICU. This multi-centre pilot study aimed to investigate staff and patient perceptions and experiences of communication within ICUs.

Conclusion: - This section highlighted specific areas for improvement in communication between nurses and nonspeaking patients in the intensive care unit. Nurses if involved in decision making for patients care patients outcomes improves This section also shows that there is a need for nurses to use different modes of communication while communicating with the on ventilator. Nursing intervention guideline should be distributed to all the nursing personal in ICU to acquaint them with the requirement of therapeutic communication with family members.
2.3) STUDIES RELATED TO INTUBATION, EXTUBATION, CHANGE OF TIE AND SUCTIONING.

Raghda Elbokhary, Await Osama, Mugahed AL (2015) conducted a study on Knowledge and Practice of ICU Nurses Regarding Endotracheal Suctioning for Mechanically Ventilated Patients descriptive cross-sectional study on 142 nurses. All nurses working in Khartoum teaching hospital ICU included in the study findings showed that the majority of nurses working in Khartoum teaching hospital (35.7%) have 2 month - 1 year working experience, (85.7%) had poor knowledge level, (76.7%) had fair practice level, and there was no significant relationship between working experience & levels of knowledge & practice. Nurses have better practical level than knowledge level and they were not affected by nurse’s length experience as there should be. The study recommended that is need for Practice guidelines and teaching programme to be implemented and updated monthly or annually in all hospitals.

Jansson M, Tero A, Ylipalosaari P, H and etal. (2012) performed a study on “Evaluation of endotracheal-suctioning practices of critical-care nurses – performed an observational correlation, non-participatory, observational study (n=40) using a 25-item best-practice information sheet to assess critical-care nurses’ ETS practices in a mixed medical-surgical intensive-care unit ETS performance against current recommendations within different ICU experience groups. The quality of observed ETS practices was significantly lower than the required quality of care \( p<0.001 \). The most significant discrepancies were observed in ETS practices related to infection-control practices. Critical-care nurses are currently not following current ETS recommendations. Significant discrepancies, which may constitute a risk factor for VAP by increasing microbial colonization of the lower airway, were identified. Unsafe ETS practices may jeopardize patient safety, and thus the quality of nursing care. Educational interventions, clinical guidelines and adequate support need to be provided to critical-care nurses to assess and improve their professional capabilities and current practice. Regular auditing and prompt feedback would be beneficial.

Choi YS and Chae YR (2012) performed a comparative study on “Effects of rotated endotracheal tube fixation method on unplanned extubation, oral mucosa and facial skin integrity in ICU patients” The study was done to compare effects of two endotracheal tube
(ET tube) fixation methods (rotated fixation versus conventional) on unplanned extubation and skin integrity for orally intubated patients in intensive care units. Participants were 80 patients; 40 participants assigned to each group. ET tube for the experimental participants fixed with rotated method every morning. Unplanned extubation was assessed by bedside nurses using the unplanned extubation report form. Oral mucosa and facial skin integrity were assessed using oral assessment guide and facial skin integrity assessment guide. It was found that there was no difference in the unplanned extubation rate between the two groups. Oral mucosa impairment scores for the rotated fixation method were significantly lower at day 7 (p=.044), 10 (p=.048) and day 14 (p=.037). Also facial skin integrity impairment scores for the same group were significantly lower at day 7 (p=.010), 10 (p=.003), and 14 (p=.002). Results of the study suggest that the rotated fixation method is effective for these patients, to prevent impairment of oral mucosa and facial skin integrity. Further research is needed to prevent unplanned extubation.

Barbara B (2011) in the study “Practice decisions related to suctioning intubated patients” states that several research-based protocols for suctioning intubated patients have been published over the past decade. This descriptive study compared current suctioning practices to those recommendations. Twenty-two ICU nurses were randomly selected. All agreed to be observed during a routine suctioning event. Afterward, each nurse was interviewed to validate the observations and to clarify the nurse's decision-making regarding components of the suctioning procedure. Data were collected using a structured checklist; interviews were audiotaped. Hyperinflation and hyperventilation were associated (p<0.001) with whether the nurse used the in-line closed suctioning system or opened that system to use an external suction catheter, as was hyperoxygenation (p=0.02). Eight of the 12 nurses who did not hyperoxygenate considered this practice unnecessary unless the patient's oxygen saturation fell below 90% during suctioning. Ten nurses (45%) used normal saline lavage. Observed suctioning practices differed from evidence-based recommendations in a number of respects. The methodology of observing practice and then interviewing nurses about specific elements in their decision-making may be useful when attempting to foster a change towards evidence-based practice. Optimizing nurses' use of research evidence in practice requires both a research base that focuses on clinically important outcomes and an understanding of the factors that influence nurses' practice.
Ansari A, Alavi N M, Hajbagheri A M, Afazel M (2011) In the cross sectional study on “The gap between knowledge and practice in standard Endo-tracheal suctioning of ICU nurses”, states that study, knowledge and performance of 44 nurses working in three ICUs was analyzed in three areas of prior, during and post suctioning, using a 26 item questionnaire and check list. In the 8 items in question of prior suction the average score for knowledge and performance were 5.4 (±1.12) and 0.81 (±0.71) respectively and in the analysis of ten items during suction an average score of 7.7 (±1.09) and 4.6 (±0.75) were obtained for knowledge and performance respectively. In 8 items of post suction the average score of knowledge was 6.47 (±0.69) and that of performance was 3.86. In general, from 26 possible points, the average score of knowledge and performance were 19.59 and 8.75 respectively. The type of ICU and nurses’ working experience were not significantly related to their knowledge and performance. This study revealed that despite acceptable knowledge, nurses' performance in endotracheal suctioning is poor. This shows that education alone is not sufficient for observance of the standards.32

Maboudi A, Abtahi H, Hosseini M and etall in (2010). In the study on “Accuracy of Endotracheal Tube Cuff Pressure Adjustment by Fingertip Palpation after Training of Intensive Care Unit Nurses” states that twenty-five nurses were asked to adjust the ETT cuff pressure to 25 cmH2O by palpation on three different patients in seven sessions: before training, two hours and two days after first training session, and two hours, two days, one week, and eight months after second training session. Before training, 41.3% of the cuff pressures were adjusted to the safe range of 21-35 cmH2O. The pressures obtained in S2-S7 were lower and less variable than S1 (P = 0.02 to < 0.0001). After the first training session, all the ETT cuff pressures in the high range (36-50 cmH2O) and 87.5% in the very high range (> 50 cmH2O) changed to the safe range, this showed that using trained fingertip adjustment of the ETT cuff pressure throughout the nursing shift with protocols for the adjustment of out of range pressures at the beginning of each shift by cuff manometer could decrease the rate of ETT cuff over- and under-inflation. The study showed that most of the ICU nurses were unaware of the ETT cuff functions and its safe pressure range. Consistent with their findings, more than half of British ICU nurses in a survey did not know the recommended range of ETT cuff pressure.33

care units—a survey into current practice and knowledge.” The author says that the daily bedside routine of the intensive care, potentially hazardous interventions that lack evidence need critical consideration. Hence the current practice and knowledge of basic principles of manual hyperinflation (MH) in intubated and mechanically ventilated patients among intensive care unit nurses in the Netherlands were examined. A written survey method was used, questionnaires were sent to ICU nurses specialized in mechanical ventilation in 115 Dutch hospitals. The questions related to following domains:

1. demographics;
2. use of MH;
3. presumed benefits;
4. essential elements of the MH procedure;
5. equipment and safety.

It was found that the response rate was 77%. From responding ICUs the majority (96%) stated they performed MH; 27% as a daily routine procedure, 69% performed MH on indication only. MH was mainly performed by ICU nurses. Half of ICUs reported to have a MH guideline available. Improved oxygenation and better removal of sputum were presumed benefits of MH. While slow inspiration and rapid expiration are considered to be essential elements of MH procedures, the majority of respondents stated to use rapid inspiration and slow expiration. This survey indicated that MH is widely used as an important item of airway management. Importantly, there is no uniformity in the performance of the procedure. There is a need for standards to be established.34

Kelleher S, and Andrews T (2005), “An observational study on. The open-system endotracheal suctioning practices of critical care nurses” , a structured observational study was conducted using a piloted 20-item observational schedule on two adult intensive-care units to determine how critical care nurses (n = 45) perform ETS in their daily practice and to establish whether the current best practice recommendations for ETS are being adhered to. the findings indicate that participants varied in their ETS practices; did not adhere to best practice suctioning recommendations; and consequently provided lower-quality ETS treatment than expected. Significant discrepancies were observed in the participants' respiratory assessment techniques, hyperoxygenation and infection control practices, patient reassurance and the level of negative pressure used to clear secretions. The findings suggest that critical care nurses do not adhere to best practice recommendations when performing
ETS. The results of this study offer an Irish/European perspective on critical care nurses' daily suctioning practices.35

González A N, Mingo M A, Sagardoy E M, and etall in (2004) performed a evaluated study on “Assessment of practice competence and scientific knowledge of ICU nurses in the tracheal suctioning”. She says that tracheal suctioning is essential to maintain permeability of the artificial airway and this procedure may be associated to risks for the patients. Thus, it is very important to know if the nurses perform it correctly and if the practice is based on scientific evidence. This study was to evaluate practical competence of the nurses, as well as the scientific knowledge that they have on these procedures in a Intensive Care Unit and analyze if there are discrepancies between the practice competence and scientific knowledge. This descriptive study, performed in 34 nurses, analyzed the performance of tracheal suctioning by direct observation, using the data collection of a structured grid that included 19 aspects to evaluate, grouped into 6 categories. In the same way, knowledge on the procedure was analyzed, using a 19-item self-administered questionnaire, also grouped into 6 categories, which evaluated the same aspects observed. The total mean score obtained in the practice observation grid (P) was 12.09 for a maximum score of 19, while it was 14.24 in the knowledge questionnaire (Q). When analyzed by categories, discrepancies were obtained in the following aspects: in the need for hand washing prior to suctioning (P = 55.9%; Q = 97.1%), in cleaning of the suction catheter after each suctioning during the procedure (P = 0%; Q = 38.2%), in the correct performance of hyperoxygenation and hyperinsufflation, before, during and after the procedure (P = 11.8%; Q = 941%), in the correct selection of the size suction catheter in relationship with endotracheal tubes internal lumen (P = 0%; Q = 52.9%), in the maximum time the catheter remains in the trachea (P = 100%; Q = 23.5%), in the maximum number of times that the catheter should be introduced in each suctioning (P = 100%; Q = 73.5%) and in the non-instillation of saline solution (P = 29.4%; Q = 58.8%). When the total scores obtained were compared, both in practice and knowledge, with the years of experience in ICU, no statistically significant differences were found. It is concluded that the study nurses have scientific knowledge of the suctioning procedure that are better than their practice competence. Discrepancies between practice and knowledge were also found in several of the aspects evaluated, which orients towards the specific needs of training in this procedure.36
Darvas J A and Hawkins LG. (2003) performed a study on “The closed tracheal suction catheter: 24 hour or 48 hour change?” Closed suction catheters (CSC) for removal of bronchial secretions in intubated patients have been used in intensive care units (ICU) for many years. Manufacturers still recommend daily changes of the catheter in order to reduce the incidence of ventilator associated pneumonia (VAP). There is, however, a lack of clinical evidence to support this recommendation. The objective of this study was therefore to compare the incidence of VAP in patients who receive either 24 hourly or 48 hourly changes of the CSC. Eligible patients were randomized to one of the two groups to receive either a 24 hourly change (n = 53) or a 48 hourly change (n = 48) of the CSC. Sputum specimens were sent second daily for quantitative culture. Chest x-rays (CXR) and white blood cell counts were attended daily. A VAP was diagnosed according to previously established criteria. A second set of modified criteria were also used to conduct a further analysis of the results. Of the 158 patients randomized, 101 completed the study. These patients had a mean age of 65 years and a mean APACHE II score of 28.2 in the first 24 hours of the study. The average duration in the trial was 10 days. The two groups were comparable in terms of demographic features. There were no reported cases of VAP in either group using the criteria originally selected in the study design. Using a modified criteria to diagnose VAP there were 10 (19%) patients with VAP in the 24 hour group and 13 (27%) in the 48 hour group. The incidence of VAP between the two groups was not statistically different (p = 0.35). To conclude, there was no difference in the incidence of VAP between the two groups studied. Based on previous studies conducted by Quirke and Kollef and the experience of our study we have changed our clinical practice to a 48 hour change of the CSC. We would, however, suggest further study or a meta-analysis of the available literature before a recommendation is made.37

According to Day T, Wainwright S P and Wilson-B J (2001) in a study on “An evaluation of a teaching intervention to improve the practice of endotracheal suctioning in intensive care units”, states that endotracheal suctioning is a frequently performed procedure that has many associated risks and complications. It is imperative that nurses are aware of these risks and are able to practice according to current research recommendations. This study was designed to examine to what extent intensive care nurses knowledge and practice of endotracheal suctioning is based on research evidence, to investigate the relationships between knowledge and practice, and to evaluate the effectiveness of a research-based teaching programme. This quasi-experimental study was a randomized, controlled, single-blinded comparison of two research-based teaching programmes, with 16 intensive care
nurses, using non-participant observation and a self-report questionnaire. Initial baseline data revealed a low level of knowledge for many participants, which was also reflected in practice, as suctioning was performed against many of the research recommendations. Following teaching, significant improvements were seen in both knowledge and practice. Four weeks later these differences were generally sustained, and they provided evidence of the effectiveness of the educational intervention. The study raised concern about all aspects of endotracheal suctioning and highlighted the need for changes in nursing practice, with clinical guidelines and focused practice-based education.\(^{38}\)

**Conclusion:** This section shows that Educational interventions, clinical guidelines and adequate support need to be provided to critical-care nurses to assess and improve their professional capabilities and current practice as despite of acceptable knowledge, nurses' performance in endotracheal suctioning is poor. The critical care nurses do not adhere to best practice recommendations when performing ETS. Discrepancies between practice and knowledge were also found in several of the aspects evaluated, which orients towards the specific needs of training in this procedure.

These studies also highlighted that change of twill tape with rotated fixation method is effective for the intubated patients to prevent impairment of oral mucosa and facial skin integrity.

### 2.4) STUDIES RELATED TO ORAL CARE AND PRESSURE ULCERS:

Adib-H M. (2013) in the study on “Intensive care nurses' opinions and practice for oral care of mechanically ventilated patients.” This study aimed to evaluate the nurses' opinions and practice about oral care in patients under mechanical ventilation. A cross-sectional study was conducted on 130 intensive care nurses from 6 intensive care units in the university hospitals of Iran. A questionnaire was used to gather the data and charts of 45 patients were evaluated and descriptive statistical analysis was presented. Oral care obtained the 7\(^{th}\) rank in priority and a mean score of 5.7 on a scale of 1-10. More than 21% of subjects did not perform oral care in their usual duties. High load of writing tasks and personnel shortages were the major barriers to oral care. Only 20% of the patients' charts contained a report on oral care. It was noticed that Nurses did not consider oral care in intensive care patients as a high priority. This result highlights the need to continue education programs on oral care for improving the knowledge and attitude of intensive care nurses with respect to oral care.\(^{39}\)
Prendergast V, Jakobsson U, Renvert S, and et al (2012) “Effects of a standard versus comprehensive oral care protocol among intubated neuroscience ICU patients”: results of a randomized controlled trial. The purpose of the study was to compare changes in oral health during intubation until 48 hours after extubation in neuroscience intensive care unit (ICU) patients enrolled in a standard or a comprehensive oral care protocol. The effects of manual tooth brushing (standard group, n = 31) were compared with those of tongue scraping, electric tooth brushing, and moisturizing (comprehensive group, n = 25) in intubated patients in a neuroscience ICU in a 2-year randomized clinical trial. Oral health was evaluated based on the Oral Assessment Guide (OAG) on enrollment, the day of extubation, and 48 hours after extubation. There were no significant differences in the frequency of the oral care protocol. Protocol compliance exceeded 91% in both groups. The total OAG score and all eight categories significantly deteriorated in the standard oral care group and did not return to baseline after extubation. Large effect sizes were present at all three points in this group. The total OAG score deteriorated during intubation within the comprehensive protocol group (Friedman test, p < .004) but returned to baseline status after extubation. In four categories, the ratings on tongue, mucous membranes, gingiva, and teeth did not deteriorate significantly over time. Published oral care protocols are substandard in promoting and maintaining oral health in intubated patients. A comprehensive oral care protocol, using a tongue scraper, an electrical toothbrush, and pharmacological moisturizers, was more effective for oral hygiene throughout intubation and after extubation than manual tooth brushing alone.40

Lin Y.S, Chang J C, Chang T H et al (2011) performed a survey on “Critical care nurses’ knowledge, attitudes and practices of oral care for patients with oral endotracheal intubation” they state that effective oral care improves patient comfort and prevents oral infection. Although oral care is a common requirement of nursing practice, providing intubated patients with oral care is a challenging task. This study applied purposive sampling method at 12 adult intensive care units in one medical centre in northern Taiwan. Two hundred and five nurses were recruited. Data were collected by structured questionnaires which consisted of four sections: knowledge, attitudes and practices of oral care for intubated patients and demographic information for the nurses. The average percentages indicating the intensive care unit nurses’ oral care knowledge, attitudes and practices were 58.8, 79.4 and 49.8%, respectively. Higher scores on oral care knowledge were associated with nurses performing oral care more frequently. Nurses learning about oral care from reading related
studies and materials of their own accord may increase the frequency with which they provide oral care to intubated patients. The nurses’ age and the type of intensive care unit they work in were significant factors related to the frequency of performing practices related to oral care. Findings showed that nurses who have more resources for learning about oral care have greater knowledge about it and provide oral care to intubated patients more frequently. Encouraging nurses to learn more about oral care using diverse educational resources will enhance their knowledge and improve their practice. Nursing administrators are encouraged to establish policies and procedures for oral care of intubated patients based on the type of patients cared for, in addition to holding in-service training, with a view to enhancing the quality of oral care for critically ill patients.41

Coyer FM, O'Sullivan J, Cadman N and et al 2011 performed a study on “The provision of patient personal hygiene in the intensive care unit: a descriptive exploratory study of bed-bathing practice”. The aim of this study was to describe ICU RNs current practice with respect to the timing, frequency and duration of the patient bed-bath and the cleansing and emollient agents used. The study utilized a two-phase sequential explanatory mixed method design. Phase one used a questionnaire to survey RNs and phase two employed semi-structured focus group (FG) interviews with RNs. Data was collected over 28 days across four Australian metropolitan ICUs. Ethical approval was granted from the relevant hospital and university human research ethics committees. RNs were asked to complete a questionnaire following each episode of care (i.e. bed-bath) and then to attend one of three FG interviews: RNs with less than 2 years ICU experience; RNs with 2-5 years ICU experience; and RNs with greater than 5 years ICU experience. During the 28-day study period the four ICUs had 77.25 beds open. In phase one a total of 539 questionnaires were returned, representing 30.5% of episodes of patient bed-baths (based on 1767 bed occupancy and one bed-bath per patient per day). In 349 bed-bath episodes 54.7% patients were mechanically ventilated. The bed-bath was given between 02.00 and 06.00h in 161 episodes (30%), took 15-30min to complete (n=195, 36.2%) and was completed within the last 8h in 304 episodes (56.8%). Cleansing agents used were predominantly pH balanced soap or liquid soap and water (n=379, 71%) in comparison to chlorhexidine impregnated sponges/cloths (n=86, 16.1%) or other agents such as pre-packaged washcloths (n=65, 12.2%). In 347 episodes (64.4%) emollients were not applied after the bed-bath. In phase two 12 FGs were conducted (three FGs at each ICU) with a total of 42 RN participants. Thematic analysis of FG transcripts across the three levels of RN ICU experience highlighted a transition of patient
hygiene practice philosophy from shades of grey - falling in line for inexperienced clinicians to experienced clinicians concrete beliefs about patient bed-bath needs. This study identified variation in process and products used in patient hygiene practices in four ICUs. Further study to improve patient outcomes is required to determine the appropriate timing of patient hygiene activities and cleansing agents used to improve skin integrity.42

Dilie and Daniel Mengistu 2015 conducted a study on “Assessment of Nurses’ Knowledge, Attitude, and Perceived Barriers to Expressed Pressure Ulcer Prevention Practice” a cross-sectional study on 217 nurses. When queried, 61.2% of the respondents had adequate knowledge on pressure ulcer prevention practices, while 68.4% had favourable attitudes towards prevention practices. Moreover, 67.3% of participants had good pressure ulcer prevention practices. More than half of the nurses were found to have adequate knowledge about pressure ulcer prevention and their attitude towards it was overall favourable. Expressed pressure ulcer prevention practice was affected by the participant’s level of knowledge, attitude, and barriers of care. To provide effective prevention of pressure ulcer, nurses’ level of knowledge and attitude should be enhanced43

Margareth Yuri Miyazaki; Maria Helena Larcher Caliri; Claudia Benedita dos Santos (2010) conducted a study on Knowledge on Pressure Ulcer Prevention Among Nursing Professionals. This study aimed to describe and to analyse knowledge on pressure ulcer prevention among nursing team members working in direct care to adult and elderly patients at a university hospital. 386 professionals, of whom 64.8% were nursing auxiliaries/technicians and 35.2% baccalaureate nurses (BSN). The mean percentage of correct answers on the knowledge test was 79.4% (SD=8.3%) for nurses and 73.6% (SD=9.8%) for nursing auxiliaries/technicians. Both professional categories display knowledge deficits in some areas related to the theme. The identification of deficient areas can guide strategic planning with a view to the dissemination and adoption of prevention. 44

Ozdemir H, Karadag A. (2008) in the study “Prevention of pressure ulcers: a descriptive study in 3 intensive care units in Turkey”. The aim of this descriptive study was to describe the level of preventive care provided to intensive care unit (ICU) patients at risk for development of pressure ulcers study population comprised 126 nurses working at coronary ICU, cardiovascular surgery ICU, or a gastroenterology ICU The study sample consisted of 30 nurses selected from these units using a layered sampling method. Nurses
were observed while giving care to patients at risk according to Braden Scale scores and each action of the nurses to prevent PU was recorded. Data were collected until 90 observations (3 observations with each of 30 nurses) were completed. Nurses did not consistently engage in interventions recommended for prevention of PU. Subjects did not consistently use the risk-evaluation scale, document position changes on the appropriate form, and train auxiliary personnel about PU prevention. The most frequently fulfilled behaviors for PU prevention were avoiding hot water when cleansing the skin, helping the patient to eat, avoiding placing the patient directly on a trochanter, refraining from using improper support material, and use of pressure-redistribution surfaces. The least fulfilled behaviors were (1) application of a skin barrier or protectant on moist skin and (2) application of a moisturizer to dry or compromised skin, protecting the skin during patient transfer, repositioning, and documenting prevention interventions. This study demonstrates that critical care nurses do not consistently provide preventive care for PU.

Berry AM, Davidson PM. (2006) in a study on “Beyond comfort: oral hygiene as a critical nursing activity in the intensive care unit”. Mentions that the role of oral hygiene in maintaining the health and wellbeing of patients in the intensive care unit (ICU) is indisputable. This importance is not reflected in the body of research related to ICU practice. While a number of studies have examined oral hygiene practices in oncological patients there is significantly less attention devoted to these practices in the critically ill. This study had two aims. Firstly, in relation to current available evidence and based on a sound knowledge of oral physiology, identify barriers to effective oral hygiene and subsequent effectiveness of the most commonly used and recommended methods of providing oral hygiene in the critically ill population. Secondly, informed by the critical review, identify recommendations for practice and future intervention studies. It was found that there is no definitive evidence to determine the most appropriate method of oral hygiene including the use of beneficial mouth rinses. Barriers identified in this review to providing optimal hygiene include:

1. mechanical barriers and equipment issues,
2. perceptions of the importance of mouth care and empathy with patient discomfort by nurses,
3. altered patient sensory perception and discomfort and
4. difficulties in patient communication.
In spite of these challenges, opportunities for collaborative research and increasing expertise in nurse researchers creates a climate to derive solutions to these factors. It was clearly evident from this review of oral hygiene practices in intensive care that the need for ongoing research is of paramount importance. ICU nurses undeniably require rigorous research studies in order to inform their practice in the provision of oral hygiene for critically ill patients.46

Dekeyser G F, Fink N F, Raanan O and et al (2005) study on “ICU nurses’ oral-care practices and the current best evidence”. The purpose of this study was to describe the oral-care practices of ICU nurses, to compare those practices with current evidence-based practice, and to determine if the use of evidence-based practice was associated with personal demographic or professional characteristics. A convenience sample of 218 practicing ICU nurses. The most commonly used equipment was gauze pads (84%), followed by tongue depressors (55%), and toothbrushes (34%). Chlorhexidine was the most common solution used (75%). Less than half (44%) reported brushing their patients’ teeth. The majority performed an oral assessment before beginning oral care (71%); however, none could describe what assessment tool was used. Only 57% of nurses reported documenting their oral care. Nurses rated oral care of intubated patients with a priority of 67+/−27.1. Wide variations were noted within and between units in terms of which techniques, equipment, and solutions were used. No significant relationships were found between the use of an evidence-based protocol and demographic and professional characteristics or with the priority given to oral care. While nurses ranked oral care a high priority, many did not implement the latest evidence into their current practice. The level of research utilization was not related to personal or professional characteristics. Therefore, attempts should be made to encourage all ICU nurses to introduce and use evidence-based, oral-care protocols.47

Jones H, Newton J T and Bower E J (2004) did a study on “A survey of the oral care practices of intensive care nurses”, they mentioned that intensive care unit (ICU) patients have complex oral care needs. Inadequate oral care may predispose ICU patients to nosocomial infections. Objectives of her study was to describe the current priority given to oral care, the knowledge and practice of oral needs assessment and oral care methods, and adherence to the local ICU oral care protocol of ICU nurses working in one hospital. In this study Self-administered questionnaire survey of all nurses working in adult ICU was done (n = 160). Replies received were from 103 (response rate 64.5%). On average, oral care was
given a similar priority to other aspects of personal care. 13.5% nurses rated oral care as a low priority. Whilst 98% nurses routinely performed an oral needs assessment, only 26% used a written assessment tool. Toothbrushes were used at least once a day by 85.5% nurses and chlorhexidine products were routinely used by 50.5% nurses. The oral care practices of most nurses matched the local ICU protocol. 23.5% nurses had received no training in oral care and 58% nurses requested initial/further training. The conclusion drawn from the study was that most oral care methods were appropriate, based on the available evidence. Small minorities of nurses gave oral care a low priority and were not using evidence-based oral care methods recommended in the local ICU protocol. Encouraging the general use of oral needs assessment tools is a priority, and further oral care training is required.48

Mary Jo Grap, (2003) conducted a survey on “Oral Care Interventions in Critical Care: Frequency and Documentation” In this study nursing care providers were surveyed. Data was collected in the medical respiratory, surgical trauma, and neuroscience ICUs at a large southeastern academic medical center Staff members completed a written survey describing their oral care practices, and oral care interventions were recorded from the unit’s flow sheet for the previous 24 hours for all patients at 5 randomly selected times during 1 month. Most respondents (75%) reported providing oral care 2 or 3 times daily for nonintubated patients, and 72% reported providing care 5 times daily or more for intubated patients. Reported use of toothpaste and a toothbrush was significantly greater in nonintubated patients (P < .001), and use of a sponge toothette was significantly greater in intubated patients. Despite evidence that they are ineffective for plaque removal, sponge toothettes remain the primary tool for oral care, especially in intubated patients in intensive care units. Nurses report frequent oral care interventions, but few are documented. Education and focus on good oral care strategies are required. Nursing research to delineate the best procedure for all patients in intensive care units is needed. in intubated patients and to improve quality of oral care. Toothbrushes are more effective in plaque removal and gingival stimulation than are foam swabs and toothbrushes are generally regarded as the best tool for oral care in healthy populations.49

**Conclusion:** This section focus on the need for continuing education programs in-service training, and researches on oral care for improving the knowledge and attitude of intensive care nurses with respect to oral care and enhancing the quality of oral care for critically ill patients. The review also showed that that critical care nurses do not consistently provide
preventive care for Pressure Ulcers and the appropriate timing of patient hygiene activities and cleansing agents used are important in improving skin integrity.

2.5) STUDIES RELATED TO MONITORING AND WEANING PATIENT ON VENTILATOR:

Blackwood B, Alderdice F, Burns KE and et al (2010). In the study “Protocolized versus non-protocolized weaning for reducing the duration of mechanical ventilation in critically ill adult patients.” states that reducing weaning time is desirable in minimizing potential complications from mechanical ventilation. Standardized weaning protocols are purported to reduce time spent on mechanical ventilation. However, evidence supporting their use in clinical practice is inconsistent. Assessment of the effects of protoclated weaning from mechanical ventilation on the total duration of mechanical ventilation for critically ill adults was done; ascertain differences between protocolized and non-protocolized weaning in terms of mortality, adverse events, quality of life, weaning duration, intensive care unit (ICU) and hospital length of stay (LOS); and explore variation in outcomes by type of ICU, type of protocol and approach to delivering the protocol. There is some evidence of a reduction in the duration of mechanical ventilation, weaning duration and ICU LOS with use of standardized protocols, but there is significant heterogeneity among studies and an insufficient number of studies to investigate the source of this heterogeneity.50

According to Roh J H, Synn A, Lim C M, and et al (2009) in the study “A weaning protocol administered by critical care nurses for the weaning of patients from mechanical ventilation”. The primary objective of this clinical trial of patients on mechanical ventilation was to determine if a weaning protocol implemented solely by nurses could reduce the weaning time relative to usual care (UC). This study is a prospective, randomized, controlled trial conducted from January 2007 to January 2009 that compared protocol-based weaning (PBW) with UC. A total of 122 patients who received invasive ventilation in the medical ICU were examined. Nurses operated the mechanical ventilators according to a predesigned ventilator-weaning protocol for the PBW group (n = 61), and intensive care unit (ICU) physicians managed weaning in the UC group (n = 61). It was found that there were no significant differences in the 2 groups at baseline. The number of patients who successfully discontinued mechanical ventilation was similar in the 2 groups. The weaning protocol administered by the nurses was safe and reduced the weaning time from mechanical ventilation in patients who were recovering from respiratory failure.51
Tonnelier J M, Prat G, Le Gal G (2005) conducted a study on “Impact of a nurses' protocol-directed weaning procedure on outcomes in patients undergoing mechanical ventilation for longer than 48 hours”. A prospective cohort study with a matched historical control group. The aim of the study was to determine whether the use of a nurses protocol-directed weaning procedure was associated with reductions in the duration of mechanical ventilation and intensive care unit (ICU) length of stay in patients requiring more than 48 hours of mechanical ventilation. This prospective study was conducted in a university hospital ICU from January 2002 through to February 2003. A total of 104 patients who had been ventilated for more than 48 hours and were weaned from mechanical ventilation using a nurses' protocol-directed procedure (cases) were compared with a 1:1 matched historical control group who underwent conventional physician-directed weaning (between 1999 and 2001). Duration of ventilation and length of ICU stay, rate of unsuccessful extubation and rate of ventilator-associated pneumonia were compared between cases and controls. The duration of mechanical ventilation (16.6 +/- 13 days versus 22.5 +/- 21 days; P = 0.02) and ICU length of stay (21.6 +/- 14.3 days versus 27.6 +/- 21.7 days; P = 0.02) were lower among patients who underwent the nurses’ protocol-directed weaning than among control individuals. Ventilator-associated pneumonia, ventilator discontinuation failure rates and ICU mortality were similar between the two groups. Application of the nurses' protocol-directed weaning procedure described here is safe and promotes significant outcome benefits in patients who require more than 48 hours of mechanical ventilation.52

Ramachandran V, Grap M J, Sessler C N (2005) did a study on “Protocol-directed weaning: a process of continuous performance improvement” The use of a nursing-directed and/or respiratory therapist-directed protocol in many intensive care units for weaning from mechanical ventilation is associated with a shorter duration of ventilation and length of stay in the ICU. Most protocols have two formal components: the daily screening of a set of simple observations or interventions to identify readiness to proceed, followed by a spontaneous breathing trial that tests the patient's ability to breathe independently. The daily screen is designed to identify potential barriers regarding medical stability, level of consciousness, oxygenation, ventilation, and airway patency and protection. However, one must avoid selecting criteria that are too restrictive, potentially delaying the discontinuation of ventilation.53

protocols during weaning from mechanical ventilation is uncommon in the UK, despite research pointing to their potential benefits. This may be because the research evidence is considered not to apply in different settings. Intensive care unit consultant physicians are the major decision-makers in weaning in the UK and any attempt to introduce protocolized weaning will require consideration of their views. The study explored intensive care physicians' views on

(i) Weaning from mechanical ventilation,
(ii) The utility of weaning protocols and
(iii) Nurses' roles in the weaning process.

A specific goal was to identify potential aids and barriers to developing weaning protocols and their introduction into clinical practice. Qualitative interviews were conducted with a purposive sample of 10 consultant physicians in two intensive care units in Northern Ireland and subjected to content analysis. The primary themes identified were

(i) Information required for weaning decisions and clinical judgement,
(ii) Professional boundaries,
(iii) Protocol issues and
(iv) Timing of weaning.

Three types of information were deemed to be required for weaning decisions - empirical objective, empirical subjective and abstract - and interviewees considered that it would be challenging to incorporate all into a protocol. They were divided on whether protocols were useful when nursing experience was limited. Some groups of patients were thought more suitable than others for protocolized weaning.54

Dries D J, McGonigal M D, Malian M A and etal (2004) performed a study on Protocol-driven ventilator weaning reduces use of mechanical ventilation, rate of early reintubation, and ventilator-associated pneumonia. To reduce use, a literature-based protocol was introduced to facilitate weaning. The effect of protocol-driven ventilator weaning on ventilator use, ventilator-associated pneumonia (VAP), and intensive care unit (ICU) length of stay (LOS) is described in a survey of 2 years' activity in a multidisciplinary surgical ICU. VAP was identified by chest radiography, clinical presentation, Gram's stains, and cultures from tracheal aspirates or bronchoalveolar lavage. Infection control practitioners diagnosed VAP. Failed extubation was defined as reintubation within 72 hours. Overall, there was a 2:1 ratio of male patients to female patients. The total number of patients and days of mechanical
ventilation increased, but the use ratio (ventilator days/ICU days) fell from 0.47 to 0.33. Patients failing extubation fell from 43 (in 2000) to 25 (in 2002). From these patients, 17 cases of VAP occurred in 2000 and 5 in 2002. Mean age (40 years), Injury Severity Score (24), and ICU LOS (5.7-7.4 days; p = not significant) were unchanged in injured patients. ICU discharge was frequently delayed because of the need for subsequent respiratory care. Protocol-driven weaning reduces use of mechanical ventilation and VAP. Injured and general surgical patients show reduction in complications, but shorter ICU LOS depends on resources elsewhere in the health care system.\textsuperscript{55}

Walsh T S, Dodds S and McArdle F (2004) did a study on “Evaluation of simple criteria to predict successful weaning from mechanical ventilation in intensive care patients”. They said that increasing evidence of weaning protocols improve outcome from mechanical ventilation, but it is unclear how best to implement such protocols in large intensive care units. We evaluated a checklist of simple bedside criteria to determine whether it could be used reliably to predict successful discontinuation of mechanical ventilation. A prospective observational cohort study was carried out in a 12-bedded general intensive care unit (ICU). A metabolic, cardio respiratory and neurological criteria checklist was developed that suggested that patients should start the weaning process. We performed daily assessments throughout ICU stay and recorded whether the criteria were met. Ultimate ventilator independence was used as the reference standard. It was studied that 325 sequential admissions to the ICU. Data were available for 98% of patients; 97% of admissions were mechanically ventilated on admission to ICU. Overall, 205 of the 308 ventilated patients (67%) achieved ventilator independence during ICU admission; the other patients died or were transferred ventilated to other ICUs. Eighty-three per cent of the patients who achieved ventilator independence met the set criteria. Fulfilling the criteria was a moderately strong predictor of ultimate ventilator independence: specificity 89%, positive predictive value 94%, positive likelihood ratio (LR) 7.6. When we analyzed data by the day from admission on which patients were examined, the test was a strong predictor of subsequent ventilator independence when criteria were met by day 1 (LR 11.1) or day 2 (LR 6.9), but weaker when met by more than/equal to 4 days (LR <3). Patients who met criteria after more than/equal to 4 days often had prolonged weaning and a high incidence of re-intubation. Patients who achieved ventilator independence without fulfilling the criteria (n=35) had a short duration of mechanical ventilation (median 2 days, interquartile range 1-3 days). The most frequent reason for failing criteria before ventilator independence was a PaCO\textsubscript{2} FiO\textsubscript{2} ratio less than 24
kPa (49% of cases). This showed that a simple checklist can assist nurse assessment of suitability for weaning and could be used as a trigger to commence a weaning protocol. The day on which criteria are met is a useful way of stratifying patients for likely patterns of weaning.  

**Conclusion:** This section shows that the simple checklist can assist nurse assessment of suitability for weaning and could be used as a guideline to commence a weaning protocol. Reduction in the duration of mechanical ventilation, weaning duration and ICU length of stay with use of standardized protocols can be possible. Application of the nurses' protocol-directed weaning procedure can promotes significant outcome benefits in patients who require more than 48 hours of mechanical ventilation.

2.6) **STUDIES RELATED TO ASSISTING IN ATERIAL BLOOD GAS COLLECTION:**

Schneiderman J, Corbridge S, and Zerwic J J. (2009) conducted a research on demonstrating the effectiveness of an online, computer-based learning module for arterial blood gas analysis. The result showed that staff nurses' knowledge increased significantly after viewing the computer-based learning module \( t = 6.3; P < .001 \). This improvement was irrespective of experience or department. Computer-based, online learning has emerged as a means of providing continuing education to nurses. Such a teaching strategy helps to overcome barriers pertinent to traditional classroom settings.  

Dodds S (2007) reports that assessments for long-term oxygen therapy are now being undertaken by nurses. The key skill required is arterial blood gas sampling. This has traditionally been the role of the doctor, however by using an education and training package along with a competency-based assessment, nurses can now perform this extended role. Findings stated that competency-based education and training programme is useful for nurses to carry out ABG analysis procedure.  

Ganguly Sonali (2007) conducted a study about effectiveness of a need based teaching protocol on nurses responsibility in ABG analysis for the nursing personnel working in the critical care units. Findings of the study revealed that the teaching programme was effective and increasing the knowledge on ABG analysis as the computed “t” test was
significant at 0.05 level. The nursing personal were motivated to learn and continuing nursing education is the key to up to date the knowledge of the nursing personal which will help to provide comprehensive nursing care.\textsuperscript{39}

Youssef W, Yahia A, Ali N S and etall (2004) in a study on “Factors Affecting Validity of Arterial Blood Gases Results among Critically Ill Patients: Nursing Perspectives” mentions that their aim of study was to assess the different pre- analytical factors affecting ABGs results’ validity among critically ill patients. A descriptive exploratory research design was utilized in this study. A sample of convenience of 68 bed side nurses were recruited from three intensive care which are; Surgical ICU, medical ICU, and Neurological ICU, Findings of the study showed that all the studied subjects (100%) demonstrated unsatisfactory knowledge and practical level in relation to ABG sampling and controlling the different factors that might affect ABG results validity. Moreover, There were no significant statistical difference between knowledge scores regarding educational level Results of the current study indicated a real gap between nurses' knowledge and practices as compared to the evidence based guidelines of American Association for Respiratory Care in management of ABG sampling. The current study recommends an enrichment of critical care nurses’ knowledge and practices related to this essential procedure in addition to consideration of the different corrupting factors by hospital authorities to keep with the related evidence based guide lines that will be great benefits for patient, hospital, and all health professionals.\textsuperscript{60}

“Knowledge of the intensive care unit nursing professional about arterial gasometry” by Rolim L R a descriptive study with, quantitative, performed in a public hospital in with 45 nurses. Participants were predominantly aged 20-29 years and were female; time of academic graduation and in the ICU ranged from one to four years. Nurses demonstrated knowledge about the technical procedure of ABG and nursing actions after arterial puncture, however had little role in discussions of clinical procedures with the multidisciplinary team. They emphasized the need for nurses working in ICU empower continually seeking to update themselves, mainly dealing with critically ill patients.\textsuperscript{61}

A study on “Practice guideline for arterial blood gas measurement in the intensive care unit decreases numbers and increases appropriateness of tests.” By Pilon, C S. Leathley R R, Mary R N (1997), who stated the hypothesis that implementation of a practice guideline for blood gas measurement would decrease numbers and increase appropriateness of tests.
(according to criteria in the guideline) for up to 1 year after introduction of the guideline. The Numbers of tests and appropriateness of each test were measured retrospectively during each of five periods: two baseline periods 2 years and 1 year before introduction of the guideline and three follow-up periods 2 to 3 months, 6 to 7 months, and 12 to 13 months after introduction of the guideline. This was done in a ten-bedded multidisciplinary intensive care unit (ICU) within a 500-bedded tertiary teaching hospital. A random sample of 30 patients admitted to the ICU during each of the periods specified above. The nominal group process was used to develop a new guideline and a multipronged educational approach was used to facilitate implementation of the guideline. Main Results: At 2 to 3 months, test numbers decreased from 4.9 +/- 1.6 to 3.1 +/- 1.8 (SD) tests/patient/day and to 2.4 +/- 1.2 tests/patient/day at 12 to 13 months. Appropriateness increased from a mean of 44% at baseline to 78% at 2 to 3 months and 79% at 12 to 13 months. There were no differences in Acute Physiology and Chronic Health Evaluation scores or ICU mortality among the patient groups and no differences in number of ventilator days or time to wean from ventilation. Cost-minimization analysis showed that the incremental cost-saving 1 year after introduction of the guideline was $19.18 per patient per day. Conclusions: Implementation of this guideline for arterial blood gas measurement increases efficiency of test utilization without prolonging mechanical ventilation or affecting outcome.

Conclusion: The section enlightens us that Nurses demonstrated knowledge about the technical procedure of ABG and nursing actions after arterial puncture, has little role in discussions of clinical procedures with the multidisciplinary team The need of empowering nurses, seeking update themselves, mainly dealing with critically ill patients and ABG reports is necessary Implementation of guidelines for arterial blood gas measurement increases efficiency and avoids w prolonging mechanical ventilation or affecting outcome

2.7) STUDIES RELATED TO ENTERAL FEEDING:

Woien H and Bjork I T (2006) in a study on “Nutrition of the critically ill patient and effects of implementing a nutritional support algorithm in ICU”. It was performed to test whether a feeding algorithm could improve the nutritional support of intensive care patients as there were numerous factors that may impede delivery of both enteral and parenteral nutrition to patients in the intensive care unit. Often there is a discrepancy between what is prescribed and actual delivery of nutrients says the author .In this prospective study, nutritional data was collected from routinely fed critically ill patients (controls, n=21) during
the first three days following admission to the intensive care unit. A nutritional support algorithm was then implemented and nutritional data was collected from critically ill patients who participated in this intervention (intervention group, n=21). Data collected included the total amount of calories prescribed vs. received, onset of delivery of enteral nutrition, enteral vs. parenteral nutrition, and the use and size of enteral feeding tubes. It was found that the patients in the intervention group were both prescribed and actually received significantly larger amounts of nutrients than patients in the control group. They also received a larger proportion of their nutrients in the form of enteral nutrition. In addition, the nutritional support algorithm led to greater consistency in nursing practices with respect to aspiration of gastric content and rate of increment in enteral feeding. The study confirms that a nutritional support algorithm improved the delivery of nutrients to critically ill patients. The algorithm was most effective with respect to the delivery of enteral nutrition. The effect was primarily because of early and more rapid increment in the delivery of enteral nutrition administered by nurses based on improved physician orders. The combination of enteral and parenteral nutrition may contribute to meeting adequate nutritional requirements. From this study we can conclude that by using a nutritional algorithm focused on enteral nutrition, but including parenteral nutrition as a supplement, it is possible to improve the delivery of clinical nutrition in the intensive care unit patients.\textsuperscript{63}

Chen Y C, Chou S S, Lin L H and et all (2006) performed a study on “The effect of intermittent nasogastric feeding on preventing aspiration pneumonia in ventilated critically ill patients”. In this randomized, controlled study employed two feeding protocols for 107 participants in two intensive care units (ICUs) of a medical center to investigate the efficacy of intermittent nasogastric (NG) feeding in preventing aspiration pneumonia in critically ill patients on ventilators. The participants were randomly assigned to receive continuous (51 patients) or intermittent (56 patients) feeding. The primary outcomes, including gastric emptiness index and pulmonary aspiration index, were examined on Day 0 and Day 7 of the intervention. In addition, patients were followed up to the 21st day to evaluate the secondary outcomes, which included length of stay in the ICU and airway status. The results showed that the patients in the intermittent feeding group had a higher total intake volume at Day 7 (p = .000), had been extubated earlier at Day 21 (p = .002), and had a lower risk of aspiration pneumonia (odds ratios: 0.146, 95% CI = 0.062-0.413, p = .000) than the patients in the control group. Participants being treated with a high dose of dopamine were 2.95 times more likely to get aspiration pneumonia than those receiving a low dose of dopamine (95 % CI =
1.076-8.107, p = .035). However, there was no significant difference between the two groups length of stay. The results of this study provide evidence that clinical caregivers may be used to make better decisions in terms of feeding methods for critically ill patients.64

Williams T A, Leslie G D and etall. 2005 performed a study on “A review of the nursing care of enteral feeding tubes in critically ill adults.” Comprehensive review was undertaken of enteral tube management. Several nursing practices related to enteral tube management were described Enteral feeding should continue if gastric residual volumes are not considered excessive, as feeding is often withheld unnecessarily. Frequency of checking gastric residual volumes is largely opinion based and varies considerably, but prokinetics that aid gastric emptying should be used if absorption of feeds is problematic. Largely opinion based and varies considerably, but prokinetics that aid gastric, other recommendations was that continuous rather than intermittent feeding, semi-recumbent positioning to reduce the risk of airway aspiration and diligent artificial airway cuff management. Contamination of feeds can be minimized by minimal, meticulous handling and the use of closed rather than open systems.65

Conclusion: - From above studies it is evident that using a nutritional algorithm is useful to improve the delivery of clinical nutrition in the intensive care unit patients. Clinical caregivers should have knowledge to make better decisions in terms of feeding methods for critically ill patients.

2.8) STUDIES RELATED WITH ICU STAFFING:

Hugonnet S, Uçkay I, and Pittet D. (2007) conducted a study on “Staffing level: a determinant of late-onset ventilator-associated pneumonia”. The clinical and economic burden of ventilator-associated pneumonia (VAP) is uncontested. This study was conducted to determine whether low nurse-to-patient ratio increases the risk for VAP and whether this effect is similar for early-onset and late-onset VAP. The prospective, observational, single-centre cohort study was conducted in the medical intensive care unit (ICU) of the University of Geneva Hospitals. All patients who were at risk for ICU-acquired infection admitted from January 1999 to December 2002 were followed from admission to discharge. Collected variables included patient characteristics, admission diagnosis, Acute Physiology and Chronic Health Evaluation II score, co-morbidities, exposure to invasive devices, daily number of patients and nurses on duty, nurse training level and all-site ICU-acquired
infections. VAP was diagnosed using standard definitions. Results: Among 2,470 patients followed during their ICU stay, 262 VAP episodes were diagnosed in 209/936 patients (22.3%) who underwent mechanical ventilation. Median duration of mechanical ventilation was 3 days (interquartile range 2 to 6 days) among patients without VAP and 11 days (6 to 19 days) among patients with VAP. Late-onset VAP accounted for 61% of all episodes. The VAP rate was 37.6 episodes per 1,000 days at risk (95% confidence interval 33.2 to 42.4). The median daily nurse-to-patient ratio over the study period was 1.9 (interquartile range 1.8 to 2.2). By multivariate Cox regression analysis, we found that a high nurse-to-patient ratio was associated with a decreased risk for late-onset VAP hazard ratio 0.42, 95% confidence interval 0.18 to 0.99), but there was no association with early-onset VAP. This shows that Lower nurse-to-patient ratio is associated with increased risk for late-onset VAP.66

Cazorla C, Cravoisy A, Gibot S, and etall 2007, performed a study on “Patients' perception of their experience in the intensive care unit”. Study was conducted to analyze patients' assessment of quality of care in our intensive care unit. Questionnaires were sent to the homes of all patients admitted to intensive care from November 2002 to August 2003 who received mechanical ventilation for more than 24 hours. In all, 70 analyzable questionnaires were received Patients' average age was 56.3 years and the mean duration of stay 13.6 days. Pain was mentioned by 47% of patients and was associated, in decreasing order of frequency, with endotracheal suctioning, placement of a urinary catheter, venipuncture, movement into a different position by staff and arterial punctures. Pain intensity evaluated by an analogic visual scale classified these procedures in the following order: endotracheal suctioning, urinary catheterization, position changing by staff, arterial punctures, and venipunctures. 54% of the patients remembered mechanical ventilation. Overall, 17% reported feeling fear often or continuously. Aspects of the ICU environment that bothered them were, in order of decreasing frequency, communication difficulties, thirst, lack of sleep, staff discussions at the patient's bedside, noise and light. Finally, 34% no longer remembered the reason for their stay in the ICU and 19% reported they would have liked to be allowed more frequent visits from their relatives. It was found that nearly half of the respondents underwent painful procedures, primarily endotracheal suctioning. One third did not know why they had been in the ICU. Hence to improve the quality of intensive care, it is essential to make the nursing and medical teams aware of these findings.67

Williams CM. (2005) in study on “The identification of family members' contribution to patients' care in the intensive care unit: a naturalistic inquiry”. The admission of a patient
to an intensive care unit (ICU) is recognized as being a stressful experience for their families. Many studies have focused on the needs of families within ICU, but few have highlighted the unique contribution that family members make towards patient care and recovery. Using a naturalistic approach, data were collected through observation, video recording, in-depth interviewing and reflective video analysis to explore the processes and factors underpinning families' contribution to patient care. The findings can be grouped into three themes: getting to know the patient through the family, family contribution to care and the nurses' role in supporting families of ICU patients. Families can have a very positive influence on the patient's care and recovery from ICU, but both the family members, and in turn the nursing staff, need to be supported appropriately if this valuable contribution to patient care is to be maximized and maintained.

Pronovost P J, Dang D, Dorman T, and etall 2001 did a study on “Intensive care unit nurse staffing and the risk for complications after abdominal aortic surgery” they said that previously found that length of stay in the intensive care unit (ICU) after abdominal aortic surgery increased when fewer ICU nurses were available per patient. Hypothesis that having fewer nurses increases the risk for medical complications, a study was conducted to evaluate the association between nurse-to-patient ratio in the ICU and risk for medical and surgical complications after abdominal aortic surgery. Observational study in All nonfederal acute care hospitals in Maryland was done. Information about patients came from hospital discharge data on all patients in Maryland with a principal procedure code for abdominal aortic surgery from 1994 through 1996 (n = 2606). The organizational characteristics of ICUs were obtained by surveying ICU medical and nursing directors in 1996 at the 46 Maryland hospitals that performed abdominal aortic surgery. Thirty-nine of the ICU directors (85%) completed the survey. Surgery in hospitals with fewer ICU nurses (in which each nurse cared for three or four patients) compared with hospitals with more ICU nurses (in which each nurse cared for one or two patients). Proportion of patients who developed postoperative complications. It was found that seven hospitals with 478 patients had fewer ICU nurses, and 31 hospitals with 2128 patients had more ICU nurses. Patients in hospitals with fewer nurses faced more complication, than patients in patients in hospitals with more nurses: 47% vs. 34% had any complication, 43% vs. 28% had any medical complication, 24% vs. 9% had pulmonary insufficiency after a procedure, and 21% vs. 13% were reintubated (P < 0.001 for all comparisons). After adjustment for patient, hospital, and surgeon characteristics, having fewer versus more ICU nurses was associated with an increased risk for any complication.
(relative risk, 1.7 [95% CI, 1.3 to 2.4]), any medical complication (relative risk, 2.1 [CI, 1.5 to 2.9]), pulmonary insufficiency after procedure (relative risk, 4.5 [CI, 2.9 to 6.9]) and reintubation (relative risk, 1.6 [CI, 1.1 to 2.5]). From this we can conclude that having fewer ICU nurses per patient is associated with increased risk for respiratory-related complications after abdominal aortic surgery.  

Woods J C, Mion L C, Connor J T and et al (2001) conducted a study on “Severe agitation among ventilated medical intensive care unit patients: frequency, characteristics and outcomes”. The study was performed to determine the frequency, characteristics and outcomes of severe agitation among ventilated medical intensive care unit (MICU) patients. A Prospective cohort study in eighteen-bed MICU in 964-bed tertiary care center. All ventilated patients, aged 18 years or older and admitted for more than 24 hours between January 1, 2001 and May 8, 2001. Data was collected daily by concurrent chart abstractions. Variables included socio demographic, clinical, laboratory, pharmacologic and non-pharmacologic interventions, ventilator settings and adverse events. Severe agitation, the main outcome variable, was defined as two or more Motor Activity Assessment Scale (MAAS) scores above 4 in a 24-h period and sedative and/or narcotic doses above the established sedation and analgesia protocol or a combination of two or more sedatives. It was found that Twenty-three (16.1%) of 143 enrolled patients exhibited severe agitation. Agitated patients were younger (hazard ratio [HR] 1.32), more likely to be admitted from an outside hospital ICU (HR 2.48), had lower pH (HR 1.55) and PaO (2)/FIO (2) less than 200 mmHg (HR 2.59). Agitated patients had longer MICU stays (median 12 versus 5 days, p<0.0001) and more ventilator days (median 14 versus 6, p<0.0001). Agitated patients were more likely to self-extubate (26% versus 6%, p=0.002). Benzodiazepines, narcotics and neuromuscular blocking agents were administered more frequently and at higher doses, but haloperidol was not. This shows that severe agitation occurs commonly in critically ill patients and is associated with adverse events including longer ICU stays, duration of mechanical ventilation and self-extubation.  

Conclusion – This section highlighted that low nurse patient ration is associated with increases risk for late-onset VAP or respiratory–related complications.  

Summary:-  
Overall 55 studies are reviewed in this chapter. The studies reviewed were based on the different protocols that were developed to care a patient on ventilator. More emphasis was
put on the studies which would help in identifying the needs of the patient and the nurses and also the problems encountered during caring a patient on ventilator.

Three studies were found on the nursing protocols which highlighted on the performance of nurses and their compliance with the protocols. This helped the researcher to emphasis on need of protocols in the ICU.

Nine studies on communication with the patient in ICU by the nurses and also with the relatives these studies helped in development of tool, teaching module. It also helped in knowing the area of weakness during communication and identifying the needs of the patient and relatives. Problems encountered by the nurses and also the areas of improvement are studied.

Eleven Studies related to intubation, extubation, change of twill tape and suctioning, were reviewed. These studies have helped the researcher in knowing that adequate guidelines are needed by the nurses during suctioning, the effect of rotation of the ET tube, decisions related to suctioning, gap between the knowledge and practice in suctioning, knowledge regarding cuff pressure, years of experience and work performance these were the studies which supported the finding and helped in formulation of the protocols and teaching.

Eleven studies in relation to monitoring a patient on ventilator have shown that the protocols used for monitoring and weaning by the nurse have reduced the stay of patients in the ICU. Seven studies related to oral care and pressure ulcers have helped the researcher to introduce evidence based protocols.

Six studies related to Arterial blood gas collection, very few studies are found on the nurses regarding knowledge and practices by nurses in relation to arterial blood collection. Need of empowering nurses regarding knowledge on ABG is highlighted.

Three studies related to enteral feeding of the patient on ventilator helped to focus on use of nutritional algorithm, proper feeding techniques were focused.

Five studies on staffing pattern which highlighted that good postop care in the hospitals were nurse patient is adequate helped in early recovery of patient and prevention of complication.