CHAPTER II
REVIEW OF LITERATURE
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CHAPTER II
REVIEW OF LITERATURE

A review of related literature is an essential and important step for scientific research projects. It helps the investigator to develop a deeper insight into the problem and gain information on what has been done before in the field. Such reviews provide the basis for assessing the need for the study and formulate the design and tools to be used.

LITERATURE- The term literature refers to the knowledge of a particular area of investigation of any discipline, which includes theoretical, practical and its researcher studies. (Dellinger A. 2005)

REVIEW- The term “Review” means to organize the knowledge of the specific area of research to evolve on an edifice of knowledge to show that his study would be an addition to this field. (Dellinger A. 2005)

The task of review of literature is highly creative and tedious because the researcher has to synthesize the available knowledge of the field in a unique way to provide the rationale for his study (Dellinger & Leech2007).

A summary of writing from recognized authorities and of previous research provides evidence that the researcher is familiar with what is already known and what is still unknown and untested. Since effective research is based on past knowledge, this step helps to eliminate duplication and provides useful hypotheses and helpful suggestions for significant investigation. A review of related literature gives the scholar an understanding of previous work done. It develops the an insights he needs, to convert his literature or research problem into a specific and concise one. It helps the researcher to identify points that may have been overlooked. It gives him the opportunity to understand methods, measures, subjects and approaches employed by others. This, in turn, leads to significant improvement of the research design.

A literature review is written in an essay format. It is not an annotated bibliography because it groups related works together and discusses trends and developments instead of focusing on one item at a time. It is not a summary. It evaluates previous
and current research to gauge how relevant or useful it is and how it relates to one's own research (Dellinger A. 2005)

Woods N. Catanrrao (1986) states that “the literature review contains a summary of the earliest work on same or related topic. It contains critical analysis of earlier work that identifies what is known and not known about a topic. Though usually not exhaustive, it includes the most important work in the area.”

QUALITY - this study explores a phenomenon which goes a step ahead of medical and nursing practices and is known as Quality in Practices. This emphasizes a recognized and acceptable standard which goes beyond definitions of terms and assures an equivalent practice methodology. Quality in healthcare as an advanced evaluative strategy was recognized in 1960 (Stevens Traneer 1991). However, it was considered officially mandatory only by 1970 that too only in Michigan State Hospital when they marketed health strategies to broadcast better health standards.

QUALITY AND NURSING - In 1962, Qualitative Analysis emphasized that nurses played a vital role in all Quality lead parameters. Quality in Nursing goes hand in hand with medical and independent nursing practices. A standardized patient safety initiative assures the patient of safe nursing actions of acceptable quality. Nursing has been recognized as a mandatory part of Quality Healthcare since 1974 and a nurse led audit with a nursing auditor to evaluate strategies on a pre-existing guideline was established. (Davidson 1993).

This study focuses on the status carried from an international to a local setting and is now considered important in the field of patient safety. The researcher here wants to know in one clinical field of the hospital the implication of Quality in routine nursing practices.

QUALITY AND ICU (Intensive Care Unit) NURSING - Since the ICU is considered a critical clinical field, in its study it is significant to know if literature too supports this thought and at what level common Quality parameters have played a role in studies conducted over a period of time. Patient safety has been the primary focus of healthcare improvement over the last few years. An increasing body of evidence
emphasizes the magnitude of harm posed to patients by medical errors and unsafe practices, because of high technological dependence and aggressive level of care provided in it. In ICUs, patient safety has to be practiced by all individuals concerned. Consequently, the ICU also represents a tremendous opportunity to study and implement patient safety initiatives, as significant improvements can be realized in this environment. (Ray, B. et al 2009).

Here, there is an in-depth study of the nursing dimension The review of literature for this endeavor hence needs to focus on healthcare and nursing, since both are interdependent. While disease outcomes are relatively easy to appreciate and account for, intensive care outcomes are not so easy to do so because of the very nature of the unit and the way it is practiced, particularly in India, with a large number of open, few semi-closed and even fewer closed units. To develop the right kind of unit and provide best or at least optimum quality treatment to critically ill patients, appropriate key performance indicators have to be studied. Their knowledge and practice should lead to favourable outcomes, which may be used to know if the outcomes are favorable.

**Organisation of the Review of Literature.**

Keeping in mind the objective of the study the Researcher organized the review of literature as follows.

1. To study the selected Quality Control (QC) nursing parameters existing in critical care units. Here Study reviews consisted of contexts with Quality indicators -QI and parameters with independent/dependent nursing reference in the critical care units.

2. To study the implication of nursing quality assurances in the critical care unit, the following aspects were considered:
   a) Environment of the patient,
   b) Nurse patient Ratio maintained,
   c) Nursing practices performed, and
   a)d) Common errors notified.

Here studies affecting nursing in critical care units with a direct implication to nursing quality assurance through a nursing quality parameter were reviewed.
3. To study the co–relation between selected QC- quality control nursing parameters and the implication of nursing care outcomes in the critical care unit on them, studies which had direct or indirect relationships through QC, quality control parameters with implications on care outcomes were considered.

4. To study the relationship between the selected QC- quality control nursing parameters with selected variables such as qualifications and ICU experience. The Researcher here attempted to study the relationships between independent factors and the QC- quality control indicators for its positive/negative impact.

2.1 To Study the Selected QC Nursing Parameters Existing in the Critical Care Unit.

Norman, Redfern and Tomlin (1993) in their study ‘To Assess Quality of Nursing Care in Surgical Intensive Care Unit Through the Blood Stream Infection Rate Prevention Bundle in the Unit’ said that since the blood stream infection rate is the closest to knowing the infective status of the patients it is a good indicator in units which have maximum invasive interventions.

In this study, data was obtained from 67 hospitals, of which 52% were teaching facilities. The types of ICU included medical, surgical, cardiac medical, surgical, neurologic, surgical trauma ICU’s and one pediatric ICU. Thus, 103 ICUs reporting data for 1981 ICU-months and 375,757 catheter-days were included in the final analysis. According to the period of implementation of intervention to reduce the rate of catheter-related bloodstream infections, all units had to use the preventive care bundle. Various steps had to be followed to prevent infections. 13 of the 67 hospitals, 13 (19%) included chlorhexidine in the central-line kits used in the ICUs. Six weeks after the study of the 67 participating hospitals, 56 (84%) began to stock chlorhexidine, 46 (69%) stocked the agent in the ICU, and 43 (64%) stocked it in the central-line carts.

The total number of catheter-days changed little during the study. In ICUs that implemented the study intervention during the three months after baseline data were collected, the mean number of catheter-days per month was 4779. During the follow-up period, after implementation of intervention, the mean number of catheter-days per month ranged from 4757 at four to six months. After implementation of the intervention that figure rose to 5469 at 10 to 12 months.
The overall median rate of catheter-related bloodstream infection decreased from 2.7 (mean 7.7) infections per 1000 catheter-days at baseline to 0 (mean 2.3) at 0 to 3 months after implementation of the study intervention ($P \leq 0.002$). It was sustained at 0 (mean 1.4) during 18 months of follow-up.

Rates of catheter-related bloodstream infection from baseline (before implementation of the Study Intervention) to 18 Months of follow-up is as follows: A significant decrease was observed in both teaching and non-teaching hospitals, and in small hospitals (<200 beds) and large hospitals (≥200 beds).

The multilevel Poisson regression model showed a significant decrease in rates of catheter-related bloodstream infection during all study periods as compared with baseline rates, with incidence-rate ratios continuously decreasing from 0.62 (95% confidence interval [CI], 0.47 to 0.81) at 0 to 3 months to 0.34 (95% CI, 0.23 to 0.50) at 16 to 18 months after implementation of the study intervention.

There was a significant interaction between the intervention and bed size: the intervention was modestly more effective in small hospitals, with an incidence-rate ratio of 0.97 (95% CI, 0.96 to 0.99; $P < 0.001$) for each 100-bed decrease in the size of the hospital. The results of a sensitivity analysis of data from the ICUs reporting data continuously from baseline onward were similar to those of the primary analysis, with incidence-rate ratios decreasing from 0.62 (95% CI, 0.46 to 0.85) at 0 to 3 months to 0.15 (95% CI, 0.07 to 0.32) at 16 to 18 months of follow-up.

In summary, catheter-related bloodstream infections (BSI) are expensive, prevalent, and often fatal. A rise in BSI is related to fall in nursing care interventions. As part of the patient-safety initiative, what was implemented was a simple and inexpensive nursing intervention bundle to reduce these infections in 103 ICUs. Coincident with the intervention, the median rate of infection decreased from 2.7 per 1000 catheter-days at baseline to 0 within the first 3 months after implementation of the intervention. The benefit from the intervention was sustained, and there was a reduction in the rate of catheter-related bloodstream infection of 66% at 16 to 18 months after implementation. Broad use of this intervention could significantly reduce morbidity and the costs of care associated with catheter-related bloodstream infections. The study highlighted that the quality of nursing, if standardized and maintained, can decrease the BSI rate down by 66%. The study was able to compare the rates before and after implementation of quality care bundles. It concluded that good nursing can
prevent BSI’s - blood stream infections and better nursing quality in the ICU. (Norman, Redfern and Tomlin 1993).

Chrusch, C A. et al (2016). In their study ‘Quality Improvement in Critical Care: Selection and Development of Quality Indicators’ has extensively studied the importance of QI in ICUs. In that study, five healthcare organizations representing 14 hospitals across five provinces participated in the development of the scorecard for indicators. Twenty-two indicators were finalized through a survey and Statistical process Process Control (SPC) charts were used as the primary mode of data sharing and display. These indicators with the domains were –

a. Safe-
   - Unplanned extubation,
   - Readmission to the ICU,
   - Incidence of ventilator associated pneumonia,
   - Incidence of central-line related BSI,
   - Incidence of ICU-acquired Methicillin-Resistant Staphylococcus aureus (MRSA),
   - Prevalence of ICU-acquired MRSA.
   - Timely - Occupancy, ICU discharges that occur at night.

b. Efficient-
   - Avoidable days in ICU,
   - Patient flow,
   - Ventilated-patient flow,
   - Ventilator utilization ratio,
   - Inter-facility patient transfers.

c. Effective- ICU
   - Length of stay,
   - Extubation failure rate,
   - ICU mortality,
   - Hospital mortality,
   - Consent rate for solid organ donation.

d. Patient/family satisfaction.
e. Staff work life- Staff turnover, Overtime, Absenteeism.

Operational definitions of the QIs and practice methodology were defined and shared with all. Using factor analysis, Doll and Torkzadech identified and validated five components of end-user computing satisfaction: content, accuracy, format, ease of use, and timeliness. The researchers administered four questions, focusing on the components of content and format. Forty leaders (82%) completed the survey. Thirty-one of the respondents (78%) answered that the new reporting system was better than their previous one, the main reason being it was easier to access and see the data (74% of respondents). The commonest question raised by the new reporting system was how to interpret the data (45% of respondents). There were 20 responses to how the system could be improved: offer training in interpretation of the data (40%), ensure data quality and consistent definitions (25%), and add more measures (20%) and more benchmarking (15%).

Data submission, review, and revision continued with an ongoing literature review process. Participating ICUs were “closed” with all patients cared for by a consultant intensivist with 24-hour availability and daily multidisciplinary rounds. All critical care admissions were captured in local data sets that contained patient demographic information, admission diagnoses, a severity of illness measure, admission and discharge times, ventilation days, and mortality. Data on nosocomial infections was obtained from the local infection control service and data on nursing work hours from each institution's financial office. A collection of data on indicators such as extubation failure, patient satisfaction, and organ donation was obtained through processes that varied from one site to another.

As much as possible, the submission of component variables was favored over the submission of a rate. For example, rather than sites submitting the rate of unplanned extubations, they submitted the number of unplanned extubations and the sum of invasive mechanical ventilation. The rate was calculated centrally. This allowed more flexibility in deriving other indicators and in checking for internal consistency.

The findings in the 18 units showed

- Annual patient days with mean (sd) as 4368 (2395),
- For Monthly indicators-42 months,
- Readmissions (%) were at a mean (sd) of 3.3 (1.4) and,
• an Occupancy(%) showed a mean (sd) of 81 (7),
• Night time discharges (%) showed a mean (sd) of 7.0 (4.3).
• Similarly, Ventilator utilization showed a mean (sd) of 0.72 (0.16).
• Quarterly Indicators-one year 2009Q4-2010Q3 showed Unplanned extubation/1000 ventilator days as mean (sd) of 4.8 (3.5) c and Incidence VAP/1000 ventilator days of a mean (sd) 4.2 (2.0) c.
• The units that participated in this project care for sick patients as evidenced by a ventilator utilization ratio of 0.72 ± 0.16 and hospital mortality of 20.1 ± 8.2%.
• Patient flow ranged from 46.6 ± 1.2 patients/bed/year in trauma units to 98.7 ± 17.0 patients/bed/year in cardiovascular units.
• Occupancy as an indicator of unit had an average occupancy of 81 ± 7%.

The study concluded that The Quality Improvement in Critical Care Project team was able to agree upon 22 QIs spanning 6 quality of care domains. The researcher believes that the use of these quality indicators and statistical process control charts will be a powerful tool for benchmarking and using measurement to lead to improvement in patient safety and clinical processes. The methods that are described can be applied by other healthcare groups (Chrusch, C A. et al 2016)

Amidei Christina (2012) states in her paper Mobilization in Critical Care: ‘A concept analysis states that the aim of this paper is to analyze the concept of mobilization within the context of the critical care setting.’ Mobilization is a widely used term that belies the complexity of its use in practice. Whilst facilitating movement is a significant nursing concern, mobilization practices vary widely amongst nurses, perhaps due to conceptual incongruence. She uses evolutionary methodology in this concept analysis. Here Medline, Cumulative Index of Nursing and Allied Health Literature (CINAHL), Cochrane Database of Systematic Reviews and Psych Info databases were searched from 1966 to present. Search terms included mobilization, mobility, and passive exercise, yielding 61 articles suitable for analysis. Search terms included mobilization, mobility, immobility, exercise, exercise therapy, therapeutic exercise, therapeutic activity, positioning, mobility interventions, critical illness, intensive care and critical care. These terms were thought to cover the gamut of terms
used to describe ‘mobilization’ in critical care. Individual article reference lists were consulted to assure adequate depth of literature review and where possible, supplemented by review of related texts. Initially, 1083 references were located; those articles not written in English were excluded, as were any duplicate, non-retrievable or unrelated articles. The final sample for analysis comprised 61 articles. A historical perspective was found that set the contemporary context for the concept. Using evolutionary analysis, antecedents identified were the need for mobilization and a focus on improving outcomes.

Five attributes were identified that characterized mobilization:
(1) it comprises various therapies,
(2) it is goal-directed,
(3) it expends energy,
(4) it requires an interdisciplinary approach and
(5) it has both physical and psychological domains. Mobilization has both positive and negative consequences. A framework was developed to explain the relationship amongst these factors.

Two antecedents were identified: the need for mobilization and a focus on improving patient outcomes.

- The attributes found that characterized mobilization was — Mobilization may be implemented through a broad range of activities,
- Mobilization refers to activities that produce movement.
- Many different activities may be used for mobilization and actual application varies significantly.
- Activities to promote movement include positioning prone or side to side in bed, use of continuous lateral rotating therapy (CLRT) beds, passive and active range of motion, dangling, moving out of bed to a chair, movement in the bed to an upright position, ambulation, tilting on a table, use of active resistive exercise and use of electrical muscle stimulation. A combination tilt table with a continuous passive motion device for the lower extremities is also used.

The study summarized data to say that mobilization is a goal-directed therapy that facilitates movement, mobilization requires energy expenditure, mobilization is an interdisciplinary process and mobilization has physical and psychological domains. The study concluded that the concept analysis
revealed mobilization to be an interdisciplinary, goal-directed therapy to facilitate movement and improve patient outcomes. It expends energy and has both physical and psychological domains. This analysis suggests that mobilization is a complex concept that varies widely in application, components, and timing. The psychological domain of mobilization has not been well articulated and requires further development. Although mobilization is extensively used in nursing, further concept clarification would enhance use of mobilization practices in the clinical setting and guide research that identifies efficacy of mobilization interventions in the critical care setting (Amidei Christina2012).

De Vos, M. et al (2007) in their study ‘Quality Measurement at Intensive Care Units: Which Indicators Should We Use, in Nursing?’ Here the researchers studied to develop suitable indicators in ICU nursing. The study was conducted to develop a set of indicators that measure the quality of care in ICU nursing in Dutch hospitals and to evaluate the feasibility of the registration of these indicators.

To define potential indicators for measuring quality, three steps were made.

First, a literature search was carried out to obtain peer-reviewed articles from the years 2000 to 2005, describing process or structure indicators in intensive care, which are associated with patient outcome. Additional indicators were suggested by a panel of experts. Second, a selection of indicators was made by a panel of experts, using a questionnaire and ranking in a consensus procedure. Third, a study was done for six months in 18 ICUs to evaluate the feasibility of using the identified nursing quality indicators. Site visits, interviews, and written questionnaires were used to evaluate the use of the indicators.

Results of the study: was that Sixty-two indicators were initially found, either in literature or suggested by the members of the expert panel. From these, 12 indicators were selected by the expert panel by consensus. After the feasibility study, 11 indicators were eventually selected. “Inter-clinical transport”, meaning referring to a change of hospital, was dropped because of lack of reliability and support for further implementation by the hospitals participating in the study.

The following structure indicators were selected:

- availability of intensivist (hours per day),
- patient-to-nurse ratio,
strategy to prevent medication errors,
measurement of patient/family satisfaction.

Four process indicators were selected:

- length of ICU stay,
- duration of mechanical ventilation,
- proportion of days with all ICU beds occupied, and
- proportion of glucose measurement exceeding 8.0 mmol/L or lower than 2.2 mmol/L.

The selected outcome indicators were as follows:

- standardized mortality (APACHE II),
- incidence of decubitus,
- number of unplanned extubations.

The time for registration varied from less than 30 minutes to more than 1 hour per day to collect the items. Among other factors, this variation in workload was related to the availability of computerized systems to collect the data. The conclusion in this study was that - In this study, a set of 11 quality indicators for intensive care was defined based on literature research, expert opinion, and testing. The set gives a quick view of the quality of nursing care in individual ICUs (De Vos, M. et al 2007).

Salae (2000) in this study, ‘Is Quality Assurance in Intensive Care Nursing Research Based ? – an exploratory approach’, implemented quality control protocols in Intensive Care and studied its effectiveness using the research model and initiated evidence-based practice. This study used a descriptive survey approach; the sampling technique used was convenient sampling technique. The sample consisted of 100 staff nurses working in the Cardiac ICU. The Tool was a structured knowledge questionnaire (35 items). The effectiveness of detecting and process modification on medication errors formed 10 items, nurse-patient ratio in various clinical scenarios formed 10 items, space constraints and adequacy dealt with 5 items, and situational job satisfaction of nurses was studied through 10 items. The findings showed an 83% increase in job satisfaction related to adequate nurse-patient ratio, 98% of the satisfaction was related to adequate work space in patient unit, and 96% of the nurses related to good job satisfaction in absence of medication errors. An inter-relation of factors allowed for consideration of a multifactorial approach. This study opens avenues for more studies on this topic and allows exploration of multiple ideas to
conclude what would be advisable to better quality in this extremely important clinical field (Salae 2000).

Zampieri et al (2013). In their study to study ‘Factors Associated with Prolonged ICU Stay: a Retrospective Analysis’ stated that critically ill patients frequently stay in the ICU for prolonged periods. Prolonged ICU stay (PIS) is associated with increased costs, resource use and family burden. At admission, risk factors associated with prolonged ICU stay are only partially described. They initiated this study with the objective to evaluate factors associated with prolonged ICU stay in a mixed ICU. Method used was Retrospective Analysis of 3,257 patients admitted to a tertiary hospital in Sao Paulo, Brazil. Twenty-seven relevant variables that were clinically associated with prolonged (≥14 days) were included in a univariate analysis. Variables included demographic data, reason for admission, type of admission (clinical, elective surgery, emergency surgery), previous status performance, presence of comorbidities, illness severity (assessed by Simplified Acute Physiology -SAPS 3 score), laboratory data and need for organ support device (vasopressors, mechanical ventilation, dialysis) on the day of admission. A multivariate analysis was performed to identify variables independently associated with PIS. The results showed that in total, 203 (6.3%) of the 3,257 patients admitted in the analyzed period stayed in the ICU for at least 14 days. Hospital mortality was higher in patients with PIS (49.7% vs. 9.8%; P <0.01). On multivariate analysis, SAPS 3 (OR = 1.03, CI = 1.01 to 1.04), reduced status performance (dependency for one or more daily activities –OR = 1.71, CI = 1.18 to 2.46), bedridden status (OR = 1.91, CI = 1.08 to 3.38), emergency surgery (OR = 2.87, CI = 1.27 to 6.51), admission due to intracranial mass effect (OR = 4.46, CI = 1.16 to 17.04), admission from the ward (OR = 3.35, CI = 1.05 to 10.63) and hospital transfer (OR = 5.23, CI = 1.62 to 16.91) were independently associated with PIS. Age was not related to PIS. No comorbidity or organ support device was independently associated with PIS. The study concludes that in a large database of critically ill patients, global illness severity, baseline status performance and emergency surgery were related to PIS. No comorbidity or need for organ support device was associated with PIS. This is a significant finding as a low length of stay is a dominant ICU quality parameter and studying reasons for a prolonged stay is a basis of planning and implementation of causes leading to PIS (Zampieri et al 2013).
Rewa, O. et al (2015) have taken an enormous effort to initiate a review protocol using an analogue of Continuous Renal Replacement Therapy (CRRT) in the ICU, through its effort titled – ‘Quality Indicators in Continuous Renal Replacement Therapy (CRRT) Care in Critically Ill Patients: Protocol for a Systematic Review’. They say that renal replacement therapy is increasingly utilized in ICUs, of which CRRT is most common. Despite CRRT being a relatively resource-intensive and expensive technology, there remains wide practice variation in its application. This systematic review intends to appraise the evidence for QIs of CRRT care in critically ill patients.

The researcher plans to search Ovid MEDLINE, Ovid EMBASE, CINAHL, and the Cochrane Library including the Cochrane Database of Systematic Reviews, the Cochrane Central Register of Controlled Trials (CENTRAL), and databases from the National Information Center of Health Services Research and Health Care Technology. These sources will be searched for original studies involving QIs in CRRT. Gray literature sources will be searched for technical reports, practice guidelines, and conference proceedings. Websites of relevant organizations will be identified, and industry leaders in the development and marketing of CRRT technology and non-profit organizations that represent key opinion leads in the use of CRRT will be contacted. The study will also search the Agency of Healthcare Research and Quality National Quality Measures Clearinghouse for CRRT-related QIs. Studies will be included if they contain quality measures, occur in critically ill patients, and are associated with CRRT. The analysis will be primarily descriptive. Each QI will be evaluated for importance, scientific acceptability, usability, and feasibility using the four criteria proposed by the United States Strategic Framework Board for a National Quality Measurement and Reporting System. Finally, QIs will be appraised for their potential operational characteristics, for their potential to be integrated into electronic medical records, and on their affordability, if applicable. This systematic review will comprehensively identify and synthesize QIs in CRRT. The results of this study will fuel the development of an inventory of essential QIs to support the appropriate, safe, and efficient delivery of CRRT in critically ill patients. In the methodology and the study design, the researcher will perform a systematic review to identify and evaluate QIs for the prescription, delivery, monitoring and their association with patient-centered and health economic outcomes (if available) for
critically ill patients receiving CRRT using the guidelines from Cochrane and Center for Reviews and Dissemination and describe according to the PRISMA-P guideline. The analysis that is - Descriptive Analysis will be performed on all articles and QIs. Each QI will be categorized first according to the structure, process, and outcome framework and then on agreed domains of evaluation. The Donabedian framework for examining health services and evaluating the quality of care along with the relevant domains of evaluation will be used and modified as the models and frameworks are identified. Due to the anticipated heterogeneity of QIs and methods of ascertainment, a comprehensive inventory of QIs will be developed and summarized as counts and proportions. These summary counts and proportions will be further stratified based on relevant features such as study design, domains of health care quality, rank and of evidence evaluated using chi-square tests. When possible, articles and QIs will be pooled and further analysis will be performed; however, due to the heterogeneity and broad scope of material, it is expected that it will not be possible to pool all QIs for analysis. All analyses will be performed using STATA statistical software, version 13. The exclusion criteria will exclude studies that do not fulfill all of the above criteria. Search methods for identification will be developed in consultation with an information specialist at the Alberta Research Centre for Health Evidence (ARCHE), University of Alberta, and will be peer-reviewed by another librarian. The information specialist will search electronic databases: Ovid, MEDLINE, Ovid EMBASE, Cumulative Index to Nursing and Allied Health Literature (CINAHL) via EBSCO host, and the Cochrane Library including the Cochrane Database of Systematic Reviews and the Cochrane Central Register of Controlled Trials (CENTRAL). In addition, databases from the National Information Center for Health Services Research and Health Care Technology will be searched. A combination of the following search themes will be used:

(1) continuous renal replacement therapy, hemofiltration, hemo-diafiltration, dialysis, renal replacement therapy, and renal support and

(2) intensive care, critical care, critical illness, multi-organ dysfunction, and multi-organ failure.

Results will be limited to human studies, published in English, French, German, Italian, or Spanish since 1990. Bibliographic records will be exported to an EndNote X7 (Thomson Reuters, Philadelphia, Pennsylvania) database for screening. Additional sources will be included in the search strategy. The cited and citing
references of selected key studies will be searched for relevant articles. Gray literature sources will be searched for technical reports, practice guidelines, and conference proceedings. The researcher will identify and search the websites of relevant organizations (i.e., Canadian Society of Nephrology, European Societies of Nephrology [ERA-EDTA], American Society of Nephrology, American Society for Artificial Internal Organs, European Society for Artificial Organs). Industry leaders in the development and marketing of the CRRT technology (i.e., Baxter-Gambro Renal Inc., Nx Stage Inc., Fresenius Medical Care Inc., Bellco Inc., Medica Inc.) will be contacted. Non-Profit Organizations (NGOs) that represent key opinion leads in critical care nephrology and the use of CRRT (i.e., Acute Dialysis Quality Initiative) will also be contacted. The study will also search the Agency for Healthcare Research and Quality (AHRQ), and National Quality Measures Clearinghouse for CRRT-related quality measures. Finally, the survey will include an inter-disciplinary group of knowledge users, clinical experts, and decision-makers (i.e., physicians, nurses, engineers) experienced with the provision of CRRT in critically ill patients to elicit additional potential quality measures.

Data extraction and analysis has showed that eligible articles will be identified through two phases. In the first phase, two authors will independently review the titles and abstracts of all retrieved articles and documents using EndNote X7 for potential inclusion into the systematic review. Disagreements will be resolved through discussion. In the case of unresolved matters, a third party will be involved. In the second phase, full texts of the selected articles will be retrieved and information abstracted using standardized forms. The same two authors will conduct this independently. Abstracted data will be then compared amongst the two authors, and disagreements will also be resolved through discussion. In the case of unresolved matters, a third party will be involved. The authors of the retrieved studies and/or documents will be contacted for further information if necessary. Methodological quality will be rated using the Newcastle-Ottawa Quality Assessment Scale (NOS) for observational studies and a modified version of BOAS for before-after studies, as applicable. Qualitative studies will be evaluated using the consensus-based standards for the selection of health measurement instruments (COSMIN checklist) with four-point scale. QIs will be identified from included articles and documents and from the survey of experts and key stakeholders. Two independent authors will collect data on the properties of measurement and characteristics of each of the identified QIs. The
relevance of each QI will then be evaluated using the four criteria proposed by the United States Strategic Framework Board for a National Quality Measurement and Reporting System (importance, scientific acceptability, usability, and feasibility). Importance will be based on how each QI may inform about CRRT prescription, delivery, and monitoring and association with patient-centered and health economic outcomes. Scientific acceptability will assess how plausible each QI measures attributes of CRRT and Rewa outcomes. Usability and feasibility will characterize the logistics and process of implementation of each QI into clinical practice. These outcomes will be further evaluated in the second phase of this project when the evidence base for each QI will be evaluated and ranked by key knowledge users, stakeholders, and experts. Candidate QIs will be each evaluated for their operational characteristics such as association with circuit lifespan, resource intensity (i.e., nursing workload), and healthcare costs, as well as for their potential to be integrated into electronic medical records, if applicable. The Analysis as Descriptive Analyses will be performed on all articles and QIs. Each QI will be categorized first according to the structure, process, and outcome framework and then agreed upon domains of evaluation. The Donabedian framework for examining health services and evaluating the quality of care along with the identified relevant domains of evaluation will be used and modified as models and frameworks are identified. Due to the anticipated heterogeneity of QIs and methods of ascertainment, a comprehensive inventory of QIs will be developed and summarized as counts and proportions. These summary counts and proportions will be further stratified based on relevant features such as study design, domains of health care quality, rank, and domains of evidence and evaluated using chi-square tests. When possible, articles and QIs will be pooled and further analysis will be performed; however, due to the heterogeneity as well as broad scope of material, it is expected that it will not be possible to pool all QIs for analysis. All analyses will be performed using STATA statistical software, version 13.

The study can conclude that this systematic review will comprehensively identify and synthesize QIs in CRRT. The results of this study will fuel the development of an inventory of essential QIs to support the appropriate, safe, and efficient delivery of CRRT in critically ill patients. (Rewa, O. et al 2015)

Klompas Michael and Berra Lorenzo (2016), asked a very vital question in their study ‘Should Ventilator-Associated Events Become a Quality Indicator for ICUs?’ this is
very pertinent as When the respiratory system is ventilator dependent, associated events are considered vital to the study. due to its criticality and relation to respiratory system on a dependency level.

The United States Centers for Disease Control and Prevention replaced their longstanding ventilator-associated pneumonia (VAP) definitions with ventilator-associated event (VAE) definitions in 2013. Controversy abounds as to whether VAE definitions are potentially suitable to serve as QIs for ICUs.

The pro side, VAE definitions overcome many weaknesses of traditional VAP surveillance. VAE definitions are objective, reproducible, electronically computable, and strongly predict poor outcomes in patients. There is an increasing amount of data on clinical correlates, risk factors, and approaches to prevent VAEs. Potential strategies to prevent VAES are highly aligned with accepted best practices in critical care. VAE surveillance, therefore, has the potential to catalyze better care and help hospitals track outcomes in ventilated patients more rigorously and efficiently.

The on the con, side, the complete VAE definition set with sub-tiers is complicated. It is, neither sensitive nor specific for VAP, it is non-physiological compared to other ICU metrics, susceptible to gaming, and may bring about changes in clinician behavior that could paradoxically end up harming patients. The Genesis of VAE Definitions states that VAE definitions were developed by a working group of professional society representatives convened by the Centers for Disease Control and Prevention (CDC) in 2011 and 2012. Their intent was to overcome many of the limitations of traditional VAP definitions, specifically to make surveillance more objective, to broaden the focus of surveillance beyond pneumonia alone, and allow for the possibility of automating surveillance using electronic health data. VAE surveillance is designed to identify patients with respiratory deterioration after a period of stability or improvement. This is defined as at least two days of increased levels of ventilator support after at least two days of stable or decreasing ventilator support. Ventilator support is measured using patients’ daily minimum PEEP and daily minimum FIC; 2. A sustained increase in the daily minimum PEEP of > 3 cm H20 or a sustained increase in the daily minimum FID2 of > 20 points qualifies. The definitions use patients’ daily minimum ventilator settings in order to get best values each day and to avoid noise attributable to transient events such as suctioning the endotracheal tube, bronchoscopies, repositioning patients, transportation, and/or procedures. VAE definitions follow from the recognition that there is no perfect or
even good definition for pneumonia available using current routine diagnostic tools. All existing definitions have many subjective components, and none has been shown to be more accurate than another. All yield many false positives and false negatives relative to histological evaluation at autopsy. Rather than try to come up with a new VAP definition, the working group suggested shifting the focus of surveillance away from pneumonia to complications of mechanical ventilation. In doing so, the working group was simultaneously able to sidestep the inherent limitations of current VAP diagnostics, broaden the focus of surveillance (and hence prevention) to include additional morbid complications of mechanical ventilation, and simplify the surveillance definition, since the intent is only to identify episodes of nosocomial respiratory deterioration, not pneumonia. The VAE definition set includes sub-criteria for infection-related ventilator-associated complications (IVACs) and possible ventilator-associated pneumonia (PVAP).

IVAC criteria aim to identify the subset of VAEs that may be infection-related, as indicated by concurrent abnormal temperature or white blood cell counts, and the initiation of four days of new antibiotics. PVAP aims to identify the subset of IVACs that may be pneumonia by identifying patients with concurrent pulmonary specimens with moderate or heavy amounts of organism growth or with less growth but moderate or many neutrophils on Gram stain (an objective marker of purulence). Although the VAE definition set includes PVAP, there is no reason to believe that PVAP is anymore (or less) accurate than any prior pneumonia definition. The sole benefit of PVAP is to provide a familiar entity to clinicians within the framework of VAE surveillance. Indeed, CDC explicitly notes that whereas VAE and IVAC are potentially suitable for public reporting and benchmarking, PVAP is not suitable, given that

a. there is no reason to think it overcomes the limited accuracy of other VAP definitions, and
b. hospitals vary widely in their practices around the acquisition and processing of pulmonary specimens.

Hence PVAP rates are inherently unsuitable for comparisons between institutions. Considering data supporting the potential value of VAEs as a QI- There is no consensus on what constitutes a suitable QI, but arguably three key criteria are:

1) clinical importance,
2) capacity to support objective and efficient surveillance, and
3) preventability.

An ideal metric should identify a common clinical condition associated with high morbidity or mortality. The metric should be amenable to efficient surveillance in order to avoid burdening hospitals with excessive demands for data collection and analysis.

Surveillance efficiency includes the capacity to define the metric using objective clinical data that are readily available in existing electronic data systems and amenable to automated analysis. Most importantly, a good metric should help identify potential lapses in care that can inform tangible strategies to improve care. Better care should then lead to lower event rates and better outcomes for patients. Studies to date suggest that VAE definitions may fulfill many of these criteria. Clinically VAEs appear to be clinically important events. They affect 5-10% of patients and have consistently been associated with longer duration of mechanical ventilation, longer hospital stay, more antibiotic usage, and higher mortality rates. Multiple studies suggest that patients who develop VAEs are approximately twice as likely to die as compared to similar patients who do not develop VAEs. However, about the Potential Value of VAEs as a QI, observers have raised important concerns about their potential suitability. Of VAE as a quality indicator- Critics cite the following issues:

The positive predictive value of VAEs for pneumonia is low,

The sensitivity of VAE for pneumonia is low,

VAE surveillance is susceptible to gaming, and

VAEs are probably just markers of severe illness rather than complications per se, and most are not preventable.

The positive predictive value of VAE’s for pneumonia is low. A number of investigators have noted that the positive predictive value of VAEs for traditionally defined VAP is also low. Most authors have reported that about a quarter to a third of VAEs meet traditional surveillance definitions for VAP. Some investigators have even found that as few as 7% of VAEs meet VAP criteria. The fact that only a fraction of VAEs qualifies as pneumonia should not be a surprise given that VAE definitions were specifically designed to broaden the purview of surveillance beyond pneumonia alone. The low positive predictive value then is expected and is arguably a strength of VAE insofar as it indicates that VAE surveillance is bringing to light morbid complications of mechanical ventilation beyond just pneumonia, for eg., fluid overload and ARDS.
The Sensitivity of VAE Definitions for VAP is Low.
Many studies have pointed out that VAE surveillance misses many patients with traditionally defined VAPs: in most series, about 65-75%. These false-negative cases merit contemplation.

First, it is worth recalling that VAE criteria were born out of the recognition that traditional VAP criteria are too subjective and inaccurate to produce meaningful benchmarks. Clinical audits suggest that up to 75% of patients treated for VAP most likely do not have pneumonia. Autopsy series also find that 40-60% of subjects who meet clinical criteria for VAP do not have histological evidence of pneumonia. VAP is therefore a questionable standard against which to measure the accuracy of VAE definitions.

Second, a VAP that does not meet criteria for VAE either did not have a period of stability or improvement before pneumonia or did not require a sustained increase in ventilator settings equal to or greater than VAE thresholds (3 cm of PEEP or 20 points of FIOJ). In one case series in a trauma ICU, 39% of pneumonia missed by VAE were due to the lack of a period of stability or improvement. Many of these patients had pulmonary contusions and/or rib fractures, a population at high risk for pneumonia but also a population in which the diagnosis of pneumonia is particularly difficult, given the overlap in clinical signs between contusion, hemorrhage, ARDS and pneumonia. Almost all of the remaining pneumonias missed by VAE criteria were patients who did not require sustained increases in ventilator settings. One wonders about the clinical importance of pneumonia that requires little or no extra respiratory support. Some of these may have been mild pneumonias that improved very rapidly. Others may not have been pneumonia at all but perhaps alternative diagnoses or bacterial colonization alone.

Third, it is important to reiterate that VAE is a surveillance concept and not a clinical diagnosis. Surveillance is governed by a different set of values compared to clinical diagnosis. Clinical care, particularly in intensive care settings, places a very high value on sensitivity, given the potentially catastrophic consequences of missed or delayed diagnoses. Surveillance, by contrast, favors objectivity, reproducibility, and morbidity. Surveillance is meaningful only if it allows for comparisons over time and if it identifies severe events worth preventing. Focusing on
more severe events decreases subjectivity since severe events tend to be less ambiguous and more clearly meaningful. For example, workers trying to prevent surgical-site infections tend to focus on deep and organ-space infections rather than on superficial infections. Similarly, surveillance efforts to support better sepsis care tend to focus on patients with severe sepsis and septic shock rather than patients with systemic inflammatory response syndrome or sepsis alone. In the same vein, VAE criteria focus surveillance on the subset of particularly severe and unambiguous pneumonia that require sustained increases in ventilator support. At the end of the day, however, VAE analyses by their nature are designed to identify care-improvement opportunities that can be applied to all patients in the ICU. Hence changes in care learned from analyses of triggers for severe pneumonia should also help to prevent milder pneumonia, even if they would never have triggered VAE criteria.

Most VAEs are not Preventable:
Commentators have suggested that VAEs are merely surveillance markers for severe disease rather than complications. Boyer et al evaluated all VAEs detected in their institution over a 1-y period and tried to determine whether each event was preventable. They estimated that only 37% of VAEs were potentially preventable. Adjudicating preventability is notoriously difficult. Although the immediate event that precipitated the VAE may not have appeared to be preventable, it is impossible to know what could have happened if the patient had been managed differently from their first day of mechanical ventilation. Perhaps with less sedation and earlier mobilization, the patient may have been extubated long before the supposedly inevitable event. Preventability is better assessed through prospective intervention studies, and, as outlined above, at least three studies thus far have demonstrated successful decreases in VAE rates.

On the Con Position:
- It is said that the VAE algorithm is confusing. Since the initial development of a VAE algorithm in 2013, the National Health Safety Network has made several modifications to it, aimed at improving VAE surveillance. The new VAE algorithm has three definitional tiers:
  - ventilator-associated conditions (VAC),
  - IVAC, and
  - PVAP.
The first tier, VAC, takes into account only changes in patients’ ventilator settings. The two subsequent tiers, I VAC and PVAP, require that patients must first meet the initial VAC definition. However, there is a clear conceptual flaw with all three tiers insofar as they are all only apparent >48 h after respiratory deterioration first occurs. Thus, although the VAE algorithm is not intended for diagnostic use by clinicians, its after-the-fact nature is so divorced from clinical logic that it is clearly not useful to practicing ICU physicians within the normative time course of care.

VAE Surveillance Is Insensitive for Identifying VAP: An ideal ICU QI should have both high sensitivity and high specificity and thus must be compared with some accepted standard of measurement. For VAE, the accepted standard of comparison is arguably VAP. Many studies have noted, however, that VAE surveillance misses many cases of pneumonia. Likewise, most VAEs were caused by volume overload and infections but not necessarily VAP. The positive predictive value of a VAE for VAP was only 25% (95% CI 18-33%).

Klein Klouwenberg et al reported that even in cases positive for VAC or IVAC as well as clinically defined VAP, these events did not necessarily occur concurrently. Lilly et al, investigating 8,408 mechanically ventilated subjects, also demonstrated that VAE/VAC detected less than a third of VAP cases, with a sensitivity of 32.5% and a positive predictive value of 7%. A third study in trauma subjects requiring >48 h of ventilation similarly reported that IVAC criteria had low accuracy in identifying VAP in high-risk trauma subjects. The sensitivity and positive predictive values of IVAC for VAP identification were 28.1 and 58.6%, respectively. That means the algorithm failed to detect about three-quarters of subjects with VAP.

The VAE algorithm detects a broad spectrum of conditions and complications associated with changes in ventilator settings that correspond to the VAC criteria, the most common of which are VAP, ARDS, pulmonary edema, and atelectasis.22 In a retrospective study by Hayashi et al, the authors assessed the etiology of VAE, finding that among 143 subjects with VAE, 30.7% had microbiological evidence of VAP. Another 31% had no microbiological evidence of VAP. Other etiologies that could have explained VAE included:

- atelectasis in 16.3% of subjects,
- acute pulmonary edema in 11.8%,
- ARDS in 6.5%,
- pleural effusion in 3%,
• pulmonary embolism in 2%, and
• abdominal distention in 1.3%.

Lilly et al found that ARDS was associated with 73% of VAE cases and that acute kidney injury was associated with 27%. Given that most VAEs are not VAPs, the definition will cause confusion among physicians and will be difficult to implement for the purpose of significant clinical surveillance.

VAE Surveillance is not a Comprehensive Assessment of a Physiological System – This statement is applicable here. An ICU QI should be universally applicable and easy to use for clinicians, researchers, and administrators for characterizing patients’ severity of illness. The Acute Physiology and Chronic Health Evaluation (APACHE) along with the Risk, Injury, Failure, Loss, and End-stage (RIFLE) kidney classification are the most frequently used general severity-of-illness and renal failure severity scores in adult ICU patients. These score systems seek to take into account the entire range of relevant and available clinical data to predict patient outcomes. The applicability and universality of both the APACHE and RIFLE systems have been well tested and demonstrated by comprehensive multi-centre large sample studies. There is still debate regarding the rationale for using VAE in the ICU, and further multi-centre prospective validation studies are needed. VAE is not a scoring system for an organ or functional system in the body. As previously mentioned, the first qualifying tier of VAE is entirely based on changes in ventilator settings (specifically PEEP). These do not necessarily represent changes in patients’ pulmonary status. An increased APACHE or RIFLE score is associated with increased mortality, whereas a diagnosis of VAE might not always be associated with increased mortality because it can sometimes be indicative of what could actually be improved care, such as raising PEEP in the setting of atelectasis.

VAE Surveillance is Susceptible to Abuse and Misuse.

Since the first qualifying tier of the VAE algorithm, VAC, concerns changes in the ventilator settings of FIO and PEEP, the VAE algorithm is susceptible to manipulation. Lilly et al, 29, for example, reported that VAE/VAC rates can be reduced by 93% by easy manipulation of ventilator management protocols. Thus, the new VAE algorithm can easily be gamed to suggest improved ICU quality of care. If VAE surveillance is subsequently linked to public reporting, pay-for-performance, or data-driven incentive policies, physicians will be inclined to manipulate patients’ ventilator strategies to minimize the incidence of VAE.
Furthermore, a lack of changes in ventilator settings is not equivalent to stable patient health, and vice-versa. Changes in ventilator settings also have a close relationship to the therapeutic approach of the caregivers. Due to the diversity of detailed ventilator management strategies, different ICU teams may have different FiO2 and PEEP protocols for a patient on mechanical ventilation. The VAE algorithm is in truth a reflection of caregiver tendencies rather patient condition. This is one of the most important reasons why such a ventilator setting oriented algorithm cannot be used as a health-care quality indicator in the ICU.

VAEs can sometimes be triggered by improvements in care.

The VAE algorithm focuses on increases in ventilator settings during mechanical ventilation. However, when a patient is obese or suffering from fluid overload, clinicians generally make significant PEEP and FiO2 changes in order to improve care. The more aggressive the attempts are to liberate the patient from the ventilator, the more likely extubation fails, consequently leading to a higher likelihood of increased PEEP and FiO2 and thus a higher incidence of VAE. If VAE becomes a universally adopted form of ICU quality surveillance, clinicians might be less inclined to extubate mechanically ventilated patients. Paradoxically, this could lead to a situation in which VAP incidence increases due to prolonged ventilatory times and VAE incidence decreases because of fewer failed extubations.

Con Position Concluding Remarks-

The primary aim of the new VAE algorithm was to create a more objective, efficient, and reliable measure of complications associated with mechanical ventilation compared to the current clinician dependent assessment of VAP occurrence. VAE surveillance does not perform as well as VAP surveillance at detecting VAP and has several undesirable characteristics that could make its implementation as an ICU QI difficult. The VAE algorithm has a low sensitivity and positive predictive value for identifying VAP; there are difficulties in standardizing the implementation of VAE surveillance due to easily exploitable loopholes in its definition. The VAE algorithm needs significant modifications and improvement in order to replace VAP as a surveillance method and QI in the ICU. The preliminary data on the topic must be confirmed in additional large prospective studies.

Conclusions-
Ventilator-associated events are still very new concepts for clinicians, administrators, and policy makers. The pros and cons of VAE as a potential quality improvement metric are points of concern. There is a substantial body of work demonstrating the feasibility of electronic surveillance and the high attributable morbidity and mortality of VAEs. A smaller number of emerging studies are helping to identify risk factors for VAEs and demonstrate tangible strategies for prevention. Nonetheless, there is still much to be learned about the full extent to which VAEs are preventable and whether they can meaningfully influence hospital quality improvement programs. Concerns about VAE’s complexity, limited overlap with VAP, and potential to be gamed persist. More data on preventability and consensus on utility are needed if VAE is ever to serve as a QI for ICUs. (Klompas Michael and Berra Lorenzo 2016).

Gardine, Summerworth and Zanson (1998) studied quality through their study’ An Evaluation of Approaches to Study Significance of Benefits Evolved in Hospitals Through a Quality Perspective’. They studied 30 hospitals randomly selected in the state of North Carolina which had initiated various protocols to better quality healthcare in their hospitals. The selected hospitals had a minimum of 10 common protocols implemented in the field of nursing and non-nursing arenas. A mixed staff 3455 in number consisting of nursing and non nursing personnel were studied. It was found that 2935 experienced an organized implementation approach in 78% of the episodes. Amongst the 68 benefits listed, 99% of the benefits evolved were found to be significant. Median values, interquartile ranges, and group size were used to summarize the results for continuous variables. The differences among groups, and survival and non survival groups in the hospitals were examined by univariate analysis with a nonparametric test and a chi-square test. A p-value <0.05 was considered statistically significant. Predetermined variables (all as quality bundles), or those significantly associated with common hospital quality protocols in univariate analysis (p < 0.05), were tested for interaction with multiple logistic regression analysis. Odds ratios (OR) and 95% confidence intervals (CI) were also calculated. Statistical analysis of the data was done using SPSS 13.0 for Windows (SPSS, Inc., Chicago, IL, USA). The study also classified the patients involved and it was found that 42.1% of the total patients studied were female. The median age on the day of admission was 74 years with a median APACHE II score, TISS score, and coma scale of 23, 27, and 9, respectively on the day of admission. Median body weight was 58.0 kg, with a median
height of 1.6 m, and a median body mass index of 22.0 kg/m 2. There were also some differences between each group -hematologic, hepatic, metabolic, and respiratory failure. The completion of quality bundles was gradually higher after the education and operational phases (43.3% and 84.6%) and maintained a higher level (79.2%) even 1 year later during the intervention phase. The study concluded that the outcome of implementing a quality process is significantly beneficial (Gardine, Summerworth and Zanson 1998).

2.2 To study the implication of nursing quality assurances in the critical care unit in the following aspects:
   a) Environment of the patient,
   b) Nurse patient Ratio maintained,
   c) Nursing practices performed,
   a)d) Common errors notified.

De Vos et al (2010) in their study ‘Implementing Quality Indicators in Intensive Care Units: Exploring Barriers to and Facilitators of Behavior Change’, state that QIs are increasingly used in ICUs, but there are various barriers hindering their routine use. To promote the use of QIs, an exploration of the barriers to and facilitating factors for their implementation among healthcare professionals and managers of ICU is advocated. This study involved all intensivists, ICU nurses, and managers (n = 142) working in 54 Dutch ICUs who participated in training sessions to support future implementation of QIs. They completed a questionnaire on perceived barriers and facilitators. Three types of barriers related to knowledge, attitude, and behavior were assessed using a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). The questionnaire was divided into three sections.

   The first(I)section addressed the professional and demographic characters.

   The second (II) was related barriers that may affect implementation of QIs. They were classified as barriers related to knowledge, attitude, and behavior.

   The third (III) section had questions regarding perceived facilitating factors for healthcare and managers. For data analysis, descriptive statistics were used to characterize the study sample. The questionnaire contained both positively and negatively formulated statements. To calculate a mean score, the response was recorded on the negatively formulated statements. A score of more than three on the
five-point scale was indicated as positive, less than three as negative and a score of three was indicated as neutral. The result of the analysis for section I showed the majority of the 142 respondents were male (66%), 71% graduated after 1990, 50% were between 40 and 50 years of age, and 76% were affiliated to teaching or academic hospitals. Results for sections II and III showed with reference to determinants of knowledge, attitude, and behavior. Collinearity statistics did not show any variables with a VIF > 4 or a tolerance < 0.25. Therefore, all previously described independent variables were included in the multiple linear regressions. The multiple linear regressions showed that being a manager (β = 0.58; p = 0.00) and being between 40 and 49 years old (β = 0.35; p = 0.03) were related to a higher level of overall knowledge. Managers had a higher level of knowledge compared to healthcare professionals (MS = 4.1 versus MS 3.5; p = 0.004). Within the group of healthcare professionals, ICU nurses had a lower level of knowledge than intensivists (MS = 3.1 versus MS = 3.7; p = 0.01). In addition, working in a non-teaching hospital was associated negatively with overall knowledge (β = -0.32; p = 0.05). Healthcare professionals and managers working in non-teaching hospitals had a lower level of knowledge compared to those working in academic teaching hospitals (p = 0.01). None of the characteristics was statistically significant related to overall attitude. The multiple linear regression revealed that being older than 49 years (as compared to colleagues under 40 years of age) positively affected overall behavior (β = 0.36; p = 0.01), whereas working in a non-teaching hospital was negatively associated with high scores on the overall behavior scale (p = 0.01). Determinants of facilitating factors showed that the perceived facilitating factors differed among the various types of professions. Intensivists reported administrative support as the strongest facilitating factor (MS = 4.3; p = 0.02), ICU nurses reported education as being the most important (MS = 4.0; p = 0.01), and managers indicated receiving feedback (MS = 4.5; p = 0.001) and opportunities to improve care (MS = 4.5; p = 0.003) as the most important facilitating factors. Intensivists, nurses, and managers perceived social pressure from hospital management as the least facilitating factor (MS = 2.6; 2.8 and 2.8, respectively). Results demonstrate that healthcare professionals and managers are familiar with using QIs to improve care and that they have positive attitudes towards their implementation. Lack of knowledge was a significant barrier in nurses and implementing QIs in the ICU needed administrative support. Lack of support and education also reflected was another barrier. The study stated that using QIs in the ICU
demonstrates better care and a positive attitude and behavior change helps. (De Vos et al 2010).

Bhandarkar A., Shastri L.and Menon P. (2011) in their study ‘To Study The Feasibility Of Implementing Selected Quality Parameters In A Neurosurgical Intensive Care Unit’, depicted a descriptive correlational study design using the standardized tool evaluation check list by Dr. Lata Venkatraman as a Tool. This allowed implementation of 10 Nursing quality parameters which were -

- Nurse patient ratio in various clinical conditions,
- Nurse-patient ratio in different shifts,
- Prevention of bed-sores,
- Prevention of wrong surgery on the right patient,
- Prevention of the right surgery on the wrong patient,
- Prevention of medication errors,
- Prevention of patient falls,
- Facilitating patient ambulation,
- Facilitating nursing in adequate space, and
- Facilitating nursing in adequate light.

These parameters were chosen on the basis of recommendations of the Quality Committee- Hospital who, in turn, used guidelines from the Quality Council of India. The period of implementation was six months and the patient days varied between individual patients. The implementers were nurses with different educational qualifications and experiences. Consecutive Sampling Technique was used to select 15 patients from a neurosurgical ICU. The study showed that the implementation feasibility was highest in- prevention of bed sores, that is (98%) and it was attributed to the knowledge possessed factor (which was assessed as 99%). Whereas Nursing patient’s in adequate space Implementation feasibility was found to be lowest at 81%. This was attributed to space in the physical facilities of the patient that was in 19% of the patient units was apt. The highest difficulty of implementation was seen in maintaining the apt nurse-patient ratio. 98% of the nurses agreed to the implementation difficulty and the reason was attributed to a nurse turnover of 32% or more. In this study, which was performed in a neurosurgical ICU of 15 patient units, the result portrayed a successful 88% ability of
implementing these 10 nursing quality parameters (mean = 2.89, SD 0.62) 88% successfully in an ICU with nurses possessing varied nursing qualifications and experience. The findings were statistically significant (t = 2.65, p < 0.05). It was concluded that the study was able to portray numerous successful implementations of QIs in the neurosurgical ICU (Bhandarkar A., Shastri L. and Menon P.2011).

Ebenser et al (1998) were early researchers who conducted a “Study to Analyze Impact of Adequate Light on the Ability and Ease of Performing Nursing Procedures in Critical Care Units”. A concept analysis approach was used as the foundation for identification of evaluation of a concept. The study says that adequacy of light in the ICU needs to be ably defined, not extensive or deficient. It used a structured questionnaire and a light evaluation data table certified by the TASS (Tactical assessment and scheduling system). The sample consisted of nurses selected randomly from 10 ICUs in four multi-specialty hospitals. 94% of the nurses opined that adequacy of 3 lux in a windowed unit with natural light is apt when studied in 150 patient units which had windows as a source of natural light. Inputs of 852 nurses were considered here when they were all subject to a range of 2-5 lux. Light adequacy was demonstrated to the nurses using various denominations of light from 2 to 5 lux. 83% opined that 2 lux was inadequate to perform direct observation of skin-color. 80% felt that 4 lux was too bright and could distract the nurse from her task due to uneasiness. All agreed that education to use apt light sources would be helpful. The study emphasizes the impact of essential indicators considered important and makes a significant difference to the outcomes expected in routine and non-anticipatory nursing care (Ebenser et al 1998).

West Elizabeth et al (2014), in their study ‘Nurse Staffing, Medical Staffing and Mortality in Intensive Care: An Observational Study’, aimed to investigate whether the size of the workforce (nurses, doctors and support staff) has an impact on the survival chances of critically ill patients both in the ICU and in the hospital. The method used was observational. Statistical controls were used to assess the relationship between the key independent variables of interest and the dependent variable. The study seeks to understand the relationship between the size of the clinical workforce (nurses and doctors), as well as the number of support staff (administrative, clerical, technical and scientific), and patients’ chances of survival. Although they hypothesized that there
would be a relationship between the variables, they expected that the individual patient's condition—age, number of diagnoses, severity of the illness and co-morbidities—would contribute more than any other factor to the outcome. This meant they needed to take their risk of dying due to their own condition into account, as well as any other variables that contributed to the outcome, in order to get unbiased estimates of the key variables of interest. Data for the six months before and after March 1998, collected prospectively, was merged into organizational data on 65 ICUs surveyed by the Audit Commission (AC). The matched dataset contained information only on ICUs in England. They used two dichotomous dependent variables: whether or not the patients survived their stay in ICU and whether or not the patients survived their stay in the hospital.

The human variables were –

1. The number of nurses per bed: This variable counted the number of full-time equivalent nurses on the permanent staff of the ICU on one specific date.

2. The number of consultant Notional Half Days (NHDs) per bed: Units reported to the Audit Commission the total number of weekly fixed NHDs for critical care clinical sessions.

3. Intensivist: The AC survey asked whether one or more consultants worked all the time in the ICU.

4. Support Staff: This variable was the summation of several different categories of staff including administrative and clerical staff.

5. Workload variables: The researchers used several variables to measure the pressure of work experienced by the staff of the ICU. The first three were drawn from the ICNARC dataset, whereas the second two were derived from the AC dataset. They were:

   a. Proportion of beds in the ICU that was occupied at the time of each patient's admission.

   b. Mean ICNARC model predicted log odds of acute hospital mortality of other patients in the unit at the time of admission (a measure of how seriously ill the other patients were).

   c. The average length of stay of patients in the ICU, measured in hours.
d. Admissions to the unit, per bed per day.

a.e. The number of transfers in from another Trust to the unit, per bed, per week.

Statistical method used was multilevel logistic regression to perform all the analyses. All analyses were carried out using the lmer function that is part of the lme4 package in R version 3.0. Multilevel regression is used for these analyses because it is inappropriate to consider patients treated in the same ICU as independent observation. Data showed descriptive statistics from AC data from 69 ICUs. They were able to merge data from the two sources (AC and ICNARC) on 65 ICUs. Of the 38,168 patients in this study, 6413 (16.8%) died in the ICU where they were being treated. A further 4397 (11.5%) died in hospital after leaving the initial ICU, with 579 (1.5%) patients being lost to follow-up. The observed crude mortality rates in the units varied between 8.1% and 33.9%, while the hospital mortality rates were between 16.9 and 47.9%. This variation could not be entirely explained by variation in patient risk factors. The correlation between the ICU and hospital mortality rates was 0.90. The distribution of nurses per bed (whole time equivalents) across different units was as regulated. Only a small minority of units in the UK had seven or more nurses per bed on their permanent payroll, the number generally accepted as being required to maintain a one patient per nurse ratio over three shifts, with allowance for sickness and holiday leave. Considering first the impact on ICU mortality, it can be seen that the risk of mortality is significantly increased by the severity of the patient's own condition (ICNARC model predicted log odds of acute hospital mortality) and by our measures of workload (hypothesis). The risk of mortality increases when a higher proportion of beds in the unit are occupied and when there are a large number of transfers into the unit. The number of nurses and the number of consultants both significantly reduce the risk of mortality (hypotheses). The hypothesis that the number of support staff would affect patient mortality is not supported. Further, the effect of staffing might depend on the severity of a patient's illness. Results of the study show that after controlling for patient characteristics and workload it was found that higher numbers of nurses per bed (odds ratio: 0.90, 95% confidence interval: [0.83, 0.97]) and higher numbers of consultants (0.85, [0.76, 0.95]) were associated with higher survival rates. The number of nurses had the greatest impact on patients at high risk of death (0.98, [0.96, 0.99]) whereas the effect of medical staffing was unchanged across the range of patient acuity (1.00, [0.97, 1.03]). No relationship between patient outcomes and the number of
support staff (administrative, clerical, technical and scientific staff) was found. Distinguishing between direct care and supernumerary nurses and restricting the analysis to patients who had been in the unit for more than eight hours made little difference to the results. A separate analysis of in-unit and in-hospital survival showed that the clinical workforce in intensive care had a greater impact on ICU mortality than on hospital mortality which gives the study additional credibility. In conclusion, this study supports claims that the availability of medical and nursing staff is associated with the survival of critically ill patients and suggests that future studies should focus on the resources of the healthcare team. The results emphasize the urgent need for a prospective study of staffing levels and the organization of care in ICUs. (West Elizabeth et al 2014).

Stanton Mark (2004), in their study, ‘Hospital Nurse Staffing and Quality of Care’, studied nursing staffing levels defined as per the nursepatient ratio and compared the ratio to various outcomes:

   a) Hospital Nurse Staffing and Nursing-Sensitive Outcomes – With adequate staffing, a drop in urinary tract infections (UTIs) by 35%, pneumonia by 6%, shock by 3%, upper gastrointestinal bleeding by 4%, longer hospital stays decreased by 26%, and 30-day mortality decreased by 3%.

   b) Lower Staffing Levels Are Linked to Higher Adverse Outcome Rates – with lower staffing an increase in urinary tract infections (UTIs) by 5%, pneumonia by 1%, shock by 1%, upper gastrointestinal bleeding by 2%, longer hospital stays increased by 16%, and 30-day mortality increased by 1%.

   c) Nurse Workload and Job Dissatisfaction –The study interviewed 13,471 nurses and the findings were: From the units that were short staffed – 40% were dissatisfied with their jobs. 44.8% said that there had been deterioration in the quality of care in their hospital during the past year. 83% reported that there had been an increase in the number of patients assigned to them during the previous year. Only 34.4% believed that there are enough RNs to provide high-quality care. 85.7% surveyed from units with adequate staff described the quality of care on their unit as excellent.

The study concluded that adequate nurse staffing is necessary for better patient care quality and can possibly prevent multiple eventualities like infections, morbidity, and mortality. Quality also depends on the adequacy of staffing as a patient safety initiative.
and calls it safe staffing. This allows one to conclude that inadequate staffing is equivalent to unsafe staffing which can affect the patient outcomes directly (Stanton Mark, 2004).

Stevens and Traneer (1991) in their study, ‘To Study Implementing Quality Assurance Program at the Unit Level in Intensive Care to Know the Essential Elements for Successful Implementation’, state that the findings show that the essential element of better nursing quality was the nurse-patient ratio. They studied the effectiveness of the nurse-patient ratio on the errors notified during blood administration. They used an evaluatory approach. The sample consisted of 30 nurses selected randomly. There were two groups. Group I had a nurse-patient ratio of 1 – 1.5 nurses/ patient. This group was converted to group Ia, Group Ia had one nurse / 3 – 4 patients. Comparison was done using the unpaired “t” test, calculated ‘t’ value (2.037) with more than the table value (t= 2.00) at 0.05 level of significance. Among 30 cases studied in group I, 6.7% of cases were detected to have had (mild) errors as compared to 23% of cases in group Ia who depicted (moderate) errors. A sharp decrease (70%) in blood administration errors was noted with a high nurse-patient ratio of 1.5 – 2 nurses/ patient in the ICU’s,(Stevens and Traneer, 1991).

Pickering B W,Hurley K and Marsh B,(2009) in their study, ‘Identification of Patient Information Corruption in the Intensive Care Unit: Using a Scoring Tool to Direct Quality Improvements in Handover’, attempted to use a handover assessment tool for identifying patient information corruption and objectively evaluating interventions designed to reduce handover errors and improve medical decision making. The continuous monitoring, intervention and evaluation of the patient in modern ICU practice generates large quantities of information, the platform on which medical decisions are made. Information corruption, defined as errors of distortion/omission compared with the medical record, may result in medical judgment errors. Identifying these errors may lead to quality improvements in ICU care delivery and safety. A handover assessment instrument development study was divided into two phases by the introduction of a handover intervention. The setting of the study was a closed, 17-bed, university-affiliated mixed surgical/medical ICU. The subjects were senior and junior medical members of the ICU team. An electronic handover page was used. The findings showed that when the subjects were asked to recall clinical information
commonly discussed at handover on individual patients - the handover score measured the percentage of information correctly retained for each individual doctor-patient interaction. The clinical intention score, a subjective measure of medical judgment, was graded (1–5) by three blinded ICU experts. A total of 137 interactions were scored. Median (interquartile range) handover scores for phases 1 and 2 were 79.07% (67.44–84.50) and 83.72% (76.16–88.37), respectively. Score variance was reduced by the handover intervention (p < .05). Increasing median handover scores, 68.60 to 83.72, were associated with increases in clinical intention scores from 1 to 5 (chi-square = 23.59, df = 4, p < .0001). When asked to recall clinical information discussed at handover, medical members of the ICU team provided data that was significantly corrupted compared with the medical record. Low subjective clinical judgment scores are associated with low handover scores. The handover/clinical intention scores may, therefore, be useful screening tools for ICU system vulnerability to medical error. Additionally, handover instruments can identify interventions that reduce system vulnerability to error and may be used to guide quality improvements in handover practice. The tool can be very valuable to prevent relevant medical errors (Pickering, B.W. Hurley, K. and Marsh, B., 2009).

Chiarello, Farias and Mondaini (2007) in their study, ‘Evaluation of the Nurse Care Given to Critically Ill Patients Through Quality Indicators’ conducted a retrospective analysis of six QI(phlebitis, falls out of bed, accidental extubation, drug-related complications, pressure ulcer and accidental nasoenteral catheter displacement) from a 10-bed medical ICU in a private hospital. The information was collected daily by nurses from the data found in the patient's medical register. A monthly critical and statistic evaluation of this data was accomplished in order to develop an action plan. The result showed that according to the goal established by the institution, some indicators such as phlebitis and fall out of the bed were found within the expected rates. The accidental extubation and development of pressure ulcers were very close to the expected numbers. The daily evaluation and systematic intervention to prevent and treat pressure ulcers is a nurse's task. There is a proven relationship between assistance quality and pressure ulcer care. The drug-related complications and nasoenteral catheter displacement were above the established limits, requiring specific actions from the ICU team to reduce these problems. It was concluded that the rates presented through the analyses of the QIs show specific failures in nurse care. The action plan to
correct these failures consists of continued education with close monitoring of the QIs to assure better results regarding increased patient safety. (Chiarello, Farias, and Mondaini (2007).

Mathews and Thompson (2000) in their study, ‘A Study to Know the Incidence of Practice in the Quality Parameters Initiated in a Neurosurgical ICU’, exploratively studied the practices and used a structured questionnaire through which a purposive sample of patients was studied. The findings reported that the incidence amongst nurses practicing implementation of sound and light protocols was low (33%) in comparison to reporting of pressure ulcers which was high (83%). Patients were divided into two groups: those undergoing surgery after the establishment of the multidisciplinary QI program (n = 922) and those undergoing surgery before the institution of the program (n = 1289). Logistic regression and propensity score analysis were used to adjust for imbalances in patients' preoperative characteristics. The study showed that Operative Mortality was lower in the quality improvement group (2.6% vs 5.0%, P < .01). Unadjusted odds ratio was 0.5 (95% confidence interval 0.3–0.8, P < .01); propensity score–adjusted odds ratio was 0.6 (95% confidence interval 0.4–0.99, P = .04). In multivariable analysis, patients with 1:1 N/P ratio (P < .01), chronic patient ambulation practices (P = .05), previous neurovascular operation and bedsore occurrence (P = .04), nursing with adequacy of space (P < .01), confidence of nurses, inadequacy of light in unit (P < .01), age older than 75 years and delay in ambulation (P < .01), medication error detection (P < .01), and prolonged ICU stay (P = .05) emerged as independent predictors of better quality predictions after neuro surgery. Implement quality improvement program (P < .01) and (P = .03) were associated with lower quality predictions. The study concluded that nursing protocols are easily implemented using a systematic approach. (Mathews and Thompson, 2000).

2.3 To Study The Co–Relation Between The Selected Quality Control Nursing Parameters And The Implication Of Nursing Care Outcomes In The Critical Care Unit On Them.

Özdemir et al (2008). This descriptive study aimed to describe the level of preventive care provided to ICU patients at risk for development of pressure ulcers (PU). The study population comprised 126 nurses working in coronary, cardiovascular surgery,
or gastroenterology ICUs of the State Hospital in the Republic of Turkey. The study sample consisted of 30 nurses selected from these units using a layered sampling method. Data was collected using the following four forms:

(1) ICU evaluation,
(2) demographic questionnaire,
(3) Braden Scale, and
(4) observation. The observation form was developed by the investigator to record PU prevention interventions made by the study nurses.

Nurses were observed while giving care to patients at risk according to Braden Scale scores and each action to prevent PU was recorded. Data was collected until 90 observations (three with each of 30 nurses) were completed.

Results showed nurses did not consistently engage in interventions recommended for prevention of PU. Only 36% of the nurses practiced prevention of PU. Subjects did not consistently use the risk-evaluation scale: 21% used the risk evaluation scale, only 13% documented position changes on the appropriate form and 28% trained auxiliary personnel about PU prevention.

The most frequently fulfilled behaviours for PU prevention were avoiding hot water when cleansing the skin (89%), helping the patient eat (91%), avoiding placing the patient directly on a trochanter (92%), refraining from using improper support material (83%) and use of pressure-redistribution surfaces (99%).

The least fulfilled behaviors were:
(1) application of a skin barrier or protectant on moist skin (9%),
(2) application of a moisturizer to dry or compromised skin (11%),
(3) protecting the skin during patient transfer (9%),
(4) repositioning (21%), and
(5) documenting prevention interventions (4%).

The study demonstrates that critical care nurses do not consistently provide preventive care for PU. (Özdemir et al 2008).

Savitz L., Jones C., and Bernard S.(2005), in their study ‘Quality Indicators Sensitive to Nurse Staffing in Acute Care Settings’ stated that their paper aims to compare and contrast available quality indicator tools associated with nurse staffing outcomes. Here the authors conducted a meta-synthesis of published reports that described indicators or measures that could be used to assess the outcomes of nurse staffing. This approach
allowed them to inductively ascertain the current state of measures available to assess the outcomes of nurse staffing.

The analysis included a published report to provide measures associated with the structure, process, and outcomes of nursing care in inpatient, hospital settings with sufficient detail on indicator purpose and construction.

A three-stage search process to identify reports included:

1. a systematic search of MEDLINE via the PubMed database,
2. a targeted search of select Web sites, and
3. subsequent review of relevant articles referenced in abstracted items from the initial two sources and professional contacts among the author group.

The targeted Web-site search focused on the AHRQ, JCAHO, NQF, and the ANA indicators based on our knowledge of recent work in this area. The results of this study provide an important comparative assessment of the types, content, and intended purpose of available nursing indicators. A little overlap and direction in the types of indicators available to examine the influence of nurse staffing on the outcomes of care were found. The need for consistent indicator definitions and process measures is addressed. It may be concluded that the central role nurses play in patient safety suggests a need for consensus on a set of measures that will enable the nurses to examine the impact of staffing changes on the quality of care received. To support institutionalization of this set, research examining the sensitivity of available, evidence-based indicator outcomes sensitive to nurse staffing is needed. Such indicators could be used to evaluate the outcomes of nursing practice when changes are made in care processes or the delivery of nursing care. (Savitz L., Jones C., and Bernard S. 2005).

Rodrigues, Shinde, and Thakkar (2007), in their study ‘A Study to Evaluate the Existence of Prescription Medication Errors in an Intensive Care Set Up’ attempted to find errors at the grassroots level when a drug is prescribed. Medication errors reporting system allows establishing a protocol to state that evaluation for reforms may be conducted. This study shows that the ICU being a high medication administration zone quantitatively portrays that many patients receive medications and medication error potential needs to be considered. Medication errors (MEs) in the ICU are common and can arise from a number of causes. This study from two tertiary care hospitals reported the error rate was highest
in medical ICUs (19.4 per 100 patient days), particularly at the prescribing stage, which accounted for 56% of errors detected. The study was designed in advance to collect data over 70 weeks to enable reliable estimates of error rates. The MEs were assessed by type and patient outcome. The type of error was categorized by the pharmacist into groups that best represented the data. A single error could be recorded as several types of error. The total numbers of MEs were also recorded. If a single drug episode was judged to be in error for multiple reasons, it was counted only once for the error rate analysis. The patient outcome from each error was assigned by the pharmacist and the ICU clinical director according to an adapted scale. Minor errors were classified as those causing no harm or an increase in patient monitoring with no change in vital signs and no harm noted. Moderate errors were classified as those causing an increase in patient monitoring, a change in vital signs but without associated harm or need for treatment or increased length of stay. Major errors were categorized as those causing permanent harm or death. In this study, intercepted errors (e.g. where an incorrect dose of a drug was prescribed but not administered) were separated from non-intercepted errors (where the patient received the drug). The intercepted errors were scored separately on the basis of their possible impact on the patient if the prescription had been administered as prescribed. The chi-squared test for trend was used to test whether there was a learning effect over time with CPOE. A chi-squared test was used to test for error rates and outcome comparisons. A two-tailed t-test was used to compare means of APACHE II score for the HWP and CPOE periods. For this test, as the Levene's test was not significant, equal variance was assumed. The mean Acute Physiology and Chronic Health Evaluation (APACHE) II scores for the HWP (19.4, standard deviation 9.5, n = 56) and CPOE (20.0, standard deviation 8.0, n = 99) periods were not significantly different (p = 0.71). 134 drug charts with 1036 prescriptions were reviewed in the HWP group and 253 charts with 2429 prescriptions were assessed in the CPOE group. The proportion of MEs before CPOE was 6.7% (69 errors from 1036 prescriptions) and 4.8% after CPOE introduction (117 errors from 2429 prescriptions) (p < 0.04). The reduction in the proportion of MEs following the introduction of CPOE was statistically significant. The proportion of MEs with CPOE varied over time after its introduction (p < 0.001). Evidence also indicated the strong linear trend of a declining proportion of MEs over time (p < 0.001). CPOE appeared to be associated with a high number of dosing errors, an omission of the required drug and the prescriber's signature. A number of hand-written prescriptions were missing
key details, for example, dose, units or frequency. Several incidences were noted with CPOE in which a drug was not prescribed; for example, caspofungin was omitted when a patient previously on this drug was admitted to the ICU. Although all missed prescriptions were not prospectively looked at, standard care was taken for the pharmacist to review admissions and note discrepancies between ward and ICU prescriptions. This error occurred during the CPOE prescribing period.

Error types in prescriptions were:-

- Drug was prescribed on incorrect drug chart section (e.g. continuous IV infusion prescribed on 'when required' part of drug chart) -2 (2.8%).
- Drug needed but not given as not prescribed properly -3 (4.2%).
- Inappropriate/inadequate additional information on prescription to adequately administer the drug appropriately -8 (11.3%).
- Dose/units/frequency omitted on prescription -22 (31%).
- Prescription not signed or change not signed/dated- 10 (14.1%).
- Still wrong next day after pharmacist recommended appropriate correction that was agreed with doctor- 0 (0%).
- Dose error -12 (16.9%).
- The wrong drug prescribed -3 (4.2%).
- Incorrect route/unit -5 (7%).
- Formulary not followed without reason- 3 (4.2%).
- Administration not in accordance with prescription -3 (4.2%).
- Required drug not prescribed -0 (0%).

Total 71 errors were noted of 1036 prescriptions. The study concluded that prescription errors are primary errors and significantly important enough to be considered for remediation. The study also showed that handwritten prescriptions depicted more errors. A computerized prescription does not provide a definite solution as that too portrayed errors though fewer. The specification of a prescription if not followed is depicted as an error and the dose/frequency not prescribed is highly common. Medication errors through a faulty prescription can be prevented and this study shows the areas which need to be strengthened to achieve this (Rodrigues, Shinde and Thakkar 2007).

Li et al (2014), in their study, ‘The Application of Nursing- Sensitive Quality Indicators in Evaluating Nursing Efficiency’ studied the application of nursing-
sensitive QIs, taking up 20 indicators and evaluating nursing efficacy by studying nursing outcomes. The study involved 97 nursing units of four general hospitals, where quality-improvement projects were implemented. The efficacy of the projects was measured through the use of nursing-sensitive QIs followed by a Plan-Do-Study-Act cycle. Nursing efficacy was observed before and after the implementation. In the findings of the study showed the indicators revealed that patient satisfaction with basic nursing care, professional skills, and service attitude increased significantly after implementation of the quality-improvement projects (p<0.05). The incidence of nursing adverse events, including deficient care and accidents, also decreased significantly (p<0.01). However, patient satisfaction with the medical environment did not increase. The study allowed the investigators to conclude that nursing-sensitive QIs are a valid and reliable way to determine if nursing quality-improvement projects are efficacious. They also promote continual improvement in nursing quality and provide a scientific evidence for setting an implementation plan and detecting the implementation efficacy in nursing care, and possess certain promoting effects on the continual improvement of nursing quality. (Li et al 2014).

Nguyen H.B., et al.,(2007). ‘Implementation of a Bundle of Quality Indicators for the Early Management of Severe Sepsis and Septic Shock ss Associated with Decreased Mortality.’. The purpose of this study was to examine the outcome implications of implementing a severe sepsis bundle in an emergency ICU as an AI, set with feedback to modify physician behavior related to the early management of severe sepsis and septic shock. The study design was a 2-year prospective observational cohort in an academic tertiary care facility. There were 330 patients who presented to the emergency ICU who met the criteria for severe sepsis or septic shock. Interventions included five QIs which comprised the bundle for severe sepsis management in the emergency ICU:

a) initiate central venous pressure (CVP)/central venous oxygen saturation (Scvo2) monitoring within 2 hrs,

b) give broad-spectrum antibiotics within 4 hrs,

c) complete early goal-directed therapy at 6 hrs,

d) give corticosteroid if the patient is on vasopressor or if adrenal insufficiency is suspected, and
e) monitor for lactate clearance.

Measurements and main results of the study were:

- Patients had a mean age of 63.8 ± 18.5 yrs,
- Acute Physiology and Chronic Health Evaluation II score 29.6 ± 10.6,
- Emergency department length of stay 8.5 ± 4.4 hrs,
- Hospital length of stay 11.3 ± 12.9 days, and
- In-hospital mortality 35.2%.

Bundle compliance increased from zero to 51.2% at the end of the study period. During the emergency ICU stay, patients with the bundle completed received more CVP/Scvo2monitoring (100.0 vs. 64.8%, p < .01), more antibiotics (100.0 vs. 89.7%, p = .04), and more corticosteroids (29.9 vs. 16.2%, p = .01) compared to patients with the bundle not completed. In a multivariate regression analysis including the five QIs, completion of early goal-directed therapy was significantly associated with decreased mortality (odds ratio, 0.36; 95% confidence interval, 0.17–0.79; p = .01). In-hospital mortality was less in patients with the bundle completed compared with patients with the bundle not completed (20.8 vs. 39.5%, p < .01). The study concluded that implementation of a severe sepsis bundle using a quality improvement feedback to modify physician behavior in an emergency department was feasible and associated with decreased in-hospital mortality (Nguyen H. B. et.al. 2007)

Brian M.( 2003) in their study ‘A Study To Compare Intensive Care Units Practicing Nursing Quality Protocols to Those Who do not Practice Nursing Quality Protocols’, studied quality practices in ICUs. The sample was randomly selected. A total of 20 units were studied of which 10 practiced quality protocols and 10 did not have a quality policy in place. Data was collected using a quality scale Khan et al 1964 and a general information questionnaire. A statistical tool of SPSS version 15 was used for analysis. The study depicts that those intensive care units who practiced quality protocols show better ability to implement nursing care compared to those who do not. Twenty-five listed nursing practices were evaluated in the 10 units not practicing quality protocols. 45% of the practices did not comply with 68% of the cases. Compliance with 25 listed nursing practices was studied in 200 cases in each unit. The study’s depiction was demonstrated by studying bedsore occurrence. In this unit 2% in 28% of the cases developed bedsores in the ICU’s as compared to the unit which did not practice quality protocols, where no qualitative/quantitative data was found. It
was thus interpreted that occurrence when quantified gives a goal to decrease the occurrence and thus obtain better results. (Brian M. 2003).

Brandão, P., et al, (2013), in their study, ‘Causes of ICU Readmission and Mortality: Analysis of a Six-Month Period’ studied QIs leading to causes of ICU readmission and mortality. They stated that patients readmitted to ICU have a higher mortality and longer ICU and hospital stay. They used readmission rate as a QI of critical care unit performance, because this index may reflect the adequacy of treatment. The objective was to evaluate the readmission rate of a tertiary public hospital during the a six-month period. The methodology included a retrospective analysis of all adult patients readmitted to a 20-bed mixed-case ICU between 1 September 2012 and 28 February 2013. The cases (readmission) were collected from the clinical electronic information system. Results showed that during this period 402 patients were admitted to the ICU. The mortality in the ICU was 24.6% and overall hospital mortality rate was 31.6%. The average SAPS 3 during readmission on the ICU was 52 with a predicted mortality of 34%. The readmission rate was 5.2%, ICU mortality was 23.8% and hospital mortality was 28.6%. The most frequent cause of readmission was nosocomial pneumonia (29%), neurologic causes (19%), sepsis (14%), administrative (14%), postoperative support (10%), metabolic disorders (10%) and cardiology events (5%). The patients were most commonly readmitted from the ward (33%), emergency department (14%), step-down unit (14%), operating theater (5%) and others (33%). The most common supportive therapies after readmission were mechanical ventilation in 38.1%, vasopressors in 28.6%, and renal support in 9.5%. They concluded that the most common reason for ICU readmission in the unit was nosocomial pneumonia. The mortality of the readmitted patients was not superior to the predicted mortality for the overall cohort of patients. (Brandão, P. et al 2013).

2.4 To Study the Relation Between the Selected Quality Control Nursing Parameters with Selected Variables Such as Qualification and ICU Experience.

Britany, Ewald and Zienner (2006), in their study, ‘An Exploratory Study on Intensive Care Unit Quality Improvement - How to Guide an Interdisciplinary Team,’ had an objective of establishing a team of health personnel responsible for implementing quality parameters in an ICU. The study established a need for an interdisciplinary
team approach to better the quality improvement in the ICU to better health of patients and decrease the length of stay in ICU. The sample size was 133 interdisciplinary healthcare members selected through convenience. The tool used was a structured questionnaire to be answered by the team and structured retrospective data obtained from the patients’ medical records. The significance of quality-related decisions taken by the significant healthcare team (viz 98 nurses, 12 doctors, 2 physiotherapists and 21 technical staff) were retrospectively analyzed. The approach established a turnaround time of half hour for sample movement and a three-day length of in 83% of the cases amongst a sample of 586 cases. This approach was considered to be significant statistically (P<0.01).(4).

The nurses were evaluated for decisions taken to ambulate postoperative liver transplant patients from supine to upright position in 24 – 48 hours. Retrospective analysis of appropriate ambulation was correlated to the length of stay (three days) and less in all the patients who were ambulated within 48 hours. The study importantly conveyed that quality is related to the joint efforts of an interdisciplinary team. This is true in most patient care and outcome instances and relevant for one more arena, namely quality. (Britany, Ewald and Zienner, 2006).

Mannat, Shukla and Waghmare, (2008), in , ‘A Study to Measure the Extent of Patient Safety Strategies Adopted in a Medical Intensive Care Unit and Compare it with the Education Levels of the Nursing Staff’, tried to identify the prevalence of the existing safety standards using a triangulated research design using quantitative research methodology. The study was exercised in a 25-bedded medical ICU and the findings were compared to the education levels using Maslach’s inventory. Data was collected using a structured self-administered paper-based questionnaire. The questionnaire included a list of more than 200 nursing tasks for quality in critical care nursing and treatment as defined by WHO (2008) in areas such as:

(a) prevention,
(b) clinical management,
(c) Nurse Initiated and Managed Therapy - NIMART,
(d) prevention of transmission, and
(e) pediatric care and treatment.

For each task item, a four-point Likert scale was used to measure nurses' ability categorized as per the qualifications
(0 = basic diploma;
1 = additional certificate training ,
2 = post-service training , and
3 = both certificate and post-service training).
The perceived competency was marked as:
- 0 = cannot perform,
- 1 = cannot perform without supervision ,
- 2 = can perform independently , and
- 3 = can perform independently and instruct others.
Practice frequency was rated as
- 0 = never ,
- 1 = monthly ,
- 2 = weekly , and
- 3 = daily .
The questionnaire was reviewed by nursing and clinical experts in quality care and treatment at the Centers for Disease Control and Prevention, WHO, and the Ministry of Health. The questionnaire was finalized after pretesting with 10 practicing nurses in a health facility not included in the study.
Consenting participants completed questionnaires after receiving instructions on questionnaire completion from the study staff. Descriptive statistical analyses were conducted using Microsoft Excel (Microsoft, 2010). Data were categorized dichotomously for training:
- 1 = basic diploma
- 0 = not trained [no additional training received], competency
- 1 = competent [can perform independently or can perform independently and instruct others],
- 0 = not competent [cannot perform or cannot perform without supervision], and practice
- 1 = practicing [practiced daily, weekly, or monthly],
- 0 = not practicing [never practiced]).
Frequencies were calculated for dichotomous categorical data to determine the percentage of nurses trained, competent, and practicing each task.
It was found that among surveyed nurses (N = 165), more than two-thirds reported having been trained in care and treatment (69%, n = 114), but fewer felt competent
(53%, n = 87) and even fewer were practicing (44%, n = 73), representing a cascade of gaps in nurse capacity building. The percentage of nurses who reported being trained, competent, and practicing care and treatment tasks are reported in categories: prevention, clinical management, and Pediatric care.

In Nurse Initiated and Managed Therapy - Gaps existed in nurses' training, competency, and practice in NIMART, particularly in treatment initiation. Fewer than half were trained, less than a third felt competent, and less than a quarter was practicing prescribing Nursing Therapy. Gaps were also noted in management, as fewer than half felt competent or had practiced monitoring and supporting adherence to therapy and managing side effects, and less than one-third felt competent or had practiced identifying treatment failure through monitoring. The findings of this study revealed that understanding implication of the practice was directly related to the systematic identification of the process and it concludes that the education of the sample selected had to impact patient care strategies. (Mannat, Shukla, and Waghmare, 2008).

Swart, R.P.et al (2015) in their study ‘Educational Background of Nurses and Their Perceptions of the Quality and Safety of Patient Care’ have demonstrated that educational background of the nurses has a major role to play in the quality perspective. Their main aim was to investigate the relationship between the educational background of nurses, as well as their perceptions of quality and safety in patient care in surgical units in private hospitals in Gauteng Province, South Africa (SA). As such, data on the workforce profile of nurses were collected across medical-, surgical-, midwifery and ICUs, in both the public- and private healthcare sector in SA. This article builds on and extends a body of research by the RN4CAST program on the status of the practice environment of the nurse, levels of burnout, the quality and safety of patient care and the workload of nurses in medical- and ICUs in SA. When referring to nurses in the context of this study, the researchers explored perceptions of both registered (RNs) and enrolled nurses (ENs) in terms of the quality and safety of care delivered. South African nurses are divided into three different categories, namely, RNs (also known as professional nurses); ENs (also known as staff nurses) and NAs (auxiliary nurses or nursing assistants). RNs have the option to enroll for a four-year degree at an accredited University, or a four-year diploma at an approved nursing college.
The objective was to determine the relationship between the educational background of nurses and their perceptions of quality of care and patient safety in private surgical units in SA. The method used was a descriptive correlational design. A questionnaire was used for data collection, after which hierarchical linear modeling was utilized to determine the relationships amongst the variables.

Nurses working in surgical wards in private hospitals in Gauteng Province with a bed capacity > 100 were invited to participate in the study. Twenty-seven hospitals were included in the study and, because of the fact that nurses’ response rates to questionnaires are at best moderate, the researchers decided on an all-inclusive sample of RNs and ENs working in surgical units. From the staff list, 292 RNs and 306 ENs were invited to complete the questionnaire. A total of 304 fully completed questionnaires were accepted for statistical evaluation, resulting in a 51% response rate. Of the 304 questionnaires received, the RNs completed 149 and the ENs 155. This resulted in a 51% response rate for both the RNs and the ENs.

Data collection Instrument: The questionnaire consisted of four sections with 118 questions. The questions concerned issues relating to the quality and safety of patient care in the unit, and demographic information of the nurses. Twenty-five survey items measured nurses’ perceptions of the safety and quality of care in their units. A confirmatory factor analysis was conducted on the larger sample of data which included surgical units across SA. Nurses were asked to identify, on a summated rating scale, the safety and quality of care that patients received in their unit. Practices related to patient safety that were explored consisted of: (1) staff mistakes that were held against them; (2) important patient information that was lost during shift changes; (3) ways to prevent recurrence of errors; (4) feedback based on incident reports; and (5) patient safety being considered a top priority by management. Nurses perceptions of incidents were also explored in terms of medication errors, occurrence of pressure ulcers, patient falls, hospital-acquired infections, patient complaints, verbal and physical abuse directed toward nurses and work-related injuries. The 19 items clustered into seven factors that included: (i) error prevention (4 items); (ii) losing patient information (2 items); (iii) staff mistakes (1 item); (iv) verbal abuse (3 items); (v) hospital-acquired infections (3 items); (vi) physical abuse (3 items); and (vii) patient incidents (3 items).

Data analysis: Descriptive data were analyzed using SPSS 16.0 and included mean scores and reliability indices as well as frequencies and percentages for questions
related to the quality and safety of patient care. A Pearson chi-square test was also conducted to examine the relationship between the educational background of nurses and their perceptions of the quality and safety of patient care. Associations amongst the study variables were estimated using hierarchical linear modeling (HLM) in Statistical Analysis System (SAS). Because the data in this study were hierarchical in nature, with nurses working in surgical units within private hospitals, HLM was performed.

Results: From the results, it was evident that the majority of the participants in both the RN (n = 142; 96.6%) and EN (n = 141; 93.4%) categories were women. When asked about their age, the RNs’ ages ranged from 24 to 63 years (mean = 43.01, SD = 9.53); and the ENs’ ages ranged from 22 to 54 years (mean = 40.75, SD = 13.74). Nineteen (13.4%) of the RNs were trained at a baccalaureate level and 123 (86.6%) at a diploma level. Most of the nurses in both categories were also employed as full-time workers in the unit (RNs: n = 137, 93.8%; ENs: n = 140, 95.2%). When asked about their general opinion on the quality of care delivered to patients on their ward, 61 (50.8%) of the RNs rated service as good and 91 (60.3%) of the ENs rated service as excellent. Chi-square analysis revealed a significant difference between RNs’ and ENs’ general opinion of the quality of care delivered: X² (3, N = 271) = 23.1, p < 0.001. Moreover, 51% (n = 77) of the ENs rated the overall grade on patient safety in their ward as very good, whilst 75 (51%) of the RNs rated it as acceptable as before, the chi-square test revealed a significant difference between RNs’ and ENs’ overall grade of safety in their wards: X² (3, N = 298) = 34.1, p < 0.001. Deterioration of the quality of care was less commonly reported by the ENs, with 108 (74.5%) of the ENs agreeing that the quality of care in their hospitals had improved in the past year. For the RNs, an equal percentage of nurses (37.5%; n = 54) were of the opinion that the quality of care could be better. Close to 44% (n = 65) of the ENs were very confident that their patients were prepared adequately to manage their care at home upon discharge, whilst 81 (55.1%) of the RNs were moderately confident. Yet again, the chi-square test revealed a significant difference between RNs’ and ENs’ confidence in patients managing their care when they are discharged from hospital: X² (3, N = 295) = 12.0, p < 0.001. HLM indicated a statistically significant difference (level of significance at 5%) between RNs and ENs in that enrolled nurses seemed to agree with the actions taken to prevent errors from happening in surgical units (p < 0.001). Registered nurses (RNs)
neither agreed nor disagreed with the statements. Looking at the sub-scale, losing patient information, there was a statistically-significant difference between RNs en ENs responses (p = 0.05). ENs seemed to disagree more with statements that important information is lost during shift changes or when transferring patients from one unit to the next. The mean score for the RNs, at 2.91, leans toward neither agreeing nor disagreeing with the statements on losing patient information. In terms of staff feeling that their mistakes are held against them, the RNs’ mean score of 3.08 indicated that they neither agreed nor disagreed with the statement. The ENs, however, with a mean score of 3.47, seemed to lean toward agreeing with the statement that their mistakes are held against them. In terms of verbal abuse, both RNs and ENs agreed that verbal abuse occurred once a month or less, with the RNs (mean = 2.25) having a slightly higher mean score than the ENs (mean = 2.08).

Looking at the mean scores for physical abuse, both RNs (mean = 0.63) and ENs (mean = 0.89) seem to agree that incidents occur only a few times or less per year. Finally, when reporting on patient incidents in terms of medication errors, pressure ulcers and falls with injury, a statistical significance (p < 0.001) was found between RNs and ENs. RNs (mean = 1.08) indicated an occurrence of a few times per year or less, whilst the ENs, with a mean score of 0.80, were of the opinion that these incidents never occurred in their units.

Outline of the results

Findings from this study indicated that SA, as is the case with the rest of the world, has a substantial nursing workforce aged 40 years and older that is predominantly female. It may be concluded that nurses play a major role as primary patient contact and have a vital role in ensuring the quality and safety of patient care. The results of this study suggest that nurses (both registered and enrolled) have favorable perceptions of the quality and safety of patient care delivered in surgical units in private hospitals in Gauteng. It is strongly suggested that several of the findings that can affect the quality and safety of patient care, such as recording of medication errors, needs to be addressed. To that end, the findings provide a glimpse of one of the critical professions’ perceptions on the safety and quality of care in surgical units in private hospitals. Enrolled nurses (ENs) indicated that current efforts to prevent errors are adequate, whilst the registered nurses (RNs) obtained high scores in reporting incidents in surgical wards. From the results, it was evident that perceptions of RNs and ENs related to the quality of care and patient safety differed. There seemed to be a
statistically-significant difference between RNs and ENs perceptions of the prevention of errors in the unit, losing patient information between shifts and patient incidents related to medication errors, pressure ulcers and falls with injury. The end results state that both the registered- and enrolled nurses seemed satisfied with the quality of care and patient safety in the units where they work. (Swart, R.P.et al 2015)

Misset, B. et al.(2004) in their study, A continuous quality-improvement program reduces nosocomial infection rates in the ICU, aimed to study compliance of physicians and nurses with infection control practices and to assess its long-term impact on the rates of VAP, UTI, and vascular catheter-related infection in critically ill patients. It was done with the objective To assess the impact of a continuous quality-improvement program on nosocomial infection rates. The study Design and setting were a Prospective single-center study in the medical-surgical ICU of a tertiary care center. The study was performed prospectively over 5 years (July 1995–2000) in the ten-bed medical-surgical ICU of Saint Joseph Hospital, a 450-bed tertiary care center located in Paris. And it included 1764 patients during the 5-year study period (1995–2000); 55% were mechanically ventilated and 21% died. Mean SAPS II was 37±21 points and mean length of ICU stay was 9.7±16.1 days. The Interventions during the study included Implementation of an infection control program based on international recommendations. Each new nurse received a 2-month training course, during which specific protocols regarding NI prevention are discussed. The program was updated regularly according to infection and colonization rates and reports in the literature. Data collection included Disease severity which was measured by computing the Simplified Acute Physiology Score II (SAPS II) within 24 h after admission. Treatment intensity throughout the ICU stay was measured using the Omega system an instrument derived from the Therapeutic Intervention Scoring System. This Data was analyzed and Quantitative data reported as means ±SD and qualitative data as percentages. For each procedure we computed the utilization rate as the number of procedure days divided by the total number of patient days in the unit, the procedure-associated infection rate as the number of relevant NIs per 1000 procedure days, and the incidence rate as the number of patients with the relevant NI divided by the number of patients exposed to the procedure. Changes in incidence rates over the 5-year study period were tested using the χ2 test for trend. Mean SAPS II and Omega scores and
mean length of ICU stay were compared by analysis of variance among 1-year periods. Finally, the time to the first nosocomial event was compared between the patients of two consecutive periods of equal duration (2.5-years) using a Cox model with or without adjustment for the SAPS II score. Values of p smaller than 0.05 were considered statistically significant. Results showed that Incidence rates decreased significantly for UTI, CVC-related bacteremia, and CVC colonization but not for VAP. No cases of AC colonization were documented during the study period, and consequently, no data on this are shown. The decline over time in UTI and CVC-related infection rates was observed despite the absence of significant changes in disease severity (SAPS II score), the mean length of ICU stay, and treatment intensity and regardless of invasive device utilization rates. Increases in the time to the first NI were found from the first to the second 2.5-year period for UTI (p =0.005) and CVC colonization (p =0.02) but not VAP. The Cox model comparing the two consecutive 2.5-year periods showed decreases in the rates of UTI and CVC colonization. These decreases remained significant after controlling for admission SAPS II. The study Concluded that A continuous quality-improvement program based on surveillance of nosocomial infections in a non-selected medical-surgical ICU population was associated with sustained decreases in UTI and CVC-related infections (Misset, B. et al. 2004)

**Conclusion:**

These studies contributed though

1. Discussing quality impact in the healthcare sector with direct implications to the critical care units
2. These Studies studied relation to significance and importance of quality in critical care nursing
3. They also reviewed the impact on nursing care expected due to attending quality parameters making a significant difference.
4. And they also studied implications related to selected quality parameters and significant outcomes standardizing quality nursing care.

In ordinance with the objectives of the principal study
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