AN EVALUATION OF NEONATAL NURSING CARE IN SELECTED HOSPITALS IN THE WESTERN CAPE

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DECLARATION

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and that I have not previously submitted it in its entirety or in part at any university for a degree.

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Signature Date

ABSTRACT

South Africa has a proud history of a high standard of health care delivery in State funded hospitals. This implies that high standards of education and care in both medical and nursing training have been achieved. The care of sick and premature newborn infants by nurses is a speciality that has evolved worldwide over the last forty years as a result of various technological developments.

In order to ensure the standard of care delivered, protocols of care should be available for nurses to refer to and to measure their work against. There were no protocols of care available in the two Neonatal Units (NICUs) used in this study.

Using a non-experimental, exploratory descriptive design, the researcher set about measuring the quality of nursing care in the NICUs. Standards (structure, process and outcome) were written by the researcher, and validated.

The results showed that the standards were not met at an acceptable level in various areas. One of the areas of great concern was the lack of effective hand washing. Outcome standards which reflect the consequences of care indicated serious shortages of staff in some cases and insufficient staff training.

Recommendations are that a Quality Assurance Program should be introduced with training and education of the nurses working in the NICUs and the introduction of evidence-based practice. Future research should aim at showing the way to improve the service delivered.

Keywords: Neonatal Nursing Care, Standards, Quality Assurance.

OPSOMMING

Suid-Afrika het ‘n trotse geskiedenis van ‘n hoë standard van gesondheidsorgdienslewering in Staatsbefondsde hospitale. Dit impliseer dat hoë standaarde in mediese en verpleegopleiding bereik is. Die versorging van siek en premature pasgebore babas deur verpleegkundiges is ‘n spesialiteit wat oor die afgelope veertig jaar wêreldwyd ontwikkel het as gevolg van verskeie tegnologiese ontwikkelings.

Ten einde te verseker dat ‘n hoë standard van sorg gelewer word, moet protokolle beskikbaar wees vir verpleegkundiges om te gebruik en hulle werkverrigting teen te meet. Daar was geen protokolle beskikbaar in die twee neonatale eenhede wat in hierdie studie gebruik is nie.

‘n Nie-eksperimentele, verkennende, beskrywende ontwerp is deur die navorser gebruik om die gehalte van verpleegsorg in die neonatale eenhede te evalueer. Standaarde (struktuur, proses en uitkoms) is deur die navorser opgestel en gevalideer.

Die resultate toon aan dat die standaarde in verskeie areas nie aanvaarbaar nagekom word nie. ‘n Kommerwekkende bevinding was die afwesigheid van effektiewe was van hande. Uitkomsstandaarde wat die resultaat van sorg weerspieël, het aangedui dat daar ernstige tekorte aan personeel in sommige gevalle bestaan het asook onvoldoende opleiding van personeel.

Aanbevelings is dat ‘n Gehalteversekeringsprogram ingestel behoort te word en met die opleiding van verpleegkundiges werksaam in die neonatale eenhede en *evidence-based practice* aangespreek moet word. Toekomstige navorsing behoort aan te dui hoe om die diens wat gelewer word, te verbeter.

Sleutelwoorde: Neonatale Verpleegsorg, Standaarde, Gehalteversekering

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Dr Estelle Bester who has been the most patient, supportive and encouraging supervisor I could have wished for – thank you!

DEDICATION

I dedicate this work to the neonates of yesterday, from whom we have learned, the neonates of today, who are teaching us and who can benefit from those who went before and the neonates of tomorrow who can have wider horizons.

I dedicate this work to the Neonatal Nurses who took part in this study, who are doing good work despite difficult circumstances.

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Introduction

1.1 Rationale

During the 1960s the speciality of Neonatology evolved as a result of research and technological developments which allowed paediatricians to provide life-support for high-risk newborns (Cohen *et al.,* 1982). The need for nurses to provide specialized care for these infants arose and so the role of the Neonatal Nurse was born. Further technological advances have brought about inevitable changes in the care and outcomes of these high-risk infants. The role of the Neonatal Nurse has consequently undergone significant changes in the last 30 years. The Neonatal Nurse is an integral member of the multidisciplinary team in the Neonatal Intensive Care Unit (NICU). She is often considered the most important member of the team and provides more than 85% of care to critically ill infants (Peters, 1992). It is nursing care that will have the greatest influence on the progress and the consequent outcome of these patients. Enrolled nurses, nursing assistants and registered nurses - all of whom have varying experience in this area, staff the nurseries in the tertiary level hospitals. On the whole, only registered nurses work in the NICUs and some of these nurses have completed specialized training courses in the care of sick and preterm infants.

In the Western Cape there are four NICUs within the Provincial Hospitals. These are situated at Tygerberg, Groote Schuur, Mowbray Maternity and Somerset Hospitals. The patient population in the Provincial Hospitals' NICUs is drawn from infants born within the Western Cape and also infants transferred from surrounding areas as far afield as George, Oudtshoorn and Upington. However the majority of referrals to the tertiary centers come from the Midwife Obstetric Units (MOUs) which are satellite clinics that provide antenatal care, labour and delivery and postnatal care within the community.

The Midwife Obstetric Units were introduced to the service in 1973 (van Coeverden de Groot, Davey, Smith, Vader and van der Merwe, 1978). The aim of these units is to provide antenatal care for the healthy mother near to her home, deliver a healthy term infant and discharge mother and infant within twelve hours of delivery. Each MOU refers problem cases to a predetermined tertiary hospital. Referrals may be made antenatally or after delivery.

The rapid expansion of the role of the neonatal nurse in recent years has necessitated greater involvement of the nurses in the management of infants in their care. An audit by Harrison and Peat (1992) of nursing care documentation revealed that the NICU nurses were responsible for 20% of emergency procedures including endotracheal intubation and for the collection of most specimens for investigations.

The standard of care delivered has become important when cost effectiveness and quality assurance are to be addressed. Written standards should be available in the NICUs for reference and these standards should be updated and revised regularly. On investigation, the researcher was not able to find written standards of care for neonatal nursing in the majority of the provincial hospitals of the Western Cape.

An investigation into the standards of neonatal care will lead to critical evaluation of care and could result in revision of practice. This will benefit the patients because the care provided will improve and likewise the outcomes of these patients. The ultimate goal is to contribute to expanding knowledge within this nursing speciality and to encourage critical thinking by the neonatal nurse while she executes her duties, so that she will constantly strive to improve the care that she gives.

1.2 Problem Statement

The researcher has found that there are no standards of care available in the majority of the NICUs in Provincial hospitals in the Western Cape. The consequence of this is that while the nurses strive to deliver optimal care, there is no instrument against which nursing standards can be measured and so inconsistencies in care will inevitably result. There are a number of other factors influencing the quality of care given in NICUs at present.

In recent years there have been significant reductions in the staff numbers in provincial hospitals. Many of the experienced staff have taken the severance package and are lost to the service as they undertook not to seek employment at provincial hospitals again. This step was implemented in order to contain budgets and to reduce staff numbers. However the patient load has not reduced and so the remaining nursing staff are placed under greater pressure in their work. Van den Heever (1995) states that "it must be acknowledged that adequate staffing levels are a pre-requisite for an acceptable standard of neonatal care". In its document on standards for hospitals providing neonatal intensive and high dependency care (2001), the British Association of Perinatal Medicine (BAPM) states that "a lack of trained staff may lead to care that is unsafe".

The shortage of staff has resulted in it becoming almost impossible to remove nurses from the work environment in order to give them formal training in the discipline of neonatal nursing. This is not only applicable in South Africa. Redshaw and Harris (1994) state that neonatal courses had been discontinued in some centers in the United Kingdom because "the staffing situation was inadequate for running a course and creating an effective learning environment".

Evidence based practice is recognized worldwide as the preferred approach in nursing, but it is difficult, if not impossible, for the NICU nurses to gain access to current literature, which reflects new trends in the care of preterm infants, and research in this field of medicine and nursing. This is because they cannot be spared from the work environment for in-service training or journal club meetings, so the patients are not able to benefit from research and developments worldwide. The result is that nurses working in the NICU are trained while 'on the job' by peers who may not have been specifically trained in Neonatal Nursing. Nurses can learn techniques that are not correct and this may not be rectified because there is so little opportunity for in-service education.

Another area affected by the budget constraints is the maintenance and replacement of equipment. Some of the equipment in use in NICUs in provincial hospitals in the Western Cape is more than 25 years old. It no longer functions optimally, but the institutions are compelled to continue to use it, as there is no money available to replace

it. Equipment that is condemned is often not replaced and this adds to the nurses' frustrations.

While nursing staff in the NICUs are endeavoring to deliver optimum care to their patients despite the abovementioned problems, it would appear that adequate standards of care are not always achieved. This can be ascribed in part to the fact that formulated standards of care and practice are not available, so the nurses do not have reference points to use in order to maintain standards. Restrictions in finance available for equipment and staff also play a major role in influencing the quality of care given. Nurses can make a difference by managing the quality of their nursing care. If patient outcomes are adversely affected because standards of nursing care are not consistent or optimal, then the introduction of standards can positively benefit patient outcomes and consequently the cost of neonatal care can be significantly reduced. In order to justify this statement the researcher asks the question that serves as focus for this study:

Are nurses achieving adequate standards of care when nursing sick neonates?

1.3 Purpose of the study.

The researcher plans to investigate the nursing care given in NICUs in two provincial hospitals in the Western Cape. These NICUs are well established with some of their nursing staff having received training in Neonatal Intensive Care Nursing and others who have no formal training in this discipline. The researcher has developed an evaluation tool to measure structure standards, standards of care for nursing procedures in the NICU and outcome standards, after conducting an extensive literature search and using her own long-term experience of more than 20 years in the field.

1.4 Objectives.

The objectives of the research are to:

- generate standards for structure, process and outcomes of Neonatal Care;
- validate these standards;
- evaluate the quality of care according to these standards; and
- make recommendations based on the results of the evaluation.

1.5 Conceptual Framework for the Study.

This was undertaken from three aspects: structure, process and outcome. With information gathered from previous research, literature, internet discussion groups and personal experience, the researcher set standards for these three aspects. An expert in Neonatal Nursing validated these standards and they were then be used to evaluate the care rendered. Evaluation was undertaken by the researcher herself, using the standards developed, with a key to denote performance of criteria for data collection.

FIGURE 1.1

Conceptual Framework of the Study.

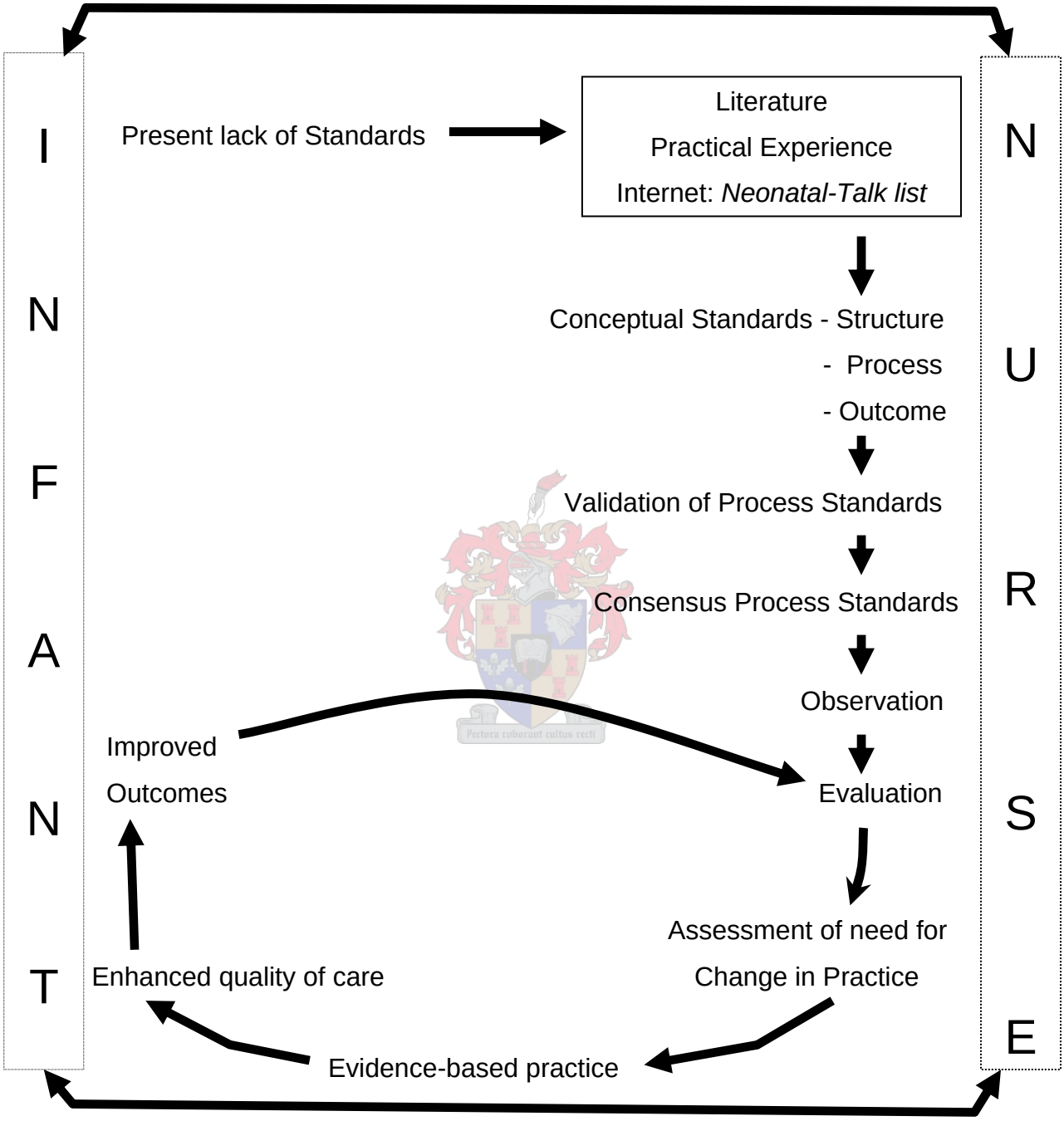


Figure 1.1 shows the nurse in constant interaction with infant in the provision of care. Further, the figure shows the situation in the NICUs when the research project was initiated, where there were no standards available. This lack of standards led to the formation of concept standards which were further researched, validated and resulted in

the development of the final standards. Evaluation took place in the NICUs and this guided the assessment of the need for changes in practice. This leads to the introduction of evidence-based practice and the positive changes in care hypothesized from this. It is important to note that the cycle includes the continuation of the revision of the standards and the subsequent continuation of the Quality Assurance cycle from there. This process is applied to the entire research project, including Structure, Process and Outcome.

1.6 Research Methodology

In order to indicate problem areas and to identify the reasons for discrepancies in care rendered, the researcher evaluated the nursing care given in selected Neonatal Intensive Care Units in the Western Cape. Structure and outcomes were also considered.

1.6.2 Approach to design.

A non-experimental, exploratory descriptive design was used for the study. The very nature of the subject indicates that it is non-experimental. The exploratory descriptive design was used in this research as it was designed to gain more information about characteristics of the subject under investigation and the researcher did not control variables, but simply observed them (Carter in Cormack, 1996).

1.6.2 Population and sampling.

Sampling was done on two levels. Two of the four Neonatal Intensive Care Units in the Provincial Hospitals in the Western Cape rendering tertiary care to neonates were included. This selection was made because the professional Nurses of the two NICUs have attended the same training courses and the medical staff receive training from the same educational institution. This meant that the attitudes and approaches of the doctors, and therefore the medical management of patients, were similar in the two NICUs.

On a second level, professional Nurses undertaking procedures and rendering nursing care in Neonatal Intensive Care Unit are included. However it is not the professional nurse herself that is evaluated, but rather the standard of care delivered. The actual procedures form the population on this level. According to De Vos (1998), sampling can be of events, procedures and/or people. Purposive sampling is done to evaluate specific events. Sampling continued until data saturation was reached and no new data emerged.

1.6.3 Instrument.

The instrument has been developed by the researcher and evaluated by another professional nurse who has significant experience in NICU nursing. Development of the instrument was a dynamic process. Factors involved were:

- information gathered from the literature search conducted using Medline, WinSPIRS 4.0 and PubMed
- information gathered from the NICUNET and the Neonatal-talk list
- the experience of the researcher

1.6.4 Data collection.

The researcher undertook assessments randomly during the day and night, to allow data collection to reflect a full twenty four hours of care. Data was gathered while the researcher occupied an observer role.

1.6.5 Data Analysis.

Data collected yielded quantitative results. Quantitative data was analyzed using the technology provided by the Microsoft EXEL program.

1.7 Ethical Considerations.

The researcher has taken into consideration the ethical implications of this study. There was no direct involvement of the neonate. No care was withheld, changed or applied. The researcher acted as the fieldworker, so the staff of the NICUs were not required to

perform any additional functions. Permission was requested from the Medical Superintendents of the institutions for access to records and from the Directors of Nursing for access to the NICUs (Addendum A). Data gathering commenced after verbal permission was granted, written permission being received from one institution more than three years after the request was made. Anonymity of NICUs and nursing staff has been maintained and the researcher respected rules and regulations applying to the NICUs while present to collect data.

1.8 Operational Definitions.

The feminine pronouns she, hers and her will be used in the text to simplify writing, except in cases where reference is made to a male.

For the purpose of this study, the following will serve to clarify terms used:

Enrolled nurse is an individual who has completed a two-year general nursing training program and is enrolled with the South African Nursing Council.

Enrolled nursing assistant is a nurse who has completed a basic six-month training in general nursing and is enrolled with the South African Nursing Council.

High-risk infant: an infant who requires tertiary level care in the NICU.

Neonate/infant for the purpose of this study refers to any newborn who is a patient in the NICU.

Neonatal intensive care unit (NICU): a department in a secondary or tertiary level hospital offering tertiary level of care to newborn infants.

Registered nurse/sister/neonatal nurse/nurse: a practitioner who is registered with the South African Nursing Council. She has a minimum qualification as a general nurse and midwife. She may or may not have an additional certificate of training in neonatal nursing.

Standards, protocols and guidelines: for the purpose of this study refer to the sequence of steps that are undertaken when performing a nursing or caring interaction with a neonate in the NICU.

1.9 Limitations.

The researcher acknowledges that the staff of the NICUs were aware that she was present to evaluate nursing care and that this could affect their practice. As most of the staff of the NICUs know the researcher, it was felt that once the reason for her presence was understood and was not regarded as threatening, practice would not be altered. Data was only collected for the study after the staff had become accustomed to the presence of the researcher.

Certain procedures, including endotracheal intubation, are not frequently performed by nursing staff in the NICU and so there were some procedures that were not evaluated in the same quantity as others. This factor was unavoidable.

The research is limited to a very small population in South Africa. There are numerous NICUs in the private sector in the Western Cape as well, which offer varied levels of care including those not available in provincial hospitals for example ECMO (extra-corporeal membrane oxygenation) and Nitric Oxide ventilation. On investigation the researcher found that these NICUs have standards or practice guidelines available. For practical and realistic reasons, the researcher was forced to limit the number of NICUs involved in the study and so selected the Provincial Hospitals.

Where equivalent technology was not available in each of the NICUs studied, that specific area was not included for the study. This was deliberately been done to enable the study to evaluate equivalent nursing care rendered in the NICUs in the study.

1.10 Conclusion.

The evolution of Neonatology has demanded significant changes in nursing care in NICUs. With no protocols available to nurses in provincial hospitals in the Western

Cape, the standards of care given can be inconsistent. In order to establish a standard of nursing care, the researcher set standards and evaluated the care given in the selected hospitals. The data collected was then analyzed and interpreted. Conclusions were drawn and recommendations made which will have a bearing on nursing practice and on patient outcomes in the NICUs.

In Chapter 2 a review of literature studied will be given.

The outline of the chapters is:

Chapter 1: Introduction

Chapter 2: Literature Review

Chapter 3: Research Methodology

Chapter 4: Results and Discussion

Chapter 5: Conclusions and Recommendations

CHAPTER 2
Literature Review

2.1 Introduction.

In Chapter 1 an overview of the study was given. The rationale was discussed and the research question asked. An outline of the methodology was given. Chapter two gives detail and discussion on the literature review.

2.2 Purpose of the Literature Review.

A review of relevant literature is conducted to generate a picture of what is known about a particular situation and the knowledge gaps that exist in the situation (Burns and Grove, 1993). Articles reviewed for this research project included those relating to practice, quality assurance and research in the field.

In reviewing the literature, the researcher was able to analyze previous research on the subject and obtained articles relevant to practice in the subject. It should be noted that the researcher concentrated on selecting literature published since 1990, in order to gain knowledge of more recent developments and trends in neonatal care. This had an influence on the setting of standards because the researcher became exposed to trends and developments in structure and process in NICUs internationally, and to questioning of practice and research undertaken there and in South Africa. This information was used along with the researcher's extensive experience in the field to generate a relevant

and appropriate instrument for the measuring of practice. Aspects that were covered in the literature review will now be discussed.

2.3 Quality assurance.

A research project of this nature assesses quality of care. The literature review was conducted to reveal current trends in quality assurance and research into Quality Assurance in Neonatal Intensive Care Units (NICUs) throughout the world.

Evaluating the practice of professionals and assuring the customers of the quality of the service that they receive, is the basis of Quality Assurance (Tappen and George in Tappen, 2nd Ed.). Continuous quality improvement in health care is aimed at reducing errors and complications and improving patient outcomes by adhering to evidence-based practice (Berwick, Godfrey and Roessner, 1990).

2.3.1 Definition

Quality assurance in nursing is a planned, continuous, evaluative process to assure excellence of patient care (Gilchriest in Beachy and Deacon, 1993). Muller, in Booyens (1998), describes ‘assurance’ as implying a guarantee of quality in accordance with the characteristics associated with excellence. She describes eight characteristics of excellence:

- Applicability of decisions;
- Acceptability of actions, legally, ethically and culturally;
- Safety of the therapeutic environment;
- Equality of treatment regardless of gender, race, financial or social standing;
- Accessibility of health care services, facilities equipment and expertise;
- Effectiveness demonstrated by clinical results and utilisation of resources;
- Professional knowledge and competence and
- Satisfaction of the patient, family and all members of the multi-disciplinary team.

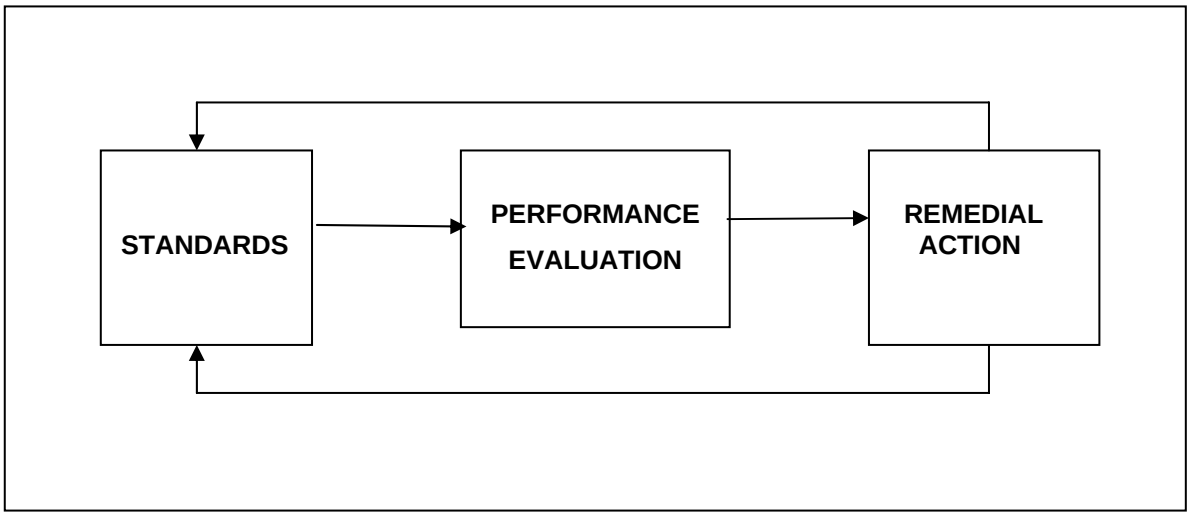
2.3.2 Historical overview

Quality assurance is an aspect of healthcare that emerged in the early 1990's as a result of demands from professional associations, accrediting agencies, federal and state regulatory parties and third party payers, who require information on the effectiveness and quality of care delivered (Suhayda and Friedrichs 1993). The pioneer of Quality Assurance, Donabedian, has had a significant influence on this area of health care since the late 1960s when he proposed a model for standard setting for evaluating nursing care. This model included assessing the structure, process and outcomes of care delivery (1969).

In order to achieve and maintain adequate standards of quality care, it is necessary that standards of practice are developed which define expected levels of work performance and that a system of documentation of interventions that supports and reflects the established standards is available. The World Health Organisation recommends that each health service should formulate generic standards which identify a required national standard of care. These standards should demonstrate content validity by being developed from research results, scientific writing and consultation with experts in the field. Specific standards can then be developed from the generic standards by nurses in particular institutions for their own use (Muller, 1990). At present the researcher is a member of the Critical Care Nurses' Forum of the Critical Care Society of Southern Africa which is formulating standards of practice in Critical Care in South Africa, in accordance with the requirement of the South African Qualifications Authority.

There should be continuous evaluation of care given against the standards set, in order to assess whether the standards are still applicable and adequate to meet the needs of the patients. This will result in the standards being reworked and developed when necessary, thus maintaining a high and relevant standard of practice. This cycle is illustrated in Figure 2.1 overleaf.

FIGURE 2.1
Schematic representation of the process of quality improvement.



From Muller, 1998.

2.3.3 Implementation.

Those involved in the actual delivery of care should be involved in developing the standards. Personal experience of problems can lead to group participation in solving them and the staff who feel that they have 'ownership' of the standard will be motivated to apply and maintain these standards. They will also become aware that standards can continually change and the evaluation and redesign of standards will become an ongoing process. However, the involvement of the practitioners does not guarantee the implementation of the standards, and leadership and facilitation are crucial factors in ensuring this (Wallin, Bostrom, Harvey, Wikblad and Ewald, 2000).

2.3.4 The role of the nurse in Quality assurance.

As quality assurance focuses on specific problems that may interfere with the provision of health care, the nurse as the person delivering the care, is able to detect these problems as they arise and take remedial action. This will help to ensure that the patients in her care are receiving appropriate standards of care. Patients have a right to be informed and to question and challenge information and care given to them by health

care providers. Those delivering health care have the responsibility to provide the highest quality health care possible.

In the NICU, the nurse is the individual most involved in providing direct care to the infants and she is therefore responsible for the quality of care given to her patients. The neonate is a patient who cannot verbalise his needs and so the nurse has to be perceptive to these needs and must also anticipate and prevent problems and complications from developing. Along with performing her nursing duties, the neonatal nurse must be observant and provide intuitive and gentle caring (Stewart Hegedus and Madden, 1994).

Nurses should use various approaches to maintaining quality of care: self-evaluation, auditing of care given, observation of fellow nurses working (eg. students), peer-group evaluation, incident monitoring, analysis and interpretation of data and patient satisfaction. In order to evaluate the care given, the nurse needs to have at her disposal standards that have been developed for this purpose.

2.4 Standards.

The formulation of standards is the first step to be undertaken when implementing a quality assurance program. 'Standards describe the expected level of work performance and serve as a basis on which the quality of that specific work performance (practice) can be evaluated' (Muller, 1992). The significance of standards in nursing care is indicated as follows:

- They can be used to evaluate work performance
- The nurse can use them to self-evaluate her practice
- They improve work satisfaction by providing objectives for professional practice
- They can be used in orientation
- They can be used for teaching
- They improve the quality of nursing care
- They reduce health care costs

There were no standards of care available to the nursing staff in the Neonatal Intensive Care Units where this research was undertaken. Standards for structure have clearly changed since the development of the two NICUs in the study as the NICUs were developed more than 10 years ago. One of the NICUs is due to be redeveloped in the foreseeable future and the standard used for the renovation design was agreed as the desirable standard for structure. The outcome standard is reflected in the outcomes achieved and is the ultimate test of the use of the structure and process standards (Donabedian, 1969).

In preparation for developing standards of practice, the researcher conducted a literature search confined to articles relating to practice that were published after 1990 in order to obtain data reflecting the changes and trends in neonatal care. Literature was obtained by using the *Medline* search facility, as well as *WinSPIRS 4.0*. Recent issues of journals were read and relevant articles selected for the literature review as well. Certain text and reference books were also used.

Other sources of information relating to practice were also used. The *Neonatal-talk list* is an interactive subscriber-based list hosted by the *Journal of Neonatal Nursing* on the electronic media. Neonatal nurses from around the world submit queries relating to practice and hold discussions on this forum which provides relevant and valuable information. The *NICU Net* was a similar forum (in existence at the time of conducting this review), used mainly by neonatologists, with a number of neonatal nurses subscribing as well, to discuss queries, many of which are related to practice.

The researcher has been working in the NICU for more than twenty years and has also used this extensive experience when writing the standards that were used in the evaluation of practice.

2.4.1 Standards in the NICU

Neonatal nursing care is continually evolving and changing as more is revealed from experience and research in the speciality about how best to care for these infants. Cognisance should be taken of the fact that the preterm infant should still be in utero and therefore not exposed to loud noise, bright light, temperature variations, odours and

tactile stimulation which form part of its' experiences after birth and in the NICU. Noise in the NICU can be regarded as equally as noxious a stimulation as nursing interventions, according to Zahr and Balian (1995). The period of 28 to 36 weeks gestation has been shown to be the time when there is rapid development of the brain (Symanski, Hayes and Akilesh, 2002) and each of the sensory systems (Mc Grath, 2000). Exposure to the stimulation of noise, light and procedures in the NICU can influence arterial oxygen saturations and contribute directly to the development of chronic lung disease (Als et al, 1994). The unexpected activation of the immature brain of the preterm infant may interfere with the development and full differentiation of the neuronal pathways (Als, Lawhon, Duffy, McAnulty, Gibes-Grossman and Blickman, 1994). The physical and social environments in which the infant is placed can delay or distort the growth and development of the infant. Environmental noise can also have an adverse effect on the NICU staff resulting in fatigue, irritability, impaired judgement and altered perceptions. Staff may habituate to unit noise and consequently have slower responses to alarms and potential increases in the overall noise level. Parents can be affected by noise as well, with the environmental stimuli, monitors and alarms distracting them from their infant and adding to their stress. The NICU was an alien environment to most of the parents of infants in the study hospitals, which is an added significant stressor.

The infant is exposed to many interactions and investigations during its course in the NICU so the contacts made by the nurses are rarely social. Nursing interactions can have negative implications for the infant. Traumatic and intrusive procedures like chest physiotherapy and endotracheal tube suctioning and even routine activities like changing a napkin have been shown to cause hypoxaemia (Graven, Bowen, Brooten *et al.*, 1992:267-275; Harrison, 1997; Oehler, 1996). Infants should be disturbed as little as possible and interventions should be grouped or 'clustered' (Modrcin-McCarthy, Mc Cue and Walker, 1996). The NICU nurse has an obligation to the neonate to consider these factors at all times so that the infant's eventual outcome is affected as little as possible as a result of external influences during its stay in the NICU. Noise should be baffled and lighting cycled with the intensity of lighting reduced (Graven, Bowen, Brooten *et al.*, 1992:164-172). With this in mind, the researcher identified certain interactions that nurses have with infants in Neonatal ICU and developed process standards of care for these.

The literature review for the specific process standard writing will now be discussed.

2.5 Structure Standards

The data collected for the writing of structure standards originated from local and international literature, as well as from the *Neonatal-talk list*. Structure standards include the physical structure of the NICU, the equipment available, staffing and other aspects that include Quality Assurance, orientation of new staff, and continuing education.

The American recommended standards for newborn ICU design were found to be the most explicit, with clear descriptions of recommendations and a guide to interpretation of each design standard. The standards were reviewed in January 2002 and it is stated in the document that they will be regularly upgraded in the future. These standards have been endorsed by significant Neonatal and Paediatric organisations in the United States and have been adapted by the American Institute of Architects (Recommended Standards for Newborn ICU Design, 2002). The document deals only with the physical structure requirements of the Neonatal ICU.

The British Association of Perinatal Medicine has published a document titled 'Standards for Hospitals Providing Neonatal Intensive and High Dependency Care'. This document defines the different categories of care, being level 1, 2 and 3. It further discusses equipment required for the stabilisation and transfer of sick infants to institutions that provide advanced care. There is not a detailed description of the exact physical requirements for the NICU as found in the American document, but there is discussion of staffing requirements that includes nursing and medical staff, sub-specialists and additional staff. When considering the formula for staff needs, allowance must be made for annual leave, sick leave, maternity leave, education and training requirements (Redshaw and Harris, 1995). Continuing professional development, clinical protocols, monitoring of long term morbidity and quality assurance are considered part of structure standards in this document.

In the Provincial Gazette no. 5728 of the Province of the Western Cape, recommendations are given for the minimum structure requirements of the Nursery and the NICU. These are not as detailed as the American requirements, but were used in

conjunction with the American standards and the British standards to formulate structure standards by the researcher. The use of American standards was considered appropriate as it is the approach used by a firm of architects contracted to design reconstruction of the NICU at one of the study hospitals.

Factors considered to be important include lighting and noise reduction in the NICU (White, 1996). Attention should be paid to the intensity of lighting and the need to cycle the lighting in the NICU so that the infant has a darkened, quiet environment at night which has been shown to lead to improved weight gain, a reduced length of stay and enhanced motor co-ordination when compared with infants exposed to continuous light (Miller *et al.*, 1995). There is abundant evidence that noise interferes with infants sleep, and causes episodes of desaturations and increased intra-cranial pressure (Graven, Bowen, Brooten *et al.*, 1992). Staff need to be made aware of this problem as they can help reduce noise by reducing volume of radios, level of conversation, telephones and intercoms. Other ways to reduce noise include using plastic refuse bins or pedal operated bins that do not make a noise on closing and placing mechanisms on doors to prevent them slamming.

2.6 Process Standards

In order to produce appropriate standards of care for assessing nursing care in the NICU, the researcher searched the literature for articles on research and practice. The literature review for the writing of the standards will now be discussed.

2.6.1 Hourly Observations.

The infant receiving intensive care should be observed continually to ascertain if there is any change in its condition and to assess any needs that may have arisen since the last intervention. It is not sufficient to rely on electrical instrumentation for the detection of problems in the NICU infant and the survival of the infant is primarily dependent on the nurse and her observation (Harrison and Peat 1992). For medico-legal purposes and for reference, a regularly documented record of the vital signs of the infant should be kept.

Hourly observations include noting the temperature of the infant and that of the incubator (in servo-controlled open incubators, the preset skin temperature). For accurate monitoring of the infant's temperature and maintaining thermal homeostasis, the placement of the temperature probe is a basic component of neonatal care (Blackburn, de Paul, Loan, Marbut, Taquino, Thomas and Wilson, 2001). Positioning a probe on an infant's back and then allowing the infant to lie on the probe has been shown to affect accuracy of the temperature measurement. Consensus has not been reached on the optimal place to apply the temperature probe, but research has indicated that it is preferable to position the probe over soft tissue and not over ribs or on extremities (Blackburn *et al.,* 2001).

Other hourly observations should also include heart rate and the pulse oxygen saturation value (SpO_2) which can be read form the saturation monitor or from the modular vital signs monitor. Trials have shown the accuracy of SpO_2 readings when compared with blood oxygen saturation (Hay, 2000), but it is important that when the oxygen saturation reading is taken from the monitor, it is not a 'low quality signal' as this will not be an accurate record of the saturation.

Respiratory rate should be counted while the nurse watches the infant breathe for at least 15 seconds and not copied from a monitor, as electronic respiratory monitoring can be inaccurate. Ventilator or oscillator pressures and the percentage of oxygen delivered, blood pressure and the Mean Arterial Pressure should also be recorded. The ventilator tubing should be checked for collection of condensate in it and condensate should be emptied into the water trap which should be emptied when necessary.

An assessment of the intravenous site should be made. In peripheral insertion sites this should include checking for redness adjacent to the site of insertion of the cannula, oedema or redness at or around the tip of the cannula and leaking at the puncture site. Centrally inserted lines may gain access via the umbilical vein or from a peripheral vein which is then advanced to a central position. These should also be checked for inflammation at the entry site of the cannula, and for leaking. In a survey of 305 nurseries in the United States of America, Trotter (1998) found no consistent documented standard for cannula care and maintenance.

Other factors that should be observed are the temperature of the humidifier and the level of water in the humidifying chamber. The position of the infant should also be observed and should be changed when the infant is awake or being disturbed for investigations. The position of the intragastric tube should be checked, especially in infants who are receiving continuous feeding. The purpose of observing the *infant* should be foremost in the nurses' mind. This is to detect changes in the infant's condition and to act appropriately.

In writing the process standard the researcher has included critical elements for observation. There is little point in recording hourly observations if the nurse making those observations does not refer to previous observations in order to establish whether the patient's condition had changed. In this case 30% of the allocated mark for the assessment was deducted if reference to previous observations is not made.

2.6.2 Routine Care

This process standard includes cord, mouth and buttock care. It is important that the infant should not be disturbed from its pattern of sleep and wakeful cycles as this would cause unnecessary stress to the infant. Theoretically, reducing the stress that the patients undergo in the NICU leads to improved outcomes and reduced hospital stays (Peters, 1999). This would have an impact on the immediate and future costs of healthcare for the patent. With this in mind, the routine care should be undertaken when the infant is awake and not approached as a routine (3 or 4 hourly) intervention.

Cord care can be viewed as an intervention that deserves research into current practices in other NICUs as well as a literature review. The chief reason for doing cord care is to keep the cord stump free from infection (E. coli, Staphylococcus Aureus, Group B Streptococcus and Clostridium Tetani) and to assist drying and separation of the cord. O'Kane (1995) found little evidence of the benefit of using 70% Alcohol as it appears to cause the cord to remain moist, foul smelling and some reported that the cords took longer to separate (Dore, Buchan, Coulas, Hamber, Stewart, Cowan and Jamieson, 1998). There was also a suggestion that 70% Alcohol may destroy the protective amniotic cover of the cord and a constituent of the Wharton's Jelly which could promote natural healing. However, 70% alcohol was the most popular solution

used for cord care. Other methods used were dusting with hexachlorophene powder and application of Chlorhexidine at regular intervals, to the base of the cord using swabs. There is another school of thought that prefers no interference with the drying process of the cord and to leave it to dry naturally. A study conducted by Dore *et al*. (1998) using term infants showed that the cords in the natural drying group separated 1.7 days earlier that those in the alcohol care group. The World Health Organisation (1999) recommends that infants in hospital nurseries and intensive care units should have a topical antimicrobial applied to the cord stump at birth and for the first three days of life, to reduce colonisation of harmful bacteria. They acknowledge that the substance used would depend on the predominant flora and should have a broad spectrum of activity for example: Chlorhexidine, Silver Sulphadiazine®, Tincture of Iodine®, Povidone-Iodine® or Triple Dye. However each of these solutions has potential complications and more research into this intervention is needed. It is recommended that newborn infants should be placed on the mother's skin at birth in order to promote colonisation of the infant with non-pathogenic bacteria from the maternal skin flora, and breast fed to provide the infant with antibodies. Cords found to be smelly or 'sticky' should be carefully cleaned when bathing the infant and changing the napkin with the solution recommended in the particular institution.

Mouth care should only be done when the infant is awake. Most infants in the NICU are prone to develop dried crusty secretions on their lips. These can be cleaned away by rubbing the lips gently with a swab moistened with glycerine or normal saline. Regular mouth care will prevent the formation of these crusts.

Changing the napkin and care of the buttocks of the infant should be done when the infant is wakeful and active. The area under the napkin should be cleaned with warm damp swabs, dried and a barrier cream applied. The cream used will be specific to each institution.

Once the routine care has been completed, the position of the infant should be changed. This is necessary to facilitate postural drainage in infants who may be sedated or are not active and to prevent shaping of the skull from constantly lying in one position. It is important that the nurse observes the infant carefully when changing the position of the infant as many ill preterm infants do not tolerate frequent changes of

position (Enzman Hagedorn, Gardner and Abman in Merenstein and Gardner 2002). The infant should be gently rolled to the new position as 'flipping' the infant over from prone to supine or vice versa, will be disorientating to the infant.

The two most commonly seen deformities are scaphocephaly, or the elongated shape common in infants whose heads have been turned from side to side and plagiocephaly where there is a flattening over the occipital area from supine lying and preference for facing in a particular direction (Sweeney and Gutierrez, 2002). When positioning the infant the nurse must consider supporting the posture of the infant, promoting movement, optimising skeletal development, providing controlled exposure to stimuli and promoting a calm behavioural state. The use of rolled blankets to create a boundary around the infant and promote flexion of the limbs, or the use of similar supportive aids is recommended so that developmentally appropriate positioning is achieved.

2.6.3 Physiotherapy and Suctioning of Intubated Infants

It is frequently necessary for intubated infants to require physiotherapy and suctioning in order to clear secretions and maintain a patent airway so that adequate ventilation and oxygenation is assured. Secretions that localise in one area of the lung when an infant's position is not changed can predispose to the development of hypostatic pneumonia (Enzman Hagedorn *et al.* in Merenstein and Gardner 2002).

As previously stated, the careful changing of position of the infant will assist with postural drainage of pulmonary secretions. Percussion and vibration are also frequently used to loosen and move secretions in the bronchial tree. This should be done with caution as rib fractures have been seen following vigorous percussion (Enzman Hagedorn *et al.* in Merenstein and Gardner, 2002). Percussion consists of gentle tapping over the affected lung, and the use of a vibrator on expiration can help to move secretions with exhalation of air. Physiotherapy is associated with decreases in the SpO_2 and signs of stress such as bradycardia, cyanosis, struggling, and should be practiced with caution. The most severe complications reported as a result of physiotherapy to the chest are the increased risk of intra-ventricular haemorrhage and encephaloclastic porencephaly which involves the periphery of the brain (Harding, Miles, Becroft, Adams and Knight, 1998). Consequences of this pathology vary, with

cognitive delay and mild hemiplegia to severe spastic quadriplegia seen in surviving infants at 6 to 16 months of age.

Enzman Hagedorn *et al.* (Merenstein, Gardner, 2002) state that there has not been sufficient research into technique, efficacy, complications, outcomes, safety and frequency of chest physiotherapy and make the recommendation that it should be used with caution. They also recommend that it should not be practiced on very low birth weight infants in the first month of life and should only be done for definite indications and when the infant is able to tolerate the procedure. It should be done after careful assessment, not 'routinely'. Percussion should only be used when secretions are not cleared by suction alone.

Endotracheal (ET) suctioning is a sterile procedure and should be performed when indicated and not as a routine intervention as it is a potential hazardous procedure. During suctioning the infant is exposed to hypoxia and changes in blood pressure which can lead to changes in cerebral blood flow and increased intracranial pressure which will predispose the infant to an increased risk of Intra Ventricular Haemorrhage (IVH). It is sometimes advisable to hyperoxygenate the infant by increasing the percentage of oxygen delivered by 10% for two minutes prior to suctioning. Research has also found that bag-ventilating the infant immediately after suctioning with 100% oxygen for three breaths shortens the time to recovery of the infants' baseline saturation (Evans, 1992). Care must be taken not to predispose the infant to developing retinopathy of prematurity from hyperoxic events (Enzman Hagedorn *et al.* in Merenstein and Gardner 2002). The use of the closed suction catheter system reduces the risk of hypoxic events as oxygenation and ventilation are maintained while the procedure is performed, but the high cost of these catheters limits their availability for use in the NICUs where data was collected.

While the presence of the endotracheal tube may cause an increase in pulmonary secretions, consideration of the disease process that is present must be given: patients with Respiratory Distress Syndrome (Hyaline Membrane Disease) produce fewer secretions in the acute phase which lasts approximately 72 hours and will require less frequent or no suctioning. Patients with meconium aspiration, pneumonia or chronic lung disease will require more frequent suctioning (Daugherty Wrightson, 1999). Assessment of the need for suctioning should include the following:

- Evidence of secretions: secretions may be visible, audible on auscultation or palpable through the chest wall.

- Alteration in vital signs: increased work of breathing, changes in respiratory rate and heart rate.

- Alteration in neonatal state: irritability, agitation, restlessness, hypertonia, hypotonia, listlessness, lethargy.

- Alteration in oxygenation and ventilation: desaturations (<90%), skin colour changes, changes in arterial blood gas values. (Enzman Hagedorn *et al.* in Merenstein and Gardner 2002).

The technique of suctioning will now be discussed. The negative pressure of the suction should preferably be set at between 60 – 80mm Hg. Many nurses prefer to instil Normal Saline into the endotracheal tube before suctioning. The reason cited for this is that is it thought to loosen secretions, to thin secretions, to encourage the infant to cough and to aid in the passing of the catheter in the ET tube. It has been shown that it is unlikely that the instillation of saline thins the secretions as mucous and saline do not mix when shaken together and the saline does not necessarily come into contact with the mucous secretions when instilled into the ET tube. The only justifiable reason for the use of saline before suctioning is that it may act as a lubricant when passing the suction tube through the ET tube. In this case a very small amount of saline should be used (Daugherty Wrightson, 1999). Beerham and Dhanireddy (1992) found that there was little difference in the SpO_2 after suctioning infants with and without saline. This was a comparative study done of infants with Meconium Aspiration and Respiratory Distress Syndrome (Hyaline Membrane Disease).

The suction catheter should not be inserted more than 1cm past the end of the ET tube, and the number of times that the catheter is passed through the ET tube should be limited to as few as possible. The ventilator should be reconnected after each pass down the ET tube, allowing the infant's oxygen saturation to return to the baseline level before repeating the procedure (Daugherty Wrightson, 1999). Time taken for recovery can be reduced by using developmentally supportive techniques such as containing the infant in a 'nest' made from rolled blankets surrounding the infant.

2.6.4 Administration of medications

The administration of medications in the NICU must be undertaken by registered nurses. The prescribed medication dosages are usually very small and the calculation of the dosage to be given should be checked with another nurse to ensure correct dosage. In many NICUs overseas the nurse is required to check the calculation and amount drawn up with another nurse and two signatures are recorded on the medication chart for the administration of the medications.

When giving medications into the intra-gastric tube, it is essential that the nurse determines the position of the tube before giving anything through the tube. Care should be taken to keep the plug that closes the end of the tube clean and uncontaminated. If continuous feeding is in progress through tubing that is fitted to the intra-gastric tube, the end of the feeding tubing should not be permitted to lie on the bedding or to touch anything while disconnected for the administration of the medications, in order to keep it free from contaminants. Because the volume required is so small, when giving medication doses less than 1ml, a 1ml syringe should be used to ensure the accuracy of the volume given.

Intramuscular injections should be avoided as the pain resulting from these could compromise the infant's state in a similar way to physiotherapy and suctioning, which should be avoided. When intramuscular injections are unavoidable, the nurse should console the infant and attempt to restore it to a state of peaceful rest. Intramuscular injections should be given in the middle third of the anterior aspect of the thigh. In infants weighing less than 1500gm the volume of one injection should not exceed 0,5ml. Intravenous injections are given once the site of the cannula has been checked for signs of infiltration, patency and infection. When using the needleless system the site for insertion of the syringe should be cleaned with an alcohol swab. Nurses should refer to available literature e.g. the Neofax, to ensure the safe administration of medications and to determine if multiple antibiotics can be given after each other. It is preferable to allow the intravenous fluid to run for 30 minutes in order to flush the medication from the tubing before giving a second antibiotic via the intravenous line. Certain antibiotics should be titrated and given over a period of time.

2.6.5 Endotracheal Intubation

This is an intervention that is not performed frequently by nursing staff, but nurses working in NICU should be competent at performing intubation in emergency situations. The nurse should know and understand indications for intubation and should try to maintain the skill (Bloom and Cropley, 1995).

The endotracheal tube should be kept sterile and it is preferable to have an assistant when intubating an infant, however the procedure can be performed unassisted by a skilled practitioner. The appropriate size of tube should be selected and the required length noted. The introducer should be inserted into the tube taking care that it does not protrude beyond the end of the tube. Oxygen attached to a resuscitator must be available. The percentage of oxygen used will be determined by the condition of the infant. It is also necessary to have suction with an appropriate size suction catheter available. The gastric contents may be aspirated before attempting the procedure, and the oropharynx suctioned to improve visibility (Davis in Beachy and Deacon, 1993). Attempts at intubation should be stopped if the procedure has not been accomplished within 20 seconds and the infant should be stabilized by ventilating with a mask and 100% oxygen (Bloom and Cropley, 1995). A saturation monitor with heart rate indication should be attached to the infant while intubation is being attempted.

On successful completion of endotracheal intubation the nurse should ensure that the endotracheal tube is appropriately secured and that the infant is comfortable and correctly positioned.

2.6.6 Supplemental Oxygen therapy

Supplemental oxygen can be delivered to the infant by headbox or nasal cannula. The physician will usually decide which method will be used.

It is preferable that the oxygen is mixed in a blender with compressed air and then piped to the headbox or nasal cannula. The headbox should be an appropriate size for the infant as a box with a large opening will allow for leaking of the blended air and a less

reliable delivery of oxygen. It is not possible to determine the exact amount of oxygen delivered by nasal cannula, so regular monitoring of SpO_2 must be recorded. The nasal cannula should be secured to the infants face by taping it carefully to the cheeks. Infants are obligatory nasal breathers, so the nurse should always ensure that there is no obstruction to the nasal passages e.g. by milk or mucous, and suction carefully as needed. It should be borne in mind that continuous positive pressure can be generated by using more than 0, 5 L/minute of flow in the nasal cannula. This can be used to advantage in infants with apnoea and in preterm infants.

As oxygen is a drug, it should be used with due caution. Oxygen should be humidified to prevent insensible water loss and because dry gases will be irritating to the airways. Warming the oxygen will prevent cooling of the infant's head and face. It is necessary that the concentration of the oxygen is stable as fluctuations in the amount delivered will cause complications in the physiological state of the infant and can predispose the infant to retinopathy of prematurity. Infants receiving oxygen therapy should be clinically monitored and the amount of oxygen delivered to the infant and the SpO_2 should be recorded regularly.

When weaning the infant off oxygen, reductions in the concentration of oxygen should be made gradually and the patient should have continuous saturation monitoring to ensure that weaning is appropriate and that saturations of oxygen do not drop below acceptable levels (Enzman Hagedorn *et al.* in Merenstein and Gardner, 2002). For the purpose of this study, only infants receiving headbox oxygen were included.

2.6.7 Initiation and care of IV therapy in a neonate

Neonates who are unable to have gastric feeding, are hypoglycaemic or need intravenous medications will require intravenous therapy or access. This may be initiated via a peripheral intravenous cannula (PIV).

The insertion of a PIV is a painful procedure and consideration must be given to this fact when attempting this procedure. It is preferable to give some form of analgesia to infants undergoing the procedure (Cotton, Turner and Miller-Bell in Merenstein and Gardner, 2002). The ability of the nurse undertaking the insertion of the PIV cannula

should be taken into consideration and no more than two attempts should be allowed for each person attempting the procedure (Franck, Hummel, Connell, Quinn and Montgomery, 2001). Some practitioners use normal saline to flush the cannula after successful initiation of the PIV. This can be a useful aid to determine that the cannula is not inserted into an artery, to determine the position of the PIV in the vein and to clear the cannula of blood before initiating the infusion (Davis in Beachy and Deacon, 1993). The nurse should check the intravenous site hourly for signs of infiltration and infection. A restraint or splint may be used to stabilise the limb in which the PIV has been inserted. Care should be taken to ensure that this is appropriately applied.

Complications of this procedure are infiltration of the intravenous fluid into the surrounding tissue which can result in necrosis of surrounding tissue, haemorrhage, haematoma, air embolus, clot embolus, infection, needle injury to surrounding structures and accidental arterial cannulation.

2.6.8 Capillary Blood Sampling.

The heelstick is the preferred site and method for collection of small quantities of blood for investigations in neonates.

The heel is quite vascular and has relatively few nerve endings (Meehan, 1998). However, a heelstick is a painful procedure and the nurse can attempt to reduce the pain and discomfort felt by warming the heel. It is important that the nurse allows the area swabbed with the alcohol prep swab to dry completely before lancing the heel. This prevents haemolysis of the specimen resulting in errors e.g. in the blood glucose values (Meehan, 1998). The depth of the heelstick should not exceed 2mm, but should be less in infants smaller than 1500gm (Meehan, 1998). This will ensure that there is a good flow of blood, eliminating the need to squeeze the heel, which increases pain and can cause inaccurate results as interstitial fluid can contaminate the specimen and red cells can be haemolysed by squeezing the heel. The puncture site should be on the lateral or medial aspects of the heel (Meehan, 1998 and Davis in Beachy and Deacon, 1993). Care must be taken that the depth of the heelstick is appropriate as a puncture that is not deep enough will not give an adequate specimen and one that is too deep can cause trauma to the surrounding tissues and bone resulting in infection.

After the specimen has been collected, gentle pressure with a dry swab will assist in stopping bleeding.

2.6.9 Capillary Blood Glucose Measurement

The collection of the specimen of blood for this procedure has already been discussed. When collecting blood for the measurement of glucose concentration, care must be taken that the alcohol used in the prepping of the area for the heelstick has been dried or wiped to prevent haemolysis of red cells which will result in an inaccurate result. There has been discussion on the Neonatal-Talk list regarding the practice of collecting blood specimens for blood glucose readings in capillary tubes. It is felt that specimens collected in this way do not give accurate results. The results were compared simultaneously with specimens not collected in capillary tubes and it was found that the specimens in capillary tubes gave a higher blood sugar level reading than those collected directly onto the test strip.

The nurse must be aware that the reading given by the glucometer may not be reliable or accurate (McGowan, Enzman Hagedorn and Hay in Merenstein and Gardner, 2002). The drop of blood used on the test strip must be adequate and the procedure of the test must follow protocol absolutely as failure to do this can result in inaccurate results and unnecessary treatments with consequent neurological and metabolic compromise. It is preferable that all abnormal readings from the glucometer should be checked with a serum glucose level from a laboratory; however this is not always possible, or it is not done because of containing costs in the hospitals where the study was undertaken.

The suggested acceptable levels of blood sugar in term infants is >2.5mmol/L and in preterm infants the suggested level is >2.6mmol/L (Cornblath, Hawdon, Williams, Aynsley-Green, Ward-Platt, Schwartz and Kalhan, 2000). However, each institution may have its own acceptable ranges and the nurse should be capable of taking the correct remedial action as prescribed.

2.6.10 Passing an Intra-gastric Tube

Infants who are unable to suck because of immaturity or illness can be fed intragastrically via a tube passed through the nose or mouth of the infant. An intragastric tube is also used to collect specimens of gastric aspirate and to perform gastric lavage.

There are Polyvinylchloride (PVC) and polyurethane intragastric tubes available, but in the institutions where data was collected, only PVC tubes were available. It is recommended that the PVC tubes are changed weekly as the plastic tends to harden in time and this can cause trauma to the stomach mucosa and in the worst case scenario, perforation. When changing the intragastric tube, alternate nostrils should be used. A size 5 Fr tube should be used for infants weighing less than 1000gm, size 6 Fr tube for 1000 – 2500gm and size 8 Fr tube for infants larger than 2500gm. Infants receiving CPAP via nasal cannula should have the tube passed orogastrically.

The desired length of the tube can be calculated in two ways: measure the distance from the tip of the nose to the base of the ear and then to halfway between the xiphoid process and the umbilicus (Estrada and Brennan-Behm in Beachy and Deacon, 1993), or by doubling the distance from the suprasternal notch to the xiphoid process and adding 2.5cm (Harrison, 2002). The desired length should be marked on the tube to allow for accurate checking of the position of the tube before feedings. It is important that the nurse takes into consideration the fact that the holes in the distal end of the tube are sometimes positioned as much as 2.5 cm from the tip and the measurement of the length for passing the tube should accommodate this.

Before initiating a feed, the nurse should verify that the tube is still in the correct position by checking that the tube is still properly strapped and that the mark of length is in the correct position at the nostril. If it appears that the tube may have slipped out, it should be re-advanced and then the position confirmed by injecting 0.5 to 1 ml of air down the tube while listening over the stomach area with a stethoscope for the characteristic sound of air entering the stomach.

2.6.11 Gastric Lavage

This procedure is undertaken when there is evidence of meconium stained liquor or excessively bloodstained liquor during the first and second stages of labour, after rupture of the membranes, with the possibility that the infant has swallowed some of the contaminated liquor. Removing the meconium from the stomach will prevent the development of gastritis and its associated complications. Excessive blood in the liquor will cause the infant to vomit and should preferably be removed. These infants can be considered to be compromised as the passing of meconium during labour is a reflection of distress in the infant and can result in a neonate with major pathology after delivery. If there is excessive maternal or foetal blood in the liquor, this can be an indication of bleeding from the utero-placental surface and potential pathology following hypoxia in the infant.

The gastric lavage is done through an intragastric tube, the passing of which has already been discussed. Once the tube is in situ, the nurse should gently aspirate the contents of the stomach to remove as much as is possible from the stomach. A solution of 2% sodium bicarbonate is then injected through the tube into the stomach (Harrison, 2002). Volumes should be restricted to 5ml in infants over 1000gm and 2.5ml in infants smaller than 1000gm. In infants weighing more than 4000 gm the nurse may prefer to use up to 10 ml for each injection of sodium bicarbonate, but the infant must be observed carefully to detect signs of discomfort due to the volumes of fluid being injected into the stomach. Care should be taken when withdrawing the solution from the stomach as trauma to the mucosa will result from pulling too hard on the plunger. The returned volume should be noted to prevent an amount of sodium bicarbonate being left in the stomach. Once the returning fluid is clear, the procedure can be completed. The nurse will assess if the tube should be left in situ or removed.

Careful observation of the infant is necessary during this procedure as the infant can become distressed and the nurse should take remedial action if the infant indicates distress.

2.6.12 Jaundiced infants under phototherapy

Infants who appear to be jaundiced and have an elevated Total Serum Bilirubin (TSB) will require phototherapy to reduce the TSB and therefore avoid the necessity for an exchange transfusion.

Each nursery has its own policy and graphs that prescribe the levels of TSB requiring treatment. This is related to the age and weight of the infant. It is important that the nurse calculating the level of TSB takes into consideration the age of the infant in hours since birth and not in days of age, as there can be a significant difference between the two resulting in a delay in starting phototherapy with a corresponding increase in the TSB. The clinical status and history of the infant should also be considered when interpreting TSB results to decide whether or not to commence phototherapy (Beachy in Beachy and Deacon, 1993).

When commencing phototherapy the nurse should ensure that the fluorescent light tubes in the phototherapy light unit to be used are all in working order and that there is a Perspex shield in place between the infant and the lights in the case of fluorescent tube lights. If the infant is being nursed in an incubator, the infant must be observed for hyperthermia and remedial action taken. Infants in an open bassinette will need observation for hypothermia. All infants receiving phototherapy must have their eyes covered with an eye pad. This should be carefully fixed to prevent the nostrils from being occluded. The eye pads should be removed whenever the infant has a feed to allow for contact between the infant and its mother and also to check for any discharge or excessive tearing that could indicate the need for further investigation. The hydration status of the infant needs regular assessment as infants receiving phototherapy can require extra fluids to replace insensible water loss and increased water loss in stools (Gilbert Frank, Cooper and Merenstein in Merenstein and Gardner, 2002). Regular turning of the infant under phototherapy will allow for maximum exposure of skin area to phototherapy and this can shorten the duration of phototherapy. Infants are nursed without a napkin to increase the skin area exposed to the phototherapy and should be turned when awake to allow for more skin to be exposed to phototherapy. The infant should be placed at a distance of 20 – 40 cm below the lights (Dent in Boxwell, 2000). The TSB should be checked within 24 hours of stopping phototherapy.

- The mother should be encouraged to interact with her infant and to continue feeding and caring for the infant while receiving phototherapy. It is important that the parents understand the pathology of Neonatal Jaundice to allay fears that they might have of further pathology in their infant.

2.6.13 General hand washing process standard

Sick and immature infants in the NICU are very vulnerable to infection. Hand washing is the most important procedure for controlling infection in the NICU. On entering the NICU, all persons who are going to interact with the infants should wash their hands thoroughly with the appropriate soap provided e.g. Chlorhexidine or Hexacholrophine products (Merenstein, Adams and Weisman in Merenstein and Gardner, 2002). It is essential that all staff interacting with the infants should spray their hands before and after touching infants. The spray used is an antimicrobial spray that has been proven to be effective. After any contact with contaminated objects from an infant, hands should be washed again with soap and then sprayed with the hand spray as well (Merenstein, Adams, Weisman in Merenstein and Gardner, 2002).

In the standards written for the purpose of evaluation of practice, each interaction with an infant is preceded by 'aseptic technique' which includes washing and spraying hands with antiseptic. For practical reasons, the procedure of washing hands was not applied to every assessment. It was however observed for and marked accordingly.

2.7 Outcome Standards

General outcome standards in nursing refer to the effect of nursing care on individuals and populations (Griffiths, 1995). In order to monitor outcomes in a clinical setting such as the NICU, outcomes should be evaluated from three aspects: administrative, economic and clinical (Petryshen and Stevens, 1995).

Administrative outcomes are associated with the managerial aspects of the NICU. They measure the efficacy (the expected benefit of the provision of nursing services), efficiency (the use of resources and technology by skilled practitioners with minimum

waste to improve the delivery of care), effectiveness (the benefit of health care when protocols, work design and delivery models are implemented) and equity (what is just and fair in the provision of health care) of care given. It was not possible to measure any of these factors as the service is not geared to this nature of assessment of care. However there are changes afoot in the management of the NICUs in the study and it may well be possible to assess these aspects in years to come.

Economic outcomes reflect the cost-effectiveness of the delivery of care and include the aspects of utilization and optimalization. Utilization refers to the way that the resources are used and optimalization refers to the balance between the quality and cost of nursing care. The recently implemented changes in the financial management of the hospitals in the Western Cape will allow for assessment of these aspects in the future but it was not possible to include this aspect in this study.

Clinical outcomes are the most important as they measure the direct benefit of care. They include morbidity/mortality, severity of illness, quality of life and satisfaction. Morbidity /mortality outcomes are reflected by the statistics shown in the NICU. These include admissions, deaths and length of hospitalization. Severity of illness is an area requiring ongoing research which is not available in the NICUs of this study and so this aspect could not be indicated in this study. Quality of life is an aspect that cannot be commented on as the infants are followed up after discharge for a limited time and then referred to specialists in the children's hospital when needed and are therefore lost to the hospital's own data base. Satisfaction is not a relevant clinical outcome for NICUs as preterm infants cannot give a verbal report.

For the purpose of this study, an analysis of statistics relating to the midnight census in the various areas of the nursery revealed average daily census from which the nursing workload could be extrapolated. Other statistics obtained from one or both of the study hospitals include: the number of admissions to the nursery in five different weight categories, the numbers of infants on Intermittent Positive Pressure Ventilation (IPPV), High Frequency Oscillatory Ventilation (HFOV), Continuous Positive Pressure Ventilation (CPAP), Phototherapy and receiving Kangaroo Mother Care (KMC).

Outcome statistics should be readily available and understandable and should be utilized for the assessment of care given. Making such statistics available for perusal in the Nurseries will allow the staff to reflect on the outcomes of care will allow assessment of care which is part of Quality Assurance.

2.8 Conclusion

This chapter discussed the review of the literature used for the study. The researcher selected articles that had been published since 1990 so that the standards created reflected more recent trends in both structure and process in neonatal care. Standards were created for assessment of the structure of the two NICUs in the study. The process standards were written and evaluated after which assessment of the care given was undertaken. Data relevant to Outcomes Standards was identified. Chapter 3 will discuss the methodology of the research including the development of the standards.

CHAPTER 3
Research Methodology

3.1 Introduction.

Chapter 2 gave a discussion of the Literature Review and introduced factors that influenced the researcher in developing the theoretical framework and the data collection instruments for the study.

This chapter will discuss the different phases of the research methodology in depth. Burns and Grove (1993) state that absolute rigor must be applied with the implementation of the research methodology as this is the crucial part of the research project, determining the scientific validity of the whole project.

3.2 Research Design.

The research design selected is the design that is most suitable to answer the research question (Cormac 1996). The design guides the researcher in the planning and implementation of the study in a way that is most likely to achieve the intended goal. The research design should increase the probability that the study results are an accurate reflection of reality (Burns and Grove, 1993).

A non-experimental, exploratory descriptive design was used for this study. While the researcher acknowledges the fact that there are many variables influencing standards of care, the scope of this project was rather to explore and describe the dimensions of a phenomenon. In this study the structure, process and outcome of neonatal care are

investigated in an attempt to provide insight into the quality of care being rendered. Giving complete and accurate information through observation, description and classification adds value to the whole project of evaluating the standard of care in a NICU. Brink (1996) states that observation, description and classification can produce similar, if not even more valid results than a poorly planned experimental study. Tappen and George (Tappen 2nd ed. no date) state that observation is probably the most reliable method to evaluate care, although it is also probably the most time consuming method.

3.3 Sampling

Sampling refers to the process of selecting respondents to form part of the study. Brink (1996) states that it is not feasible to study a whole population. The population and sampling procedures for this project are summarized in table 3.1.

TABLE 3.1

Sampling

Population	Sampling method	Sampling size
Neonatal units in provincial hospitals in the Western Cape (n = 4)	Purposive sampling	2
Specific interactions/procedures	Event sampling	Data-saturation – differs depending on event

To select the neonatal units, purposive sampling, a form of non-probability sampling was used. The reason for using this method was that the researcher is well-known to staff in these units based on practical experience of more than 20 years and because she has been involved in teaching nurses from the units on four Neonatal Nursing training courses in the past seven years. Due to the nature of direct observation required to obtain data, the researcher was of the opinion that familiarity with surroundings and staff would allow for less suspicion from the staff resulting in more

accurate data collection. The researcher allowed a period of time to pass after her arrival in the NICUs before beginning to collect data to allow the nurses on duty to become accustomed to her presence, thus preventing the “Hawthorne effect” where the nurses being observed change their practice to exhibit outcomes that they perceive the observer is expecting to see (Mateo, in Mateo and Kirchoff, 1999).

To identify specific interactions/procedures, the researcher made use of event sampling, a technique described by Burns and Grove (1993). There are many interactions that take place between the nurse and infant in the NICU. The researcher was particularly interested in evaluating the interactions that called for ‘hands on’ contact by the nurse as this type of interaction can have a great impact on the infant and his progress in the NICU. Advances in NICU care have brought about the approach to ‘developmentally appropriate care‘ (Als *et al.*, 1994). The researcher is of the opinion that, in the South African context, such an approach which has been shown to reduce the length of stay in hospital as well as improve outcomes should be utilized.

The researcher had to depend on data-capturing as the event occurred. Because there was no method to predict when these events occur or how often they would occur, it was not possible to select a sample size prior to the data-gathering phase. The researcher continued with data collection until data-saturation occurred; when no new or conflicting views or findings were revealed. The researcher was limited regarding the amount of data gathered for certain procedures, because during the data collection phase, these events occurred infrequently. The researcher evaluated these particular procedures, but could not draw definite conclusions on the standard of performance, but rather described the trends she identified. In order to maximize the number and types of events observed, the researcher visited the units at different times of the day and on different days. This also ensured that the researcher was not biased regarding any particular staff member, because data collection did not occur at specific times.

3.4 Instruments

Donabedian (1988) defined three areas that can be evaluated when assessing care given: structure, process and outcome. Standards should be available for these three aspects in order to allow for assessment and evaluation. The researcher has written

standards and criteria for the evaluation of structure, process and outcome dimensions for care of the neonate, based on documented research findings, extensive reading, and her own experience of NICU nursing. According to Muller (1992) “standards describe the expected level of work performance and serve as a basis on which the quality of that specific work performance (practice) can be evaluated.”

There are currently no standards or protocols for care in Neonatal Intensive Care Units (NICUs) in the hospitals where the research was undertaken. This means that there is no tool available for nurses to use to evaluate the nursing care that they give, or to assess if standards of care are being adequately maintained. While it is recognized that nursing care standards should be formulated by all members of the multidisciplinary team, for the purpose of this study, the researcher alone formulated the standards, which were then assessed and discussed with a second experienced and highly respected neonatal nurse. This person, with qualifications in General Nursing, Midwifery, Neonatal Nursing, Nursing Education, Community Health Nursing and a B.Cur in Ethos and Nursing Education has held a teaching position at a university and has taught Neonatal Nursing in the public and private sectors. Recommended changes were made to the standards developed and the standards were accepted for the purpose of this study. This approach was used because of the lack of available standards and because the standards were being formulated specifically for the purpose of this study.

The goal of a research project is to gather information and data that represent a general truth about the concept (Thomas, 1992). Validity of an instrument refers to the extent that the instrument measures what it is designed to measure. The most applicable form of validity applied to this project, was content validity. As mentioned in the previous paragraph, an expert was used as a moderator to confirm or differ from the researcher regarding the content and formulation of the standards. Only those actions agreed upon by both the expert and the researcher were included in the finalized document and used to evaluate the care. Validity was further enhanced by the identification of the dimensions of care and core concepts using reference books and journal articles from the library. The researcher is also of opinion that the credibility and transferability of the standards are assured by the fact that at the time of generation of the standards, the researcher was an active participant of the *Neonatal Talk list.* This is a specialized interest group which is hosted by the *Journal of Neonatal Nursing* on the electronic

media. Participants present issues and current practice is addressed and compared in a discussion forum. Participants range from clinical nurses to academic nurses in tertiary level academic positions. This also ensured that contemporary issues were addressed in the standards and that the criteria, used as 'yardstick' against which the care was evaluated, were updated, acceptable and reflected current practice as far as was possible.

Reliability refers to how consistently the instrument measures the concept of interest (Burns and Grove, 1993). Because no standards and criteria for evaluation of care were available in the neonatal units of provincial hospitals in the Western Cape where this study was undertaken, the researcher had to develop these standards and criteria. The results of the pilot study revealed similar results to the main study and the researcher is of the opinion that the credibility and trustworthiness of the standards, as reflected in the in-depth literature study and validation by an expert, was of more importance than a statistical result of the reliability of the study, an argument supported by authors such as Burns and Grove (1993).

A framework for the different standards formulated follows.

3.4.1 Structure standards (Addendum B).

Structure standards describe the environment and the resources available in it.
These relate to the:

- Physical structure of the NICU i.e. facilities
- Equipment
- Human resources i.e. manpower

3.4.2 Process standards (Addendum B).

These standards indicate the actions undertaken in giving and receiving care. They describe the specific actions of care, service and management.
The standards relate to the following:

- Hourly Observation
- Routine Care

- Physiotherapy and Suctioning
- Endotracheal intubation
- Administration of Medications
- Administration of Supplemental Oxygen
- Commencement of Intravenous Therapy
- Collecting a Capillary Blood Sample
- Testing Blood Glucose
- Inserting an Intra-gastric tube
- Performing Gastric Lavage
- Commencing and Nursing an Infant receiving Phototherapy

3.4.3 Outcome standards.

Outcome standards reflect whether the objectives of the process have been achieved. They give an indication of what has been done with the available resources.

The outcome standards for the purpose of this project relate to the following:

- Number of neonates admitted to the Nursery
- Weights of admissions
- Average daily census
- Numbers of infants requiring respiratory support
- Numbers of infants in Kangaroo Mother Care
- Numbers of infants receiving phototherapy

It is necessary for each of the three aspects to be in place if evaluation of care is to be undertaken.

3.5 Pilot study

After the process standards documents were formulated, a pilot study was conducted to evaluate the applicability of the standards; whether the criteria were indeed measurable

and whether instructions were clear. Apart from some minor adjustments to the wording to clarify interactions, no major changes were made to the documents.

The results of the pilot study were discarded before the analysis of the final results.

Structure and outcome standards were not included in the pilot study as the data collected in this assessment would not change due to the nature of those standards.

3.6 Data collection

Data relating to the process standards was obtained over a period of twelve months. The researcher requested formal permission from the institutions involved (Addendum A) and continued based on verbal permission granted. Formal written permission from one institution (Addendum A) was unfortunately only obtained three years later when the researcher was requested for a report on the findings.

The researcher was familiar with the surroundings and many of the staff of the units. Staff were not informed prior to visiting the units, as the researcher did not want the nurses to prepare for her visits which could result in the data collected being skewed. The researcher experienced no hostility on the part of the nursing staff, only curiosity about why she was there. Once staff were aware of her presence, the researcher allowed a period of time to pass before beginning observation and data collection and as there was more than one nurse in the NICU at any time, the nurses were not aware of who was being observed at any time. This adds to the reliability of the findings of the project, as the researcher is sure that the findings relate accurately to the daily care received by neonates. The researcher feels that her presence did not influence the quality of care rendered. When questions were asked of any staff member, this was done after the event and only to verify the observations made by the researcher to ensure correct interpretation of the observations.

Data collection continued till data-saturation took place. The third paragraph under heading 3.3 deals with this aspect.

The researcher was the only fieldworker. The reason for this was because the researcher could not remunerate any field workers and finding knowledgeable volunteers to assist in research for no remuneration was impossible. The researcher also was of opinion that being the only field worker enhanced the credibility of the study, as there was no opportunity for inter-observer variances to occur.

3.7 Data analysis

A checklist was developed for each standard. The following information was recorded on evaluating the criteria:

- Number 1: indicated if the action was carried out safely, effectively and completely.
- Number 2: indicated that the action was not carried out in the presence of the researcher
- Number 3: indicated that the action was not applicable to this patient
- Number 4: indicated an emergency situation resulting in an action not being performed
- Critical elements: identified as crucial elements necessary for the safe performance of the interaction, with a deduction of 30% if not performed

For each standard observed, a total number of criteria applicable to that situation was calculated. In cases of an emergency or where certain interventions were not applicable, the total number of items scoring a 3 or 4 were subtracted from the total and a percentage was calculated for the standards. If there were any critical indicators not performed in the standard, 30% was deducted before calculating the final percentages.

The percentages were then put on EXCEL spreadsheets (MSOffice application) and tables and graphs were used to reflect the descriptive data analysis.

The researcher also took field notes. These field notes were used to identify any themes and sub-themes that emerged and these are described in chapter 4.

3.8 Ethical considerations

No treatment was withheld, changed or applied to the patients during the collection of data for this project. Nursing staff were not interfered with while working in the NICU during the data collection phase of the project.

All standards were assessed anonymously, not referring to a specific neonate, staff member or institution. Anonymity, according to Burns and Grove (1993), guarantees that the identity of the subject can not be linked to his or her individual responses. The purpose of this project was to assess in general the nursing care given to neonates in the NICUs of the hospitals selected and not to identify individuals who gave care. Therefore it was necessary to retain anonymity.

3.9 Conclusion

In this chapter the researcher reflected on the research process followed in this project. It was determined that the most applicable design for this project was a non-experimental, descriptive design where the standard of care was assessed according to coded checklists consisting of specific criteria applied to the specific interaction. The data captured in the project and the analysis thereof is discussed in chapter 4.

CHAPTER 4
Results and Discussion

4.1 Introduction

In Chapter 3 a detailed discussion was presented regarding the research methodology, explaining the instruments and how the data was collected. In Chapter 4 a discussion follows regarding the interpretation of the data analysed.

4.2 Analysis and presentation of data

After the raw data was obtained, it was entered on to EXCEL spread sheets. The total for each standard was calculated and then interpreted as a percentage. For the purpose of simplifying comparisons, the percentages will be used when describing the standard of care.

The value of 80% was used as an indicator of whether the level of care was satisfactory or not. The value of 80% is considered as an 'effective level' of quality of care as revealed by domain experts in research and nursing (Mhlongo, 2000).

The three different aspects of the study will be discussed separately, with a summary of the total result at the end.

4.2.1 Structure Standards

The structure standard was not complied with in many aspects of the three areas.

- **Physical structure**

Both NICUs are positioned on a different floor from the delivery suite. This creates stress for the staff and inconvenience when transferring an infant to the NICU after delivery. Lifts are used and the delays in transferring infants can have serious consequences for the infant. Also the positioning of the NICU on a different floor in the building created the need for emergency transport incubators with a ventilator and a volumetric pump which is not available in either hospital, so when necessary, doctors have to continue ventilating infants manually in the moving incubator which has obvious disadvantages for the infant. This lays the infant open to barotrauma, inadequate ventilation, excessive ventilation and fluctuations in oxygen delivered with accidental extubation and all possible consequences thereof and loss of heat from the incubator with associated complications. This is a problem that cannot be overcome and is the result of using buildings that were designed many years ago before the speciality of neonatology had evolved.

There is no access control to either of the NICUs. Access control is exercised by security at the main entrance to each hospital. This covers entrance and exit control, though the exit control is limited. It is recommended that a closed circuit visual access control should be installed to identify people before allowing entrance to the area and that the access door to the Nursery area should be kept locked at all times.

In both nurseries in the study, glass panels were in place above a certain height, dividing the areas and allowing clear visibility of nurses and some visibility of patients. The shelf created using the area of the top of the dividing walls was utilized for placement of equipment which can partially obscure the view of patients and nurses in adjoining areas.

One of the NICUs had three access doorways, resulting in heavy traffic as it is used as a thoroughfare to an office and a further exit from the nursery. This is not in accordance with the standard recommendations. There were sufficient exits from both nurseries,

and daylight was provided, though one nursery did not have acceptable window coverings in all windows. Fluorescent lighting was provided and there was no facility for dimming or cycling lighting. In the NICUs there were additional lights available on the radiant incubators for examination, but mobile examination lights for use on patients in incubators without this facility were not seen.

Temperature was controlled in one NICU which has a ducted system of air conditioning. The other NICU had problematic air-conditioning units that were found to be not functioning properly at times. This resulted in the temperature of the NICU being variable at times. The filters of the air-conditioning supply in the nursery with ducted air conditioning were not seen to be changed as the main air conditioning units are in another area in the hospital. Filters are changed when necessary in the other nurseries' air conditioning units. It was not possible to determine the efficiency of the air-conditioners or to quantify the number of air changes that took place in an hour.

Floor and wall surfaces met with requirements and one nursery did not have a noise reduction ceiling fitted. The available work surfaces met with requirements as did the fire evacuation policy and security policy involving patient identification on admission, transfer and discharge. Emergency equipment was available, though only checked daily in one NICU. Doors were frequently slammed or closed noisily in the one NICU and bins in both NICUs were metal, resulting in noisy closing at times. Only one NICU had an assigned isolation room.

Electrical plugs available per bed space were 12 and 7 respectively, which is less than the 14 recommended by the American Standard and they were all connected to the emergency power supply. Both NICUs had one suction point per bed space. One NICU had two oxygen and compressed air points per bed space. The other NICU had one of each per bed space which presents a problem when needing to resuscitate a ventilated infant with a bag resuscitator and oxygen as the available points will be used for the ventilator.

Facilities available for hand washing met the standard though it would be preferable for the bins provided to be plastic so that the noise co-efficient could be reduced. Bio-hazardous waste was separated in both NICUs and refuse, bio-hazardous waste and

soiled linens were removed regularly from the applicable areas to the sluice room, from which it is removed twice daily.

A milk kitchen for preparation and storage of milk feeds is found in both hospitals, though it is not part of either nursery. Surfaces met with requirements in both cases, but the one milk kitchen did not have hands-free taps.

Storage and sluice rooms were found in each nursery and the facilities in them were according to the required standard. Storage areas for linen, equipment and expendable stock were adequate and an office for nursing administration was available, though in the one nursery this was outside of the actual nursery area. Doctors' offices were provided. Lockers and toilet facilities were available for staff in both cases, but there was not a dedicated staff lounge in the one nursery. The staff of that nursery use a lounge that is utilized by all the hospital staff. One nursery had a lounge for patients and visitors, but neither nursery had toilet facilities for visitors. In both cases visitors' toilets were on another floor of the hospital.

- **Equipment**

Both NICUs had 6 radiant heated incubators and sufficient incubators to meet the patient needs. Both have an oscillator available for when needed, one being a ventilator that can also be used for oscillation. Apart from that there are 5 and 6 ventilators available in each of the NICUs as well. There are sufficient ventilator circuits available for weekly circuit changes, but it appears that the circuits are not changed if used in the long term unless they become faulty. One NICU also had three flow drivers which are used for administering CPAP via nasal prongs.

Monitors are available in both NICUs, but there were not sufficient monitors for each NICU bed. They did not work reliably in the one NICU. The monitors in the other NICU have the capacity not only for heart rate and respiration rate recordings, but also invasive or non-invasive blood pressure readings, saturations and mean arterial pressure readings as well as infant temperature. There was suction equipment available for each bed-space, and resuscitators also available for each bed, though the one NICU had only one Laerdal Resuscitator at that stage and therefore used Blease Samson resuscitators. Infusion control pumps were available, though in insufficient

numbers to meet demands and each NICU had 4 syringe driver pumps. For infants receiving oxygen therapy via headbox or nasal cannula, there were sufficient blenders, each with humidifying chambers, available. Both NICUs had mobile x-ray machines though the one had been condemned but was still in use because of lack of funds to replace it. Light boxes for viewing x-rays were available in different areas in both nurseries and there was cold light for transillumination in both nurseries. Laboratory facilities were available with one being on a different floor from the NICU. In both laboratories blood gas analysis, serum bilirubin tests, microscopy facilities were available. Further laboratory tests were sent to the main laboratories in the main hospitals. An ultra-sound machine was available at both NICUs, allowing for Cranial Ultrasounds and other ultrasound investigations.

Both NICUs sent equipment to the same facility for repairs and servicing.

- **Staffing** (figures 4.1 - 4.4)

Staff allocation was insufficient in both nurseries and as a result both nurseries made frequent use of agency staff. Unfortunately the staff allocation in Hospital 2 for November was not available. On the day shift, the ratio of nurses to patients in NICU was 1:3 which is far removed from the recommended 1:1 for NICU. It should be noted that during lunch and tea breaks (total of four hours each on day- and night duty) there would be only one Registered Nurse (RN) present in the NICU of the one hospital. The registered nurses working in the NICUs were not all trained in Neonatal Nursing with an average per 24 hours of 7 NICU trained nurses on duty in the one nursery and 13 trained in the other nursery. There were additional nurses allocated to the NICU who are Enrolled Nurses (ENs) or Enrolled Nursing Assistants (ENAs). Certain of the duties performed by the ENAs in the NICU were outside of their scope of practice e.g. administration of medications. This presents the real possibility of medico-legal hazards. The number of nurses on the night shift was less, resulting in a higher nurse: patient ratio. In one of the nurseries in the study, the total available staff allocated was notably less than the other. The researcher questions the consequences of this on patient care and on the staff themselves.

Both nurseries make use of agency nurses to supplement the total of nurses on day and night duty. This situation has come about because many nurses have resigned or taken

the severance package when offered by the employer as a measure to cut costs and their posts are frozen and cannot be filled with new appointments. Agency staff are not usually allocated to the nurseries on a long term basis and so time and energy goes into the orientation and training of these nurses who are temporary members of the team. This adds to the responsibilities of the permanent nursery nurses as they have to perform their usual tasks and also be available for consultation should an agency nurse need assistance. In the nursery that had fewer nurses on its establishment, enrolled nursing assistants were allocated to areas removed from the nursery area, with a registered nurse responsible for that area, but not present there. This is placing unfair responsibility on those enrolled nursing assistants, and placing the patients at risk.

Figure 4.1 Staff Allocations in Hospital 1 – Day Duty

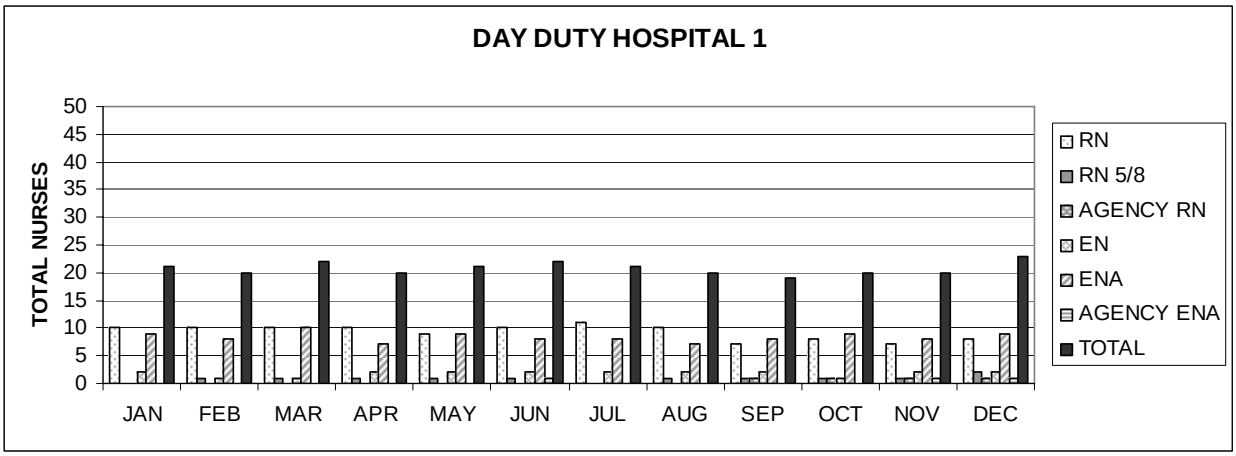


Figure 4.2 Staff Allocations in Hospital 2 – Day Duty

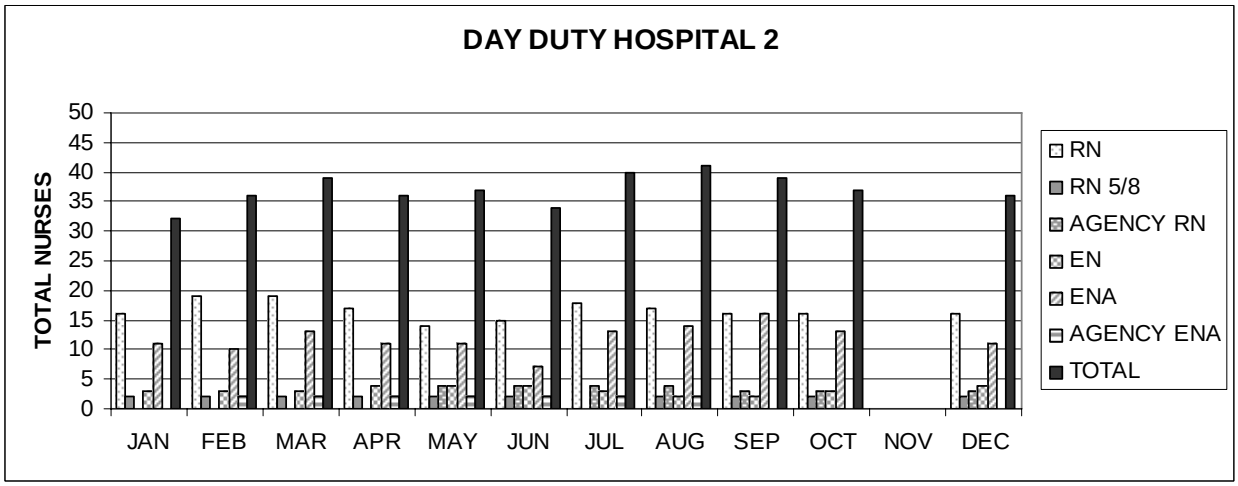


Figure 4.3 Staff Allocations in Hospital 1 – Night Duty

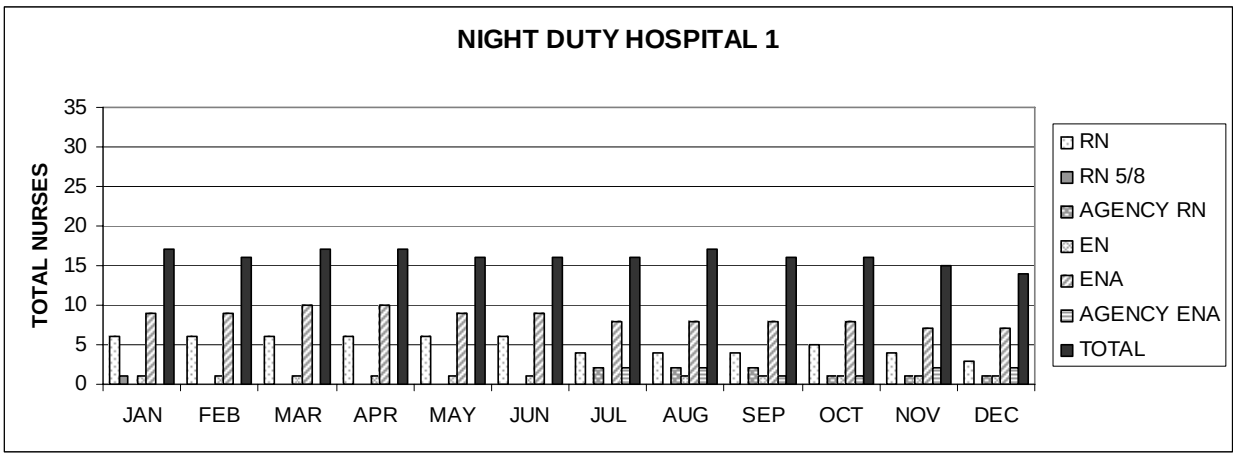
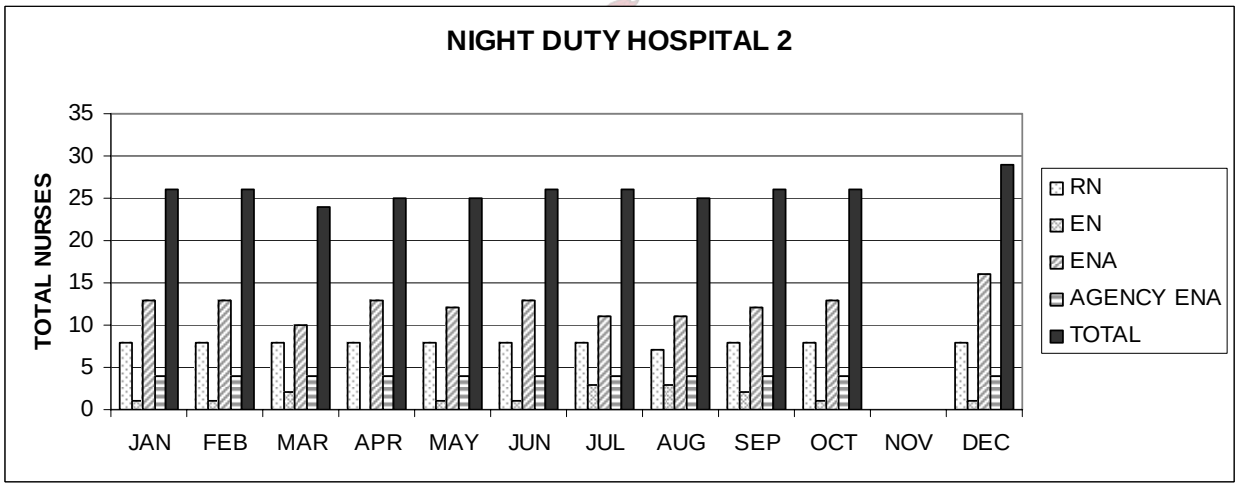


Figure 4.4 Staff Allocations in Hospital 2 – Night Duty



4.2.2 Process Standards

The twelve process standards were assessed by the researcher acting as the fieldworker. Each standard has certain criteria identified as 'critical elements'. Aseptic technique is one that is common to eleven of the twelve interactions.

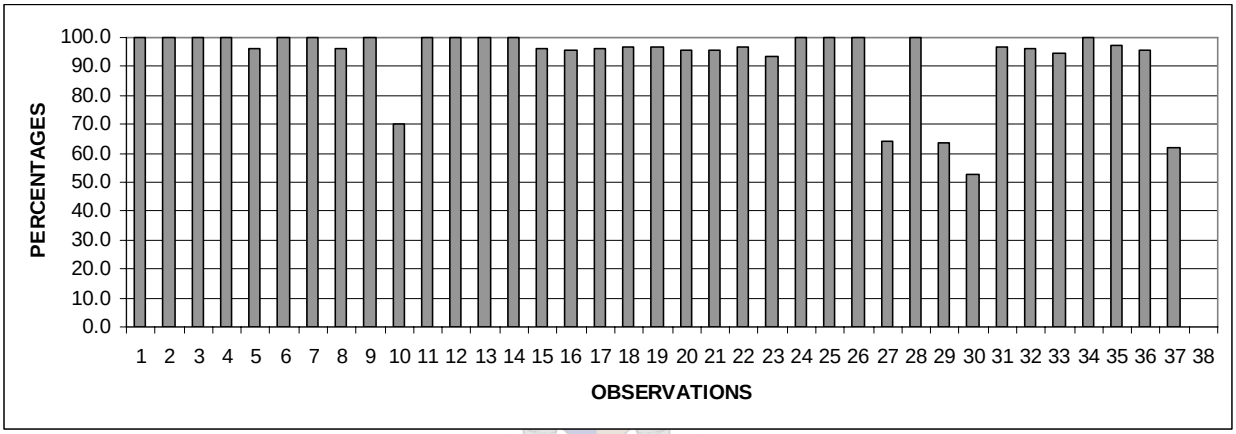
As is stated in chapter 2, paragraph 2.5.13, hand washing is a very important consideration when assessing nurses interactions with infants in the NICU. The researcher wrote a standard for hand washing in the NICU which was applied to each

process standard, but was not assessed individually at each assessment. Where this standard was not fulfilled adequately, the amount of 30% was deducted from the total score of that interaction. Therefore, when nurses did not wash or spray hands with disinfectant spray hands after changing napkins or cleaning excreta, the aseptic technique was considered not complied with, and the critical factor was consequently deducted.

- **Hourly Observations.** Addendum B pg.97.

The researcher observed the recording of hourly observations on infants in the NICU.

Figure 4.5: Hourly Observations (N=38)



The recording of vital signs was conducted according to the standard on the whole and the events that scored low marks had critical elements lacking which resulted in 30% or more being deducted from the total as in one interaction that scored 0% because three critical factors were omitted. These were ignoring the fact that saturations and heart rate were not correctly monitored, and the intravenous therapy was not checked, but was tissued.

The average attained for this procedure was 90.7%. The aim of observing the infant is to note its present state and to compare the findings with previous recorded findings, to identify differences and take appropriate action.

A disturbing trend was the recording of the respiratory rate as displayed on the monitor, and not specifically counting the respirations of the infant for 15 seconds. It is common knowledge that the signal of respirations between the infant and the monitor is disrupted

by movement of the infant, resulting in an incorrect reflection of the respiratory rate. Therefore it is essential that the nurse counts the actual respirations of the infant to make an accurate record of the respiratory rate.

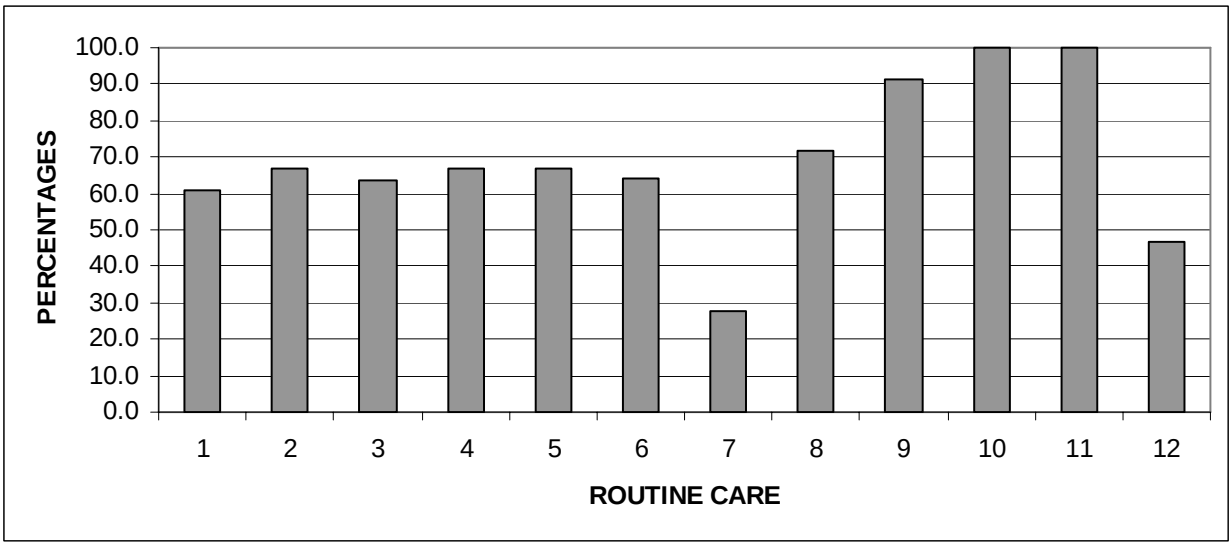
Another observation that was neglected was the checking of the pressure display on the ventilator. Nurses would simply record the previous readings without checking to ascertain if there was a difference in the readings displayed. This is notable as a decreased ventilator pressure can lead to under-ventilation and hypoxia, or barotrauma if the pressure is too high, resulting in Chronic Lung Disease and prolonged hospitalisation with the associated long term morbidity and high cost implications (Enzman Hagendorn, et al in Merenstein and Gardner, 2002).

Nurses often neglected to check the level of the water in the humidifying chamber when observing the infants in the NICU. The air delivered to the infant on a ventilator must be warmed and humidified to decrease insensible water loss and irritation to the airways (Enzman Hagendorn, *et al.* in Merenstein and Gardner, 2002). When automatically refilling humidifying chambers are not in use, it is essential that the level of the water in the chamber is checked regularly to prevent delivery of dry warm air to the infant.

- **Routine Care.** Addendum B pg. 98.

Routine care is conducted when necessary to maintain hygiene and comfort for the infant.

Figure 4.6: Routine Care (N=12)



The average obtained for this procedure was 68.9%. This result reflects more than 10% below the accepted level for satisfactory performance. The majority of the results were affected by a deduction of 30% for not washing hands before interacting with the infant. The common reason was that the nurse had just performed routine care on another infant, changing the napkin, and then did not wash her hands, but sprayed them with antibacterial spray before touching the next infant. This is a cause for concern, as the prevention of the spread of infection in the NICU is of paramount importance.

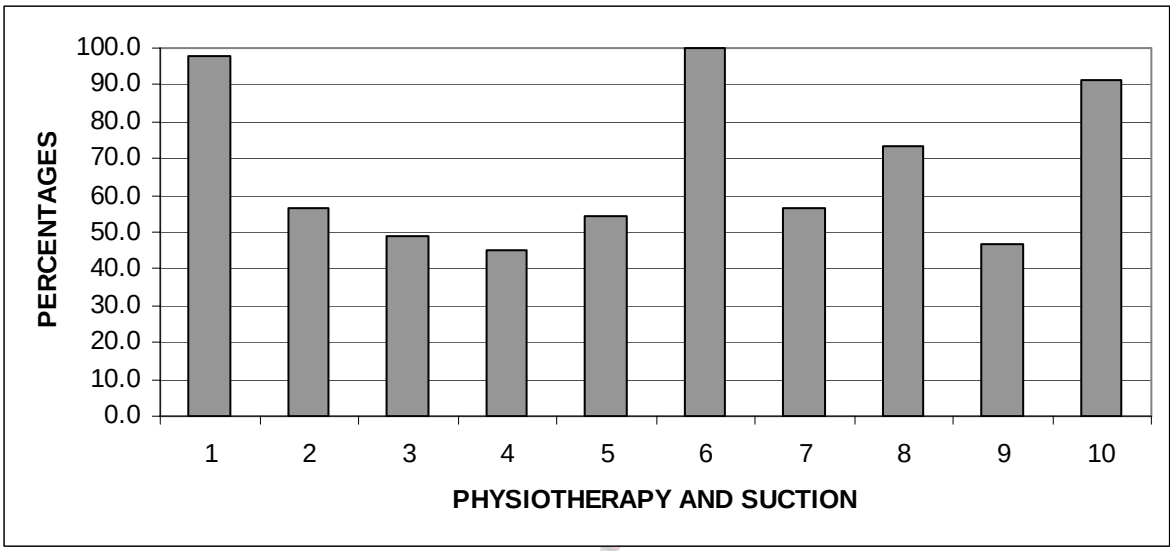
Other criteria that were not met adequately were mouth care and the positioning of the infant. As infants in NICU are not feeding orally and are frequently intubated, receiving nasal prong ventilation or are having oxygen therapy via nasal cannula or headbox, an accumulation of oral secretions commonly forms a crusty deposit on the lips. This should be removed when the infant is awake and receiving routine care. When this aspect of care is omitted, the general appearance of the infant is one of neglect as the crusts are unsightly.

When the infant is awake and being disturbed for napkin changes and cord and mouth care, it is appropriate to change the position of the infant to alleviate pressure on one area. In one case during observation, the infant was flipped over to the new position. This will be disorientating for the infant and is not developmentally sound care.

- **Physiotherapy and Suctioning.** Addendum B pg.99.

Physiotherapy and suctioning are undertaken to ensure a patent airway.

Figure 4.7: Physiotherapy and Suctioning (N=10)



The average total for this interaction was 64%. Two of the procedures were done as emergencies and one of these scored 100%. This particular procedure necessitated only one pass of the suction catheter down the endotracheal tube and the infant responded quickly to the removal of secretions. The second emergency procedure was performed because the condensate that had accumulated in the tube was excessive, resulting in an emergency procedure being required. This is not satisfactory and is avoidable as the nurse should be clearing the condensate hourly when doing the observations.

In one of the procedures, the nurse prepared the suction catheter and gave the physiotherapy but had not turned the suction machine on, so had to ask another nurse to do this as her hand was already gloved.

The most neglected criteria was again hand washing, with 6 procedures showing this critical element missing. The reason for this was that on one occasion the nurse returned from tea break and did not wash her hands before interacting with the infant. The other five interventions where hand washing was neglected occurred after the napkin of the infant who was to be suctioned.

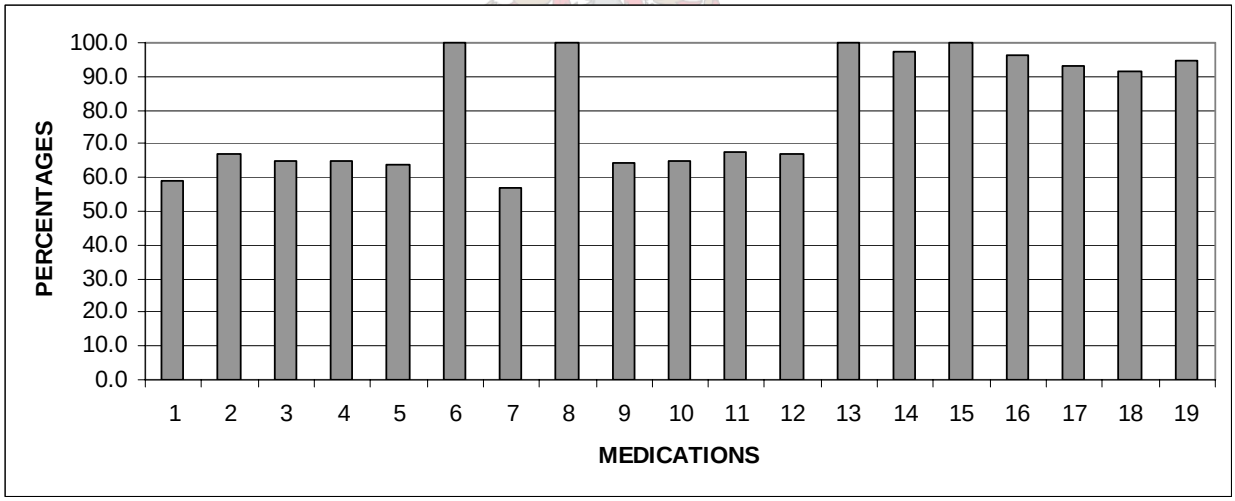
The ventilator circuit should be treated as sterile, but it was observed that frequently the nurses did not utilize a sterile field for the placement of the patient end of the circuit while suctioning the endotracheal tube. This can result in contamination of the circuit, and should be avoided at all costs. The nurses performing the procedure were careful to maintain sterility of the suction catheter and to assess the saturation and condition of the infant before proceeding with the suctioning.

A notable fact is that in only two of the procedures observed, physiotherapy was given. This is in keeping with current practice that recommends using physiotherapy with caution.

- **Medicine Administration**. Addendum B pg. 103.

The safe administration of the correct medication in the correct dose to the correct patient was assessed.

Figure 4.8: Medicine Administration (N=19)



The administration of medications is a procedure that carries with it a great onus of responsibility. The process assessed included the administration of intragastric, intramuscular and intravenous medications to 19 patients.

Once again the omission of hand washing was the reason for deduction of 30% from the final score of 10 of the procedures assessed. In addition to not washing their hands, three of the nurses did not spray their hands with hand spray before interacting with the

infants. As shown in the process standard for hand washing in the NICU, nurses should wash their hands on re-entering the NICU and after dealing with the secretions of any infant. Hands should also be washed after giving medications via the intra-gastric tube, as there are many pathogens found at the distal end of the intra-gastric tube (anecdotal evidence from Prof. V C Harrison).

Administration of oral medications was performed to a satisfactory standard, with the nurses taking care that the plug of the intragastric tube and the connection of the feeding tube giving set, in those cases, was not contaminated.

When preparing multi-dose vials for injections, the nurses sometimes omitted to label the vial with the time, date and volume of water used to reconstitute the medication. This can have serious consequences as incorrect dosages can be given as a result, or the efficacy of the medication may be reduced if it has expired. Nurses should not expect that the preparation of solutions for injection can be taken for granted as there can be different strengths of medications in the vials and reconstituting the solution with different volumes will affect the strength of the solution.

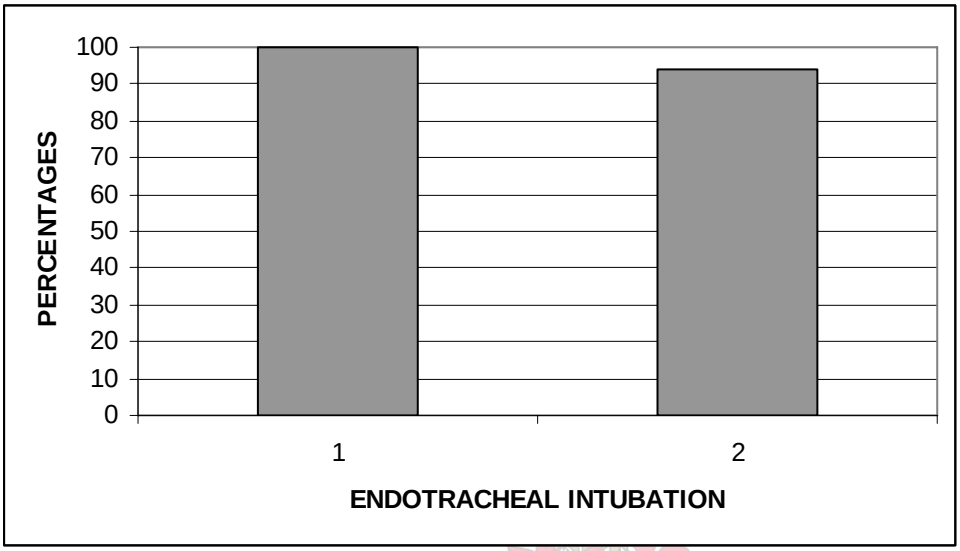
Some nurses administering intravenous medications did not clamp the intravenous tubing distal to the port of the injection before injecting the medication. This can result in the medication flowing away from the infant in the intravenous tubing delaying the administration of the medication. The site of the intravenous cannula should also be inspected for signs of infiltration before administering the medication. This was omitted in one observation, and the nurse in that case omitted to clean the injection port with an alcohol swab before giving the injection.

In general, the standard of administration of medications was satisfactory with an average score of 79.1%.

- **Endotracheal Intubation**. Addendum B pg. 101.

The researcher observed 2 endotracheal intubations performed by nurses.

Figure 4.9: Endotracheal Intubation (N=2)



This procedure is not a common occurrence in the NICU as infants are frequently intubated on arrival in the NICU. Nurses perform many of the emergency procedures in the NICU and one of the observed procedures was performed as an emergency by the nurse. The other observed procedure was a re-intubation as it appeared that the endotracheal tube had dislodged from the trachea.

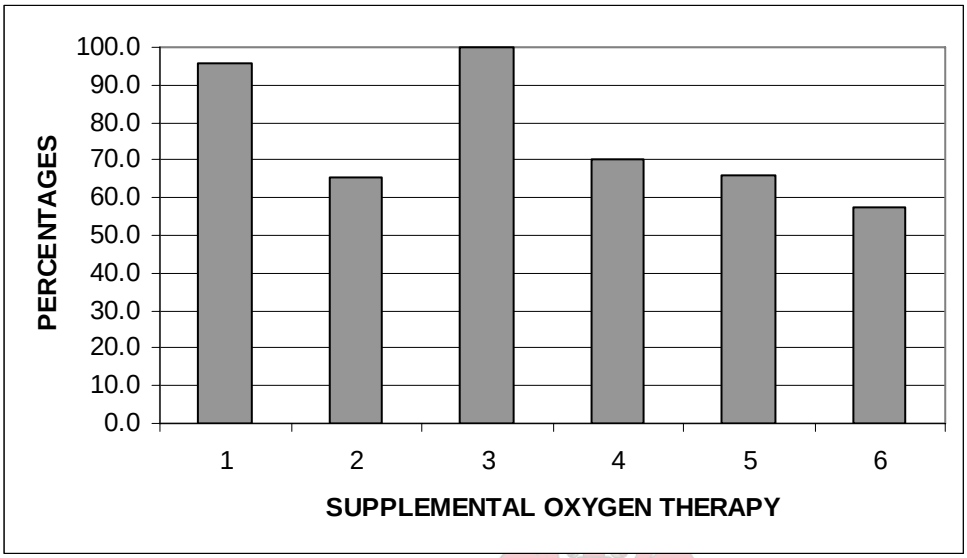
The second procedure was unsuccessful and the nurse involved reported that she had not visualised the vocal cords after identifying the epiglottis and acknowledged that this was the reason for failing to complete the procedure successfully.

While acknowledging that the observation of two procedures will not necessarily give an accurate impression of the quality of care, the researcher feels that the inclusion of this procedure in the results is necessary to demonstrate the scope of practice of the NICU nurse and to indicate the capability of these nurses. The average mark for this procedure was 96.9%.

- **Supplemental Oxygen Therapy.** Addendum B pg. 105.

The practice of nurses was observed for the safe administration of oxygen via a headbox to hypoxic infants. The average score obtained was 70.7%.

Figure 4.10: Supplemental Oxygen Therapy (N=6)



The initiation of the administration of oxygen to infants was another interaction that was negatively affected by the nurses not washing their hands before the procedure. One of the procedures was initiated after extubating the infant. It can be argued that this would be an indication for hand washing as the infant would have been suctioned before extubation, and the nurse should have washed her hands after working with secretions. However as the nurse was still interacting with the same infant, it was not necessary to wash her hands.

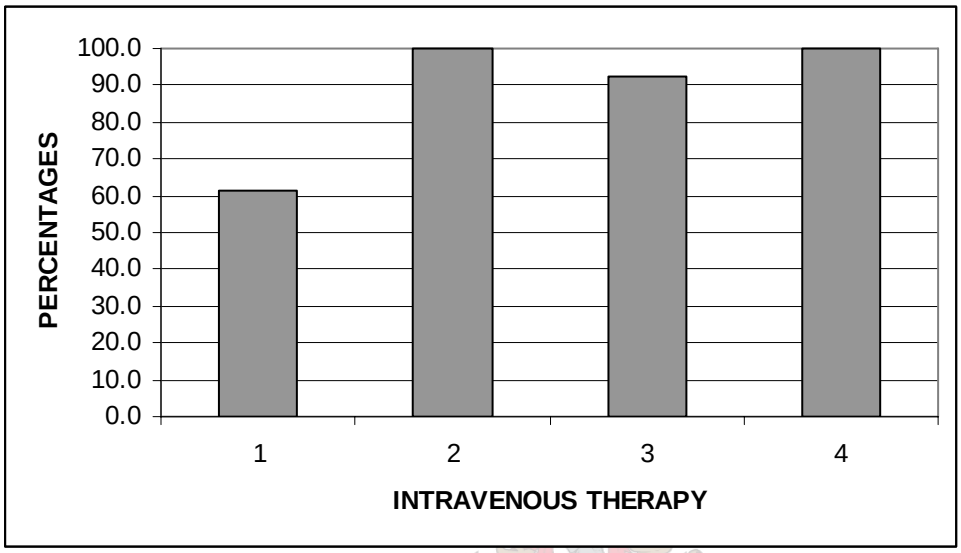
In the second observation, the opening of the headbox at the infant's neck was very big, which would allow excessive air to mix into the headbox at the opening with the result that the amount of oxygen received would not be accurately assessed.

Practice is now moving from using headboxes to using nasal cannula for oxygen therapy in neonates where ventilation is not required. This form of delivery of oxygen has been found to be preferable for use with neonates as it can create an element of Continuous Positive Airway Pressure (CPAP) and the percentage of oxygen administered is more accurately determined.

- **Initiation of Intravenous Therapy.** Addendum B pg. 106.

The NICU nurse should be able to initiate intravenous therapy in the neonate requiring this.

Figure 4.11: Initiation of Intravenous Therapy (N=4)



When commencing intravenous therapy in a neonate, it is necessary that the infant is not cold as gaining access to peripheral veins will be made difficult in a cold infant. It is also important that the infant is protected from becoming cold by covering him if working with the incubator open. These were two aspects of care that were neglected in this process standard.

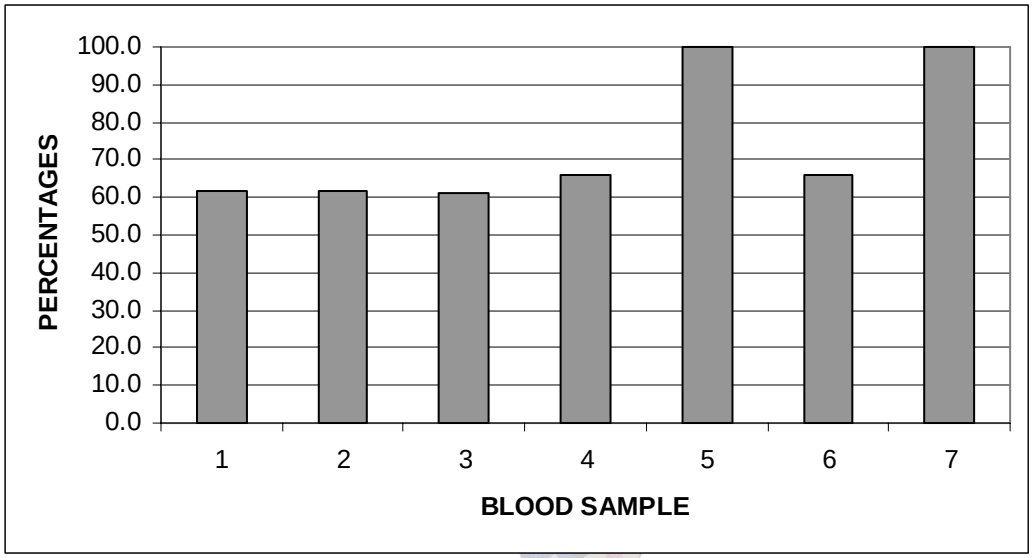
Hand washing was again a neglected aspect of care. In one instance the nurse did not wash her hands either before or after the procedure, but justified this as she was using gloves during the procedure. The use of gloves does not exclude the need for hand washing when moving between interactions with different infants. In two instances the nurses did not spray their hands before the interaction with the infant.

The average for this process standard was 88.4% which falls within the expected range.

- **Capillary Blood Sampling.** Addendum B pg. 108.

This standard requires the collection of a capillary blood sample for investigations. The average score for this procedure was 73.8% which is below the minimum level expected.

Figure 4.12: Capillary Blood Sampling (N=7)



The reason for the lower average is again because of the inconsistency in washing hands by the nursing staff. The reasons are similar to previous process standards, however there was one occasion where the nurse returned from the bathroom, and considered that having washed her hands there eliminated the need to wash again once back in the NICU.

In three of the procedures the nurses did not record that they had collected the blood specimens. The reason for one of these may have been that a blood sugar reading was also recorded after collecting blood from the same heel prick and so it would be clear that a heelstick had been done, but the other two specimen collections were not recorded. These were collected for Total Serum Bilirubin (TSB) measurements.

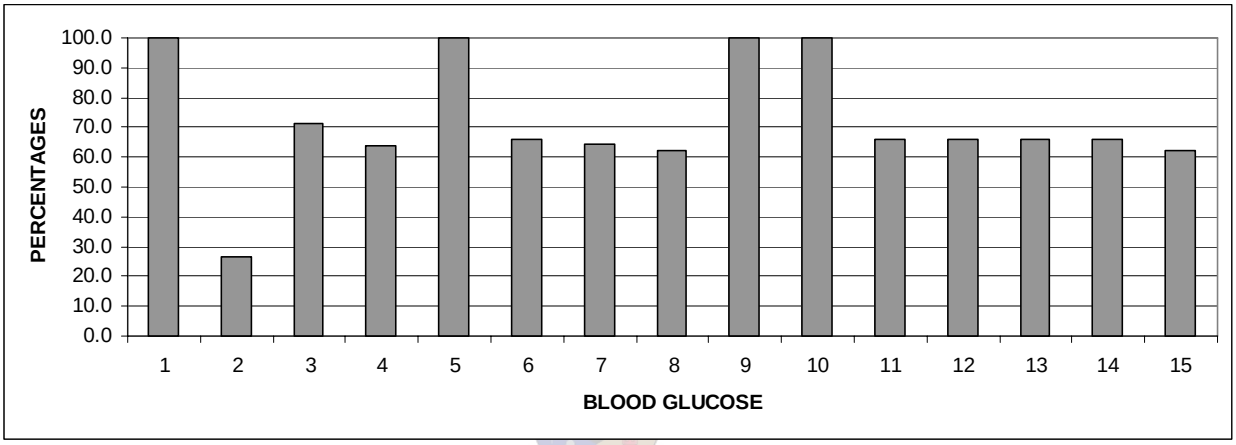
The technique used when collecting blood specimens from a heel prick should be considered. As stated in chapter 2, paragraph 2.5.8, the heel should be warm and the

site for the prick should be on the lateral aspects of the heel. Failure to comply with this can result in the specimen yielding inaccurate results. The researcher found that the nurses performing this procedure were selecting the correct sites for puncture, and this was an encouraging finding.

- **Capillary Blood Glucose Measurement.** Addendum B pg. 109.

This standard assesses the collection and testing of a blood sample using a Reflolux glucometer. The average score for this procedure was 72%.

Figure 4.13: Capillary Blood Glucose Measurement (N=15)



The technique of collecting blood from a heel prick has already been discussed in the previous standard. Although there are similarities between the last procedure and this one, the researcher observed separate interventions when collecting data for this procedure.

Hand washing was neglected in the majority of these interventions. Reasons were similar to those in previous process evaluations. Another critical element that was not always performed accurately was selecting the site for the puncture (N=3). In order to reduce the discomfort felt by the infant, it is necessary that the site of puncture is carefully selected to allow for adequate bleeding without the need to squeeze the heel which increases the pain felt and can also affect the accuracy of results.

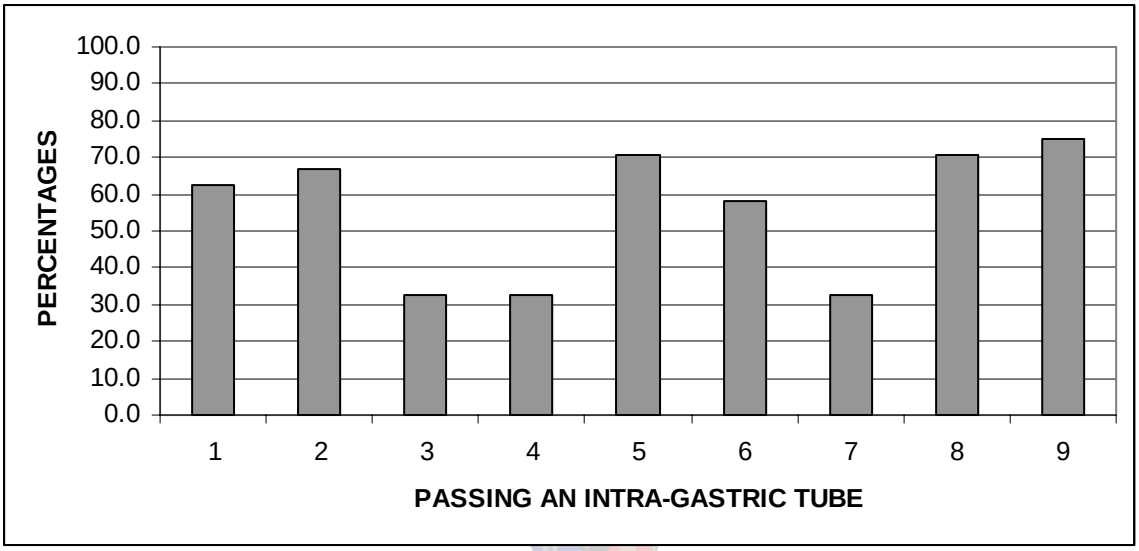
During data collection, four of the specimens were collected in capillary tubes. This practice has been discussed in chapter 2.5.9. The researcher assumed that the nurses

who did this were unaware that their practice was not optimal and when discussed with the nurses, they stated that they would change their practice.

- **Passing an Intra-gastric Tube.** Addendum B pg. 110.

An intra-gastric tube is frequently passed in the NICU to assist with management and care of the infants.

Figure 4.14: Passing an Intra-gastric Tube (N=9)



The average for this procedure was a disappointing 55.7%. This is cause for concern as the passing of an intra-gastric tube is a procedure that is often performed in the NICU. Factors that were neglected were measuring the required length of the tube, hand washing and supporting the head of the infant to allow for slight flexion of the neck, easing the passage of the tube.

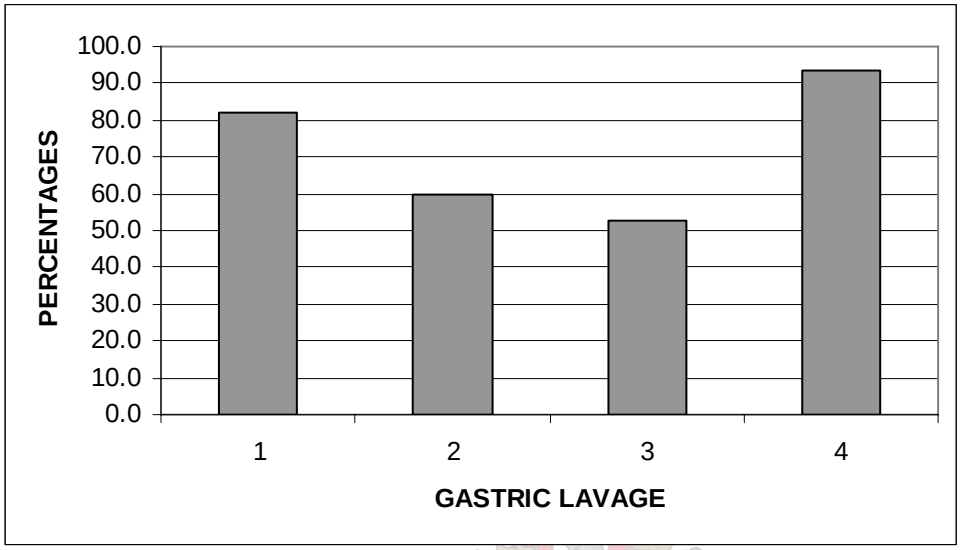
In one of the procedures, the nurse cut the adhesive tape after passing the tube. This could result in the infant removing the tube partially or totally, while the tape is being prepared, necessitating the repeat of the procedure. This could then have adverse consequences on the infant causing a drop in oxygen saturations and tachycardia, bradycardia or apnoea.

Generally, confirmation that the tube was in the stomach was taken when gastric contents were aspirated from the tube after passing it.

- **Gastric Lavage.** Addendum B pg. 112.

The researcher observed the performance of gastric lavage to assess the performance of the procedure.

Figure 4.15: Gastric Lavage (N=4)



The average obtained for this interaction was 72.1%. It is an invasive procedure that is performed on infants who have passed meconium in utero during labour, or on infants who have swallowed maternal blood during labour, indicating potential emergency.

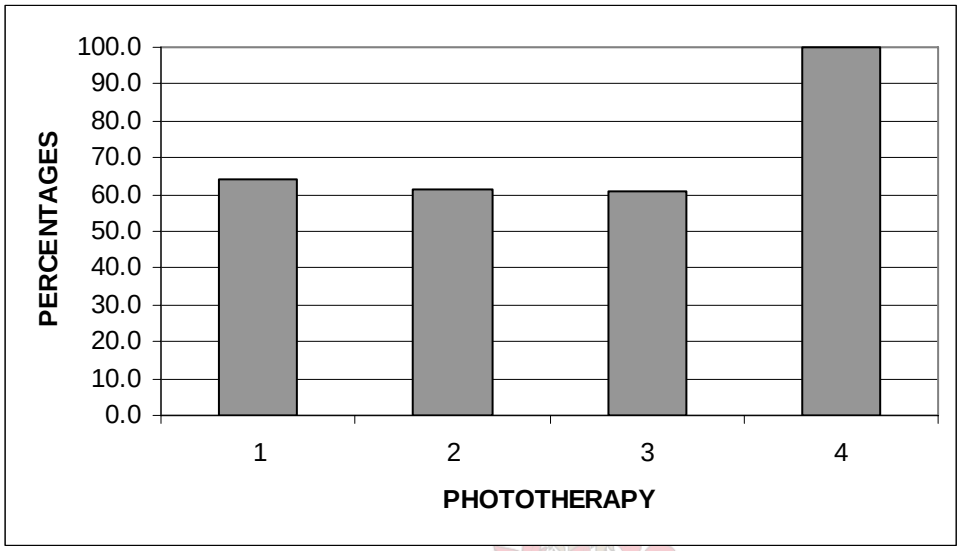
The procedure follows the passing of an intra-gastric tube, but the entire process was assessed for the purpose of data gathering. The nurses made similar omissions in the passing of the intra-gastric tube as in the assessment of that procedure, and the actual gastric lavage was performed according to the standard without exception.

It can be argued that the result is not reflective of the performance of the procedure, but it is emphasised that the gastric lavage is performed after the passing of an intra-gastric tube and therefore this must be considered part of the process standard and the two parts of the process assessed as a whole.

- **Phototherapy.** Addendum B pg. 114.

The researcher assessed the commencing and care of an infant receiving phototherapy.

Figure 4.16: Phototherapy (N=4)



In three of the four procedures observed, the nurses did not wash their hands before commencing interaction with the infant. This resulted in the lower than desired average of 75.7%.

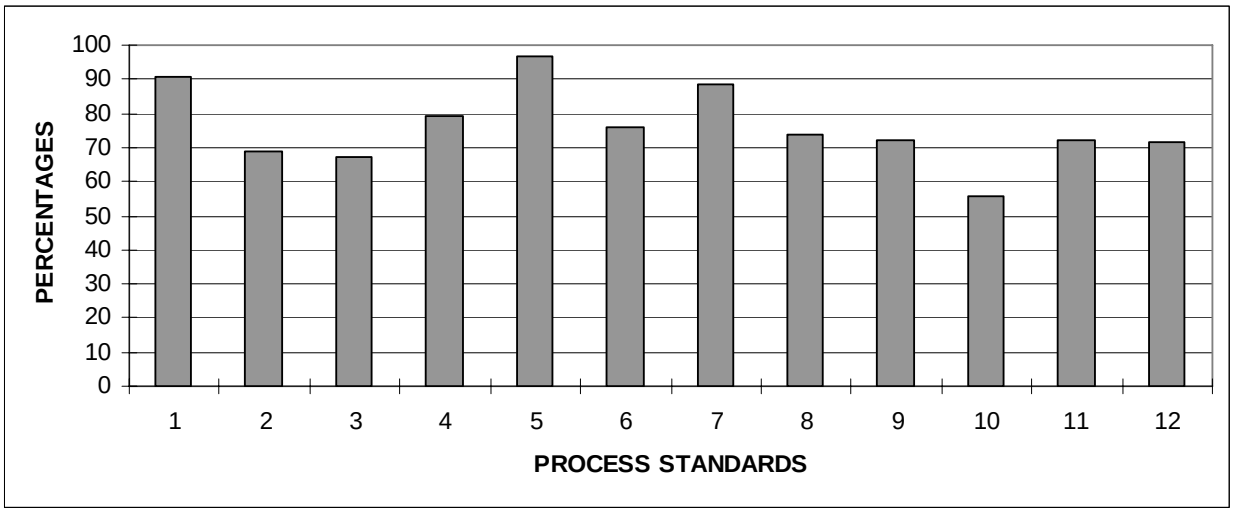
Other important factors related to phototherapy were adequately performed. The infant's eyes were covered in a way that allowed the mother to uncover them when feeding to allow eye contact between mother and infant and also to allow for checking of the eyes for discharges, except in the case of the preterm infant who was on a ventilator. Two of the infants were not turned regularly, which could result in them requiring a longer time under phototherapy.

- **Overall process standard results.**

The overall result of the evaluation of practice was disappointing with only three of the assessed standards achieving an average over the expected 80%. Six of the procedures averaged between 70% and 80%. These included the administration of medications which had an average of 79.1%. The other standards that averaged less

than 80% but more than 70% were the initiation of oxygen therapy, collection of capillary blood samples and measurement of capillary blood glucose, performing a gastric lavage and initiation of phototherapy and care of infants receiving phototherapy. These are all procedures that are frequently performed in the nursery and it is of concern that they were not better performed. However, hand washing was a critical element that frequently resulted in a deduction of 30% from the total. This clearly had a negative effect on the results of this study and the results would have been significantly better if proper attention had been paid to this aspect of each interaction with infants in the Nursery.

Figure 4.17: Process Standards (N=12).



Key:

1. Hourly Observations
2. Routine Care
3. Physiotherapy and Suctioning
4. Administration of Medications
5. Endotracheal Intubation
6. Administration of Supplementary Oxygen
7. Initiation and care of Infant with Intravenous Therapy
8. Collection of a Capillary Blood Sample
9. Capillary Blood Glucose Measurement
10. Passing of an Intra-gastric Tube
11. Gastric Lavage
12. Phototherapy

Two procedures had an average between 60% and 70%. These were Physiotherapy and Suctioning and Routine Care. Suctioning should be treated as a sterile procedure, but, as discussed in the evaluation of that procedure, this was not always the case.

It is of concern that Routine Care was a procedure that scored a low average as this is an interaction that takes place frequently and should be preformed with skill and careful consideration for the infant.

The interaction with the lowest average score was the passing of the intra-gastric tube. As this is a procedure that is frequently performed in the Nursery, it is of great concern that it was as badly performed. The average percentage of 55.7% indicates that the nurses need to give more thought to their practice.

4.2.3 Outcome Standards

The data collected was used in an attempt to discern patient numbers. Data originated from the midnight census in both nurseries. The total of infants receiving respiratory support (Intermittent Positive Pressure Ventilation/Continuous Positive Airway Pressure and Oscillation) was recorded separately (Figure 4.14; Figure 4.15). Hospital 1 did not collect separate statistics for oscillator use.

Figure 4.18: Total of patient ventilator days per month. Hospital 1

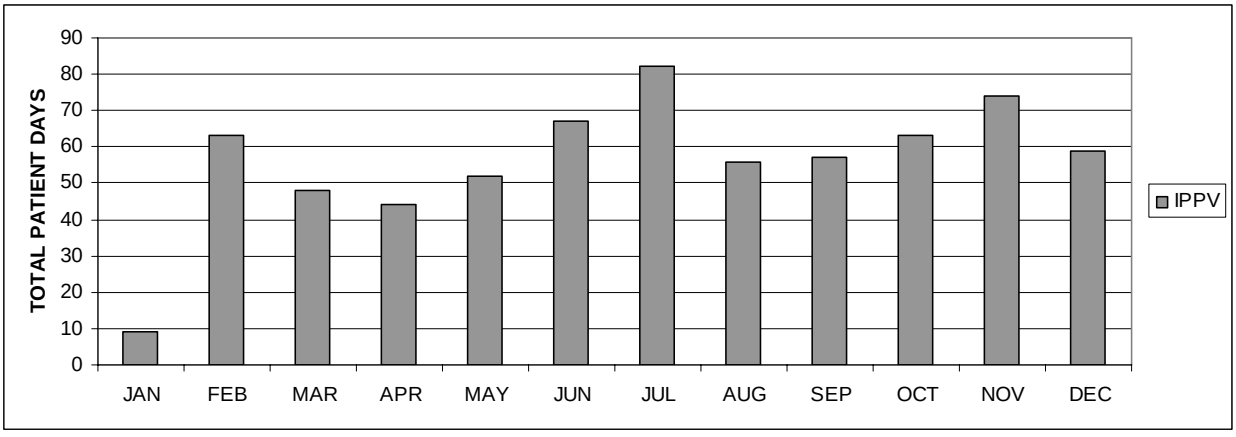
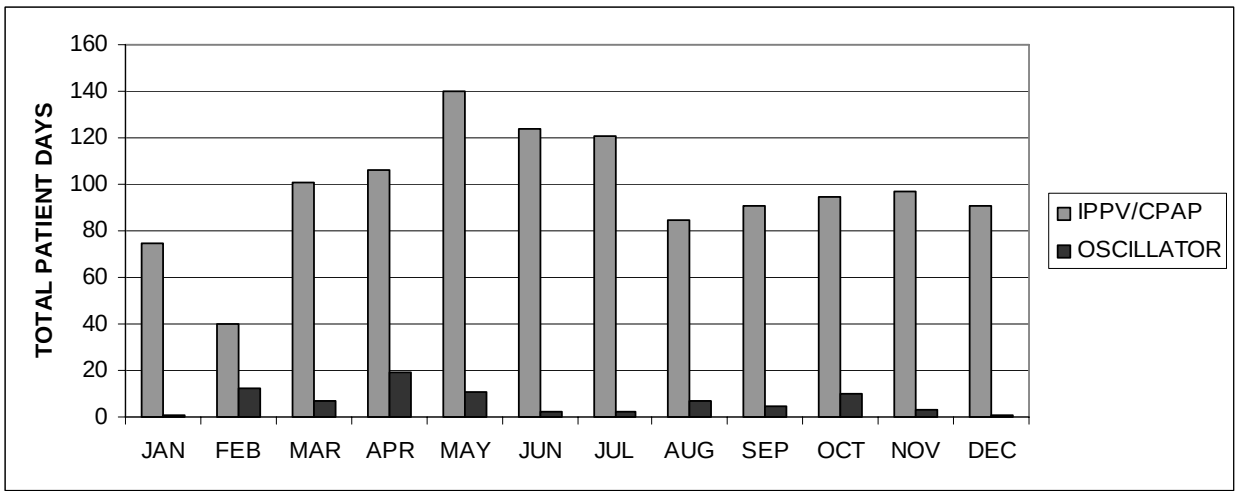


Figure 4.19: Total of patient ventilator and oscillator days per month. Hospital 2



The total number of ventilator days per month is indicated in Figures 4.18 and 4.19. This gives an indication of the nursing workload and the number of qualified nurses required for safe nursing of these infants in NICU.

Despite the fact that the nurseries in the study fell under the same umbrella of services, they did not record other statistics in the same detail. One hospital kept statistics showing the occupancy of the five different areas in the nursery, while the other hospital's statistics were more general, reflecting the ICU, High Care and General Care patient numbers. This lack of differentiation gives the impression that there are fewer infants requiring acute care in that nursery, which is not the case. One hospital collected discharge statistics only, while the other hospital collected admission and discharge statistics. These differences in statistics that have been kept made it impossible to undertake further useful analysis.

Figure 4.20: Monthly Patient Totals. Hospital 1

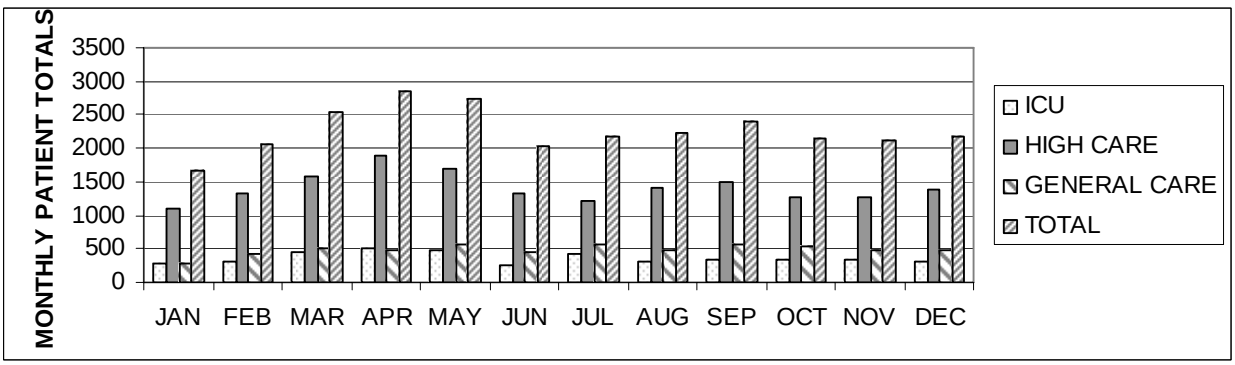
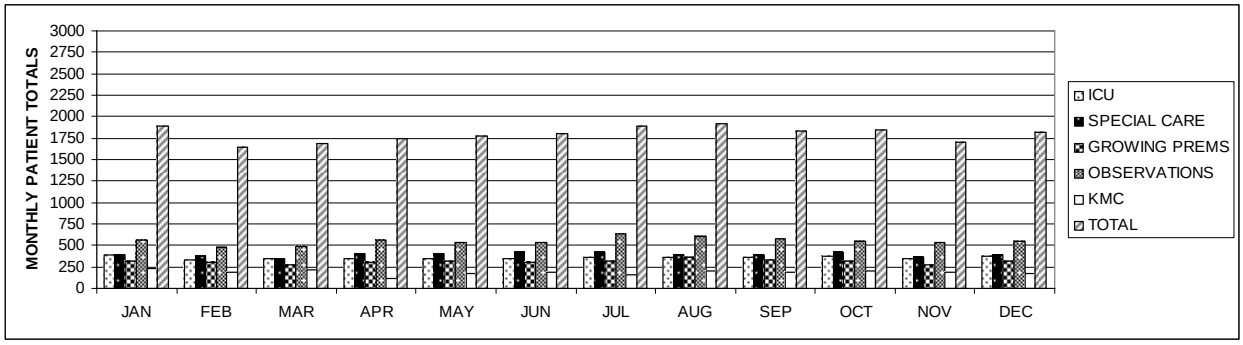


Figure 4.21: Monthly Patient Totals. Hospital 2



The significant differences in nursing staff numbers must have an impact on stress levels of the nurses and on the nursing care in the nurseries. It is interesting to note that Hospital 2 recorded more assisted ventilation days but lower monthly patient totals. However this hospital has approximately 40% more nursing staff available in its nursery than Hospital 1 (Figures 4.1 – 4.4).

It is notable that the promotion of Kangaroo Mother Care (KMC) has made more infant beds available within both nurseries, but the infants receiving KMC are nursery patients and nursery staff are allocated to care for them, but with a higher nurse: patient ratio. One nursery allocated a registered nurse to this area, but the other nursery had an enrolled nursing assistant to care for those patients with a registered nurse from another area ultimately responsible for these infants as well. This area should be the responsibility of an experienced registered nurse as the infants need to be carefully monitored because there are many possible complications that can develop there. Mothers also need to have support and teaching which could be beyond the scope and ability of the ENAs.

It would appear that the statistics collected by the nurseries are not used for planning purposes for budgets, staff allocations and costs. The statistics collected also make it difficult to determine outcomes and efficiency, as weights and gestational ages of admissions and length of stay of all infants are not noted.

Figure 4.22: Total of Patients and Percentage Occupancy per Month. Hospital 1

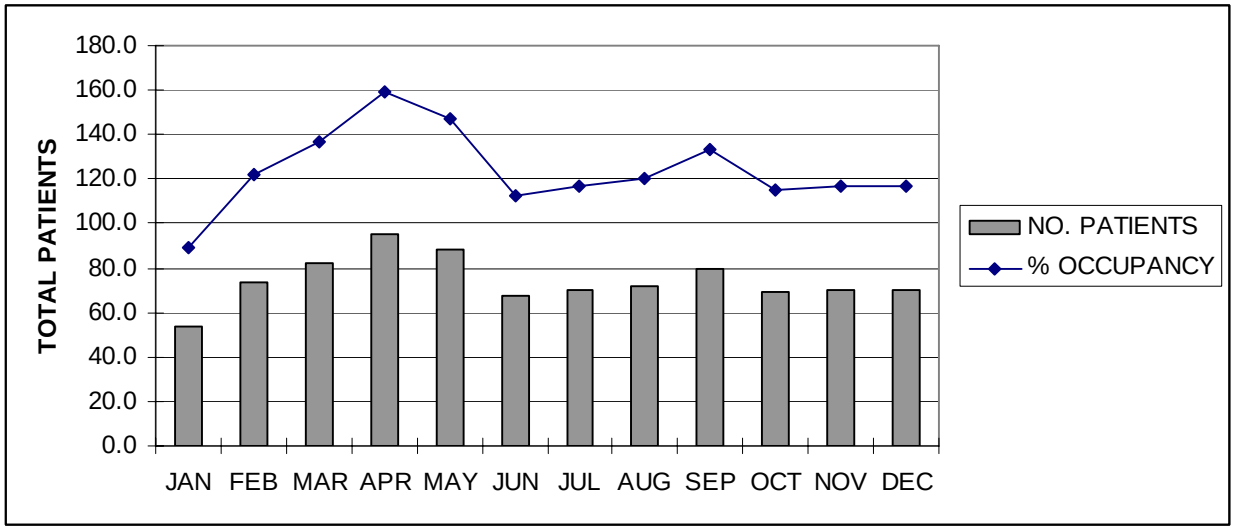
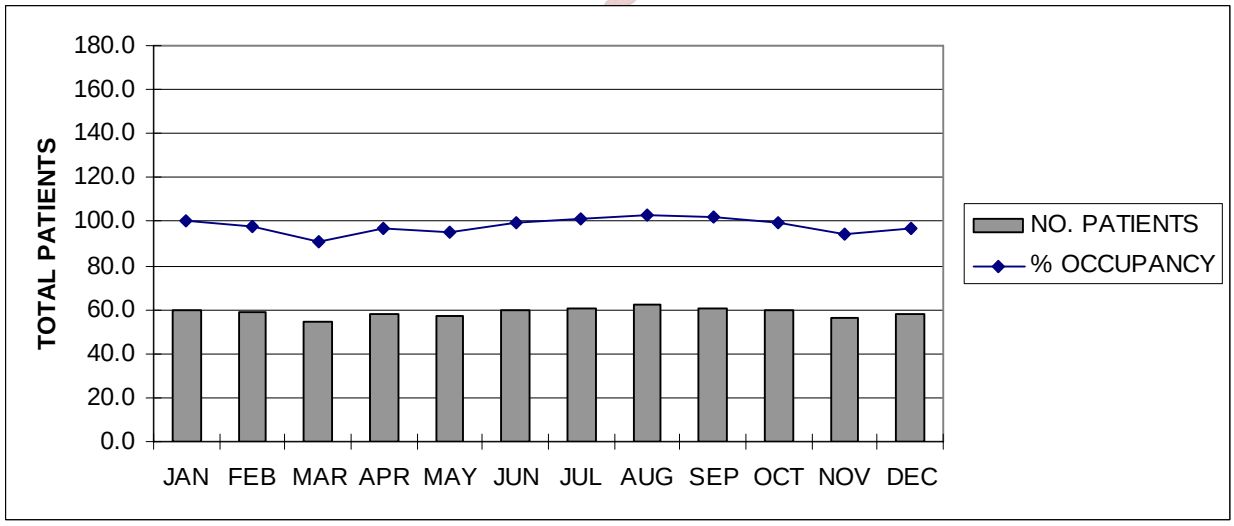


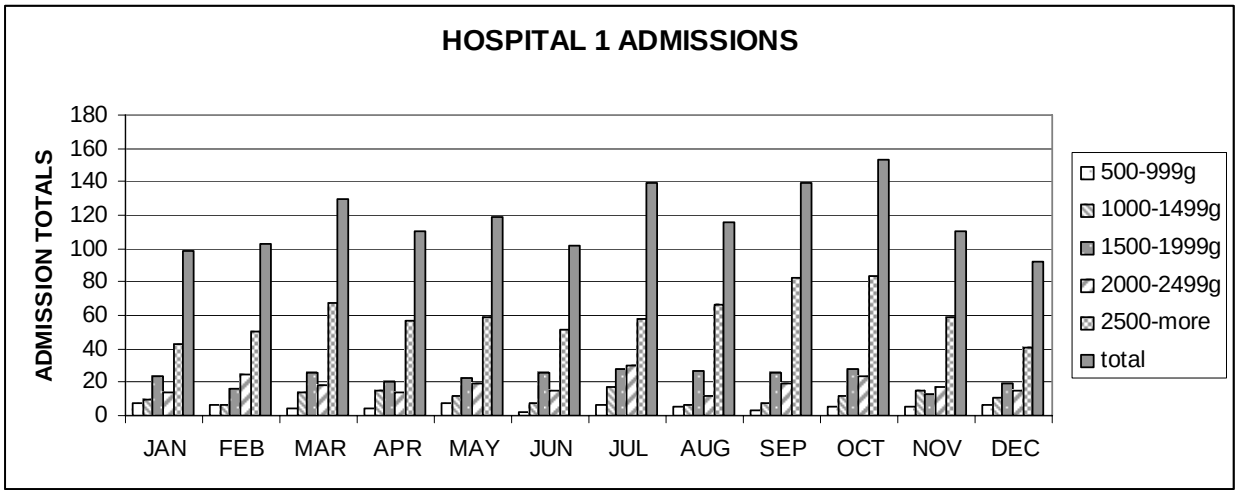
Figure 4.23: Total of Patients and Percentage Occupancy per Month. Hospital 2



Both nurseries had monthly patient census of 100% or more for most of the year (Figures 4.22 and 4.23). The numbers of available nursing staff differed between the nurseries with one nursery having approximately 40% more nurses on its establishment. This nursery had correspondingly more trained Neonatal ICU nurses. It is notable that the nursery with less nursing staff available had higher average patient numbers; however, this nursery had fewer ventilator days in its statistics. The occupancy exceeding 100% is a situation that is of great concern as it increases the stress of the nursing and medical staff working in these nurseries. The total of patients was fairly constant in the nursery of Hospital 2 (90.5% - 103.2%) but there were marked fluctuations in the total of patients in the nursery of Hospital 1 (89.3% - 159.1%). Figure

4.24 gives a graphic representation of the monthly admission totals in different weight categories in Hospital 1. Equivalent data was not available from Hospital 2.

Figure 4.24: Monthly Admissions in weight categories. Hospital 1.



It would be expected that the quality of care would be affected by the excessive patient load however it is the opinion of one of the neonatologists that infection rates have not increased noticeably since the increased patient numbers and decreased nursing staff numbers. No formal study has been undertaken regarding this, nor has it been the focus of the project under discussion.

Another factor for consideration is that the budget is calculated on the assumption of a certain patient total, but this is exceeded, therefore strain is placed on the available financial resources and they have to stretch beyond the expected patient total and so available resources per patient must be reduced and budgets exceeded.

4.3 Conclusion

While the researcher recognizes the importance of outcome standards for measuring structure and process, the collection of relevant data is essential for this to be meaningful. Planning and budgeting are dependent on adequate information, which was found lacking.

In the final chapter, conclusions will be drawn and recommendations made.

CHAPTER 5
Conclusion and Recommendations

5.1. Introduction

In Chapter 4 the results based on the findings of the research project were discussed. This was based on the information given in previous chapters that gave detail on the research process. In this chapter the conclusions are drawn and recommendations are made.

5.2 Conclusions

The conclusions are based on the objectives set in chapter 1.

5.2.1 Formulate and evaluate structure standards

The environmental structure standards were based on the actual standards to be used in the redevelopment of one of the NICUs selected for the study. The researcher held discussions with the architect who has designed the new NICU, regarding the proposed structure and design, which has been based on the American Standards (White *et al.*, 2002). It is not surprising that the current standard of structure found in the NICUs does not meet the standard set. Major deficits in this regard can be found in many aspects of the design of the existing NICUs. These definitely impact negatively on the quality of the environment and consequently on the care given in these NICUs. The reason for the NICUs not complying with the recommended standards is because they were designed or developed more than fifteen years ago and have not been altered to keep pace with new standards. This was because of the extensive financial implications involved.

Staffing of the NICUs was a major problem area. The recommendations are for one neonatal qualified nurse to each NICU patient. This is not possible in the hospitals studied as the staff shortage dictates a ratio of 1:3 with 1:6 during lunch and tea breaks. There are also limited numbers of trained neonatal ICU nurses available and this is aggravated by the fact that there are no in-service NICU training courses offered at present and very little in-service education for NICU staff as nurses can seldom be spared from the work environment for training. There is not a dedicated nurse for staff training and education in the NICUs as recommended in the standard and so little training is given. Another area for concern is that in one hospital nursing assistants are caring for infants in the High Care areas without the continuing supervision of registered nurses. This is not satisfactory as these staff, although capable and experienced, are performing some duties which are outside of their scope of practice and the potential for error with medico-legal consequences is great. This situation has also arisen as a result of the staff shortages experienced in the hospitals studied. As is now commonly the case, when staff are on leave or off sick and the available staff is insufficient to meet the requirements of the NICU, nursing agencies are contracted to provide nurses to alleviate this situation. These nurses may have very limited knowledge and experience of NICU and care of sick neonates. This adds to the burden of responsibility of the nurses from the establishment and can, in some ways, increase the workload of the nurses of the establishment.

The equipment available in the two NICUs used in this study met with the standard in general, but there were often shortages of volumetric pumps and syringe drivers. There were also shortages of incubators as many of the available incubators are more than 30 years old and no longer function optimally and so are frequently in need of repairs. Incubators are serviced twice a year.

5.2.2 Formulate and evaluate process standards

The overall performance regarding procedures was below the acceptable standard set, with an average of 76% achieved. The procedure performed to the lowest standard was passing an intra-gastric tube. This procedure scored an average of 55.7%. Routine care (68.9%) and physiotherapy and suction (67%) were also poorly performed with averages below the expected level. One of the main reasons for the low

percentages was because the nurses neglected to wash their hands. Although hand washing is the most important procedure for infection control in the NICU (Merenstein, Adams, Weisman in Merenstein and Gardner 2002), the researcher feels that it can sufficient to spray hands, specifically when performing different procedures on the same infant and when the one procedure directly follows another. However, in standards set, both in this research and in literature, the requirement is that nurses should wash hands for 10 – 15 seconds between infant contacts (Merenstein, Adams, Weisman in Merenstein and Gardner 2002).

5.2.3 Formulate outcome standards

Slagle and Gould (1992) investigated the use of databases in NICUs and found that the nurseries that had data collected were able to use this in Quality Assurance programs although the authors did state that the database needs to be carefully developed and should address issues of quality control. It was alarming to find that the statistics collected by the NICUs in the study were not comprehensive and that the NICUs did not have a uniform data collection tool reflecting details of admissions, course of progress and discharge outcomes. One NICU had admission and discharge statistics while the other had discharge statistics only. Health care professionals argue that the acuity level of patients is ever increasing, placing an additional burden on the already compromised staff numbers and that this is a contributing factor to suboptimal care. This assumption can not be verified as no statistical evidence is available to support this viewpoint or to dispute this statement.

5.3 Recommendations

The recommendations made are based on the findings as detailed in Chapter 4 and the conclusions found above.

5.3.1 Implementation of a Quality Assurance Program

The implementation of a Quality Assurance Program will ensure that the present lack of standards is remedied. In-service training and education is necessary for all categories

of staff working in the Nursery. This will raise consciousness of the work being done. In order to achieve the above, certain steps are necessary. These are detailed as follows:

5.3.2 Creation of protocols

The researcher feels that the need for guidelines or protocols of practice in the NICU has been clearly demonstrated. These should be developed by the nursing staff working together as a team so that they feel 'ownership' of the protocols and they should be motivated to comply with them and to continually develop them as practice changes and evolves. Basic guidelines that are applicable to all categories of staff e.g. Hand washing, should be developed as soon as possible so that the staff are aware of how to perform these tasks properly. The specific guidelines that apply to other areas of the NICU should then be developed by the nursing staff. This should be done with the support of recent literature, experience and with input from the medical staff.

Making protocols for care available to the nursery staff will help to guide newly qualified nurses in the nursery as to the appropriate approaches to practice as they do not generally spend much time in the nursery during their training. They can also be used for teaching and orientation of agency nurses when they come to work in the nurseries and for updates and reference for nurses working permanently in the nursery.

It must be borne in mind that a formalized guideline will not guarantee that the procedure is performed correctly. However guidelines can assist with quality assurance and can also be used as a frame of reference for practice.

5.3.3 Education of all categories of staff

The availability of protocols of practice will in itself become an educational tool for the staff of the NICU. It will be necessary to provide rationales with the actions detailed in the protocols to justify and explain the actions of the protocols. Further educational aids can be provided by making reference books available, giving informal lectures when opportunity presents and by encouraging staff to join a library attached to a University or by providing journals and articles for reading. Generally creating a culture of learning will enhance the confidence of the staff and encourage further study. The researcher feels strongly that nurses should continually learn and question while in the work

environment as, especially in the field of Neonatal Nursing, research and development are constantly making impacts resulting in changes in the work that is being done. This sentiment is supported by Lynch (1991), when she states “it is mandatory that institutional educational resources support the knowledge base for the nurse to maximize her or his caregiving potential.”

5.3.4 Training of staff

As stated previously, there is not an in-service Neonatal Nursing Course available for nurses working at the study hospitals. However there are distance-learning opportunities through several Universities in South Africa and the nurses should be encouraged to explore these so that they can further their knowledge and become more qualified in this field. The nurses will need support and encouragement and possibly also financial assistance as these courses are considerably more costly than the in-service courses previously offered by the hospitals. There are funds available to assist nurses in this regard and the nurses must be helped in securing financial assistance. It is the responsibility of all nurses in practice to increase their knowledge in keeping with the developments of their field of care and again the statement by Lynch (1991) “In addition, the nurse must have a reciprocal responsibility to participate in these educational opportunities to support safe and professional practice” supports the sentiments of the researcher.

5.3.5 Future research

The field of Neonatal Nursing has not been the subject of much research in South Africa. There is scope for research in many spheres of this discipline. There is an active nursing research community in other countries around the world and replicated studies could be helpful in encouraging South African nurses to address issues of practice and to make evidence-based choices for changes in practice.

A retrospective audit of records and regular audits of care thereafter will give indications of areas where there is scope for further study and improvement in practice.

5.3.6 The change to Evidence-based Practice

Neonatal nurses in South Africa have a wealth of information available to them in the published literature found in libraries and on the electronic media. Taking advantage of this will increase their knowledge, improve their practice and enhance their patients' outcomes. The onus is on all nurses to continue with their education and to take advantage of all available opportunities to increase their skills so that their patients can benefit and ultimately the nurse has the satisfaction of knowing that she is giving the best possible care.

Two notable recent developments in neonatal care are pain management and developmentally appropriate care. Overseas researchers have devised scales for measuring pain responses in neonates, in the context of their gestational age and behavioural state and it is the researchers' opinion that these should be investigated and utilized in all South African NICUs. This will improve the outcomes of the patients as reduction of pain and the removal of the consequent responses will be beneficial to the outcomes of sick and preterm infants

Developmentally appropriate care should also be investigated further as there are benefits associated with this approach that can reduce costs of neonatal care and enhance the outcomes of the infant.

5.4 Conclusion

This chapter has dealt with the general conclusions drawn from the research undertaken. Acknowledgement is made of the limited number of NICUs assessed, but this was unavoidable. The recommendations are based on the conclusions made.

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ADDENDUM A

Permission for Data Gathering.

ADDENDUM B

Structure and Process Standards.

Structure Standard for a Neonatal Intensive Care Unit (NICU).

Objective: to provide a safe environment for the care of sick infants in the NICU.

Key: 01: observed
02: not observed
03: not applicable

No.	Criteria.	Result
	A mission statement should be visible for staff, parents and visitors to see	
	An personnel organogram is visible for staff, parents and visitors	
1	**General**	
	The NICU should be in close proximity to the delivery suite	
	There should be access control to the NICU/nursery area	
	There should be good visibility of patients and staff	
	The NICU should not be a thoroughfare to other parts of the nursery	
	There should be two exits from the NICU	
	The doors should be a minimum of 80 cm wide	
	Daylight must be provided	
	Provision should be made to shade direct daylight from infants	
	Artificial lighting should be indirect with adjustable intensity	
	Direct lighting for procedures should be available at each bedside. This should not affect adjacent lying infants. May be integral to the radiant incubator/incubator or a free-standing light.	
	The temperature of the environment should be controlled at between 23°-25°C	
	There should be a minimum of 6 air changes each hour with at least 2 changes being outside air	
	Air flow should be at low velocity to minimize drafts, noise and airborne particulate matter	
	Filters of air-conditioners should be changed regularly.	
	The walls should be minimum 2 meters high	
	There should be a clear area of 2.5 meters around each incubator	
	Wall surfaces should be easily cleaned	
	There should be protective devices at points where equipment may make contact with walls	
	Floor surfaces should be easily cleanable and minimize growth of microorganisms	
	Floor surfaces should be able to withstand frequent cleaning and heavy traffic	
	Ceilings should be easily cleanable	
	The ceiling should have a noise reduction co-efficient	
	Ceilings should prevent the passage of particles from the space above into the clinical environment	
	Work surfaces should be easily cleanable	
	There should be a minimum of seams in the work surfaces. These should be well sealed	
	Due care should be taken to reduce noise of equipment in the NICU	
	Refuse bins should be plastic and operated ‘hands free’	
	Doors should have controls fitted to prevent slamming, but keep them closed	
	Isolation rooms should be available for isolation of infectious patients	
	A fire evacuation policy should be in place	
	Emergency equipment is available and in working order	
	There should be a policy in place for security of patients, families and staff	
2	**Electrical, gas and mechanical needs**	
	There should be 14 power plugs available for each incubator space	
	There should be 2 oxygen points available for each incubator space	

No.	Criteria	Result
	There should be 2 compressed air points available for each incubator space	
	There should be 1 suction point available for each incubator space	
	Power points should be connected to the emergency power backup	
	The sink for washing hands should not be no more than 6 m from all incubators	
	The taps on the sink should be operatable ‘hands free’	
	Receptacles for waste should be plastic, pedal operated	
	There should be a separate receptacles for bio-hazardous waste and sharps	
3	**Milk kitchen**	
	A room for preparation and storage of breast and formula milks should be provided	
	A counter area should be provided for preparation of feeds	
	A refrigerator must be available for storage of milk products in this room	
	A sink with hands-free taps and facilities for soap dispensing and hand towels should be provided	
4	**Offices, utility and storage areas**	
	Storage areas should be available for clean goods e.g. linen, equipment, medications, expendable stock	
	Soiled goods should be placed into closed receptacles and removed to the sluice area at regular intervals daily	
	An area should be designated for a staff lounge, with lockers	
	Private toilet facilities with a wash hand basin should be provided for staff	
	There should be an office for administration duties of the nursing staff	
	A private lounge area should be provided for parents and visitors	
	Private toilet facilities with a wash hand basin should be provided for visitors	
	The sluice room should have a sluice sink and hand basin, both with hands free taps	
	There should be a low level sink for filling buckets	
	Shelves should be provided for storage of materials	

Comments:

Structure Standard for Equipment in a Neonatal Intensive Care Unit (NICU).

Objective: to ensure sufficient equipment for the safe care of sick infants in the NICU.

Key: 01: observed
02: not observed
03: not applicable

No.	Criteria.	Result
	There is a radiant heated incubator available for each bed space in the NICU	
	There are closed incubators available as required	
	There is an oscillator available if required	
	There is a ventilator available for each bed space in the NICU	
	There is a humidifier available with each ventilator/oscillator	
	There are sufficient ventilator circuits to allow for weekly changes of the circuits	
	There is a monitor available for each bed space in the NICU. This monitor illustrates and records: • Heart rate • Respiration rate • Blood pressure – invasive/non-invasive • Mean arterial pressure • Oxygen saturation	
	Suction available for each NICU bed	
	Emergency resuscitator available for each bed attached to oxygen source	
	Intravenous infusion pumps available for each bed as needed	
	Syringe driver pumps available for each bed as needed	
	There is a blender available for infants receiving oxygen via nasal prongs or headbox	
	• This blended air is humidified by bubbling through water in a bottle attached to the blender	
	Oxygen analyzers available for measuring percentages of oxygen administered in headboxes	
	Emergency equipment is available for use at all times: • Laryngoscope blades size 0 and 1 • Laryngoscopes with good batteries • Extra light bulbs and batteries • Assorted sizes of endotracheal tubes • Sterile introducers • Appropriate drugs for resuscitation • Syringes and needles • Intravenous cannulae • Intravenous equipment	
	A mobile x-ray machine available for use in the NICU	
	An x-ray viewing box is available in NICU	
	A laboratory should be available close to the NICU for neonatal service needs	
	A Blood gas analysis machine available	
	Phototherapy lights available if needed	
	Cold light for transillumination	
	An ultra sound machine for ultrasound scans	
	A policy should be in place for repair, maintenance, upgrading and replacement of equipment	

Comments:

Structure Standard for staffing a Neonatal Intensive Care Unit (NICU).

Objective: There should be sufficient qualified and experienced staff to provide safe care of sick infants in the NICU.

Key: 01: observed
02: not observed
03: not applicable

No.	Criteria.	Result
1	The ratio of trained neonatal nurses to NICU (Level 3) patients should be 1:1	
	The ratio of nurses to high care (level 2) patients should be 1:2	
	The ratio of nurses to special care/normal care (Level 1) patients should be 1:4	
	The manager of the NICU should be a senior nurse with experience in Neonatal Nursing	
	There should be a dedicated nurse for further education and training of staff	
	Sufficient staff on the establishment to allow for annual leave, sick leave, study leave, maternity leave, training, and attendance of meetings and professional development without compromising the patient: staff ratios	
	An orientation program should be available for new staff to assist with their induction to the nursery	
	Nurses working in the NICU should have had post-basic training in Neonatal Nursing	
2	**Levels of care**	
	Intensive Care: • Receiving respiratory support via a tracheal tube and for 24 hours after withdrawal of support • Receiving NCPAP • Weight less than 1000g and receiving NCPAP and for 24 hours after withdrawal • In the pre-operative period before major surgery, and 24 hours post-operative • Requiring complex clinical procedures e.g. exchange transfusion, peritoneal dialysis, infusion of inotropes, pulmonary vasodilators or prostaglandins and for 24 hours afterward • Any unstable infant considered to require 1:1 nursing care • Any infant on the day of death • Infants having convulsions and requiring a second dose of Phenobarbitone • Infants with chest drains and central lines (arterial, venous or umbilical)	
	High Care • Less than 29 weeks gestation and less than 48 hours of age • Weight less than 1000g and not fulfilling criteria for NICU • Receiving Total Parenteral Nutrition • Infants having convulsions before second dose of Phenobarbitone • Receiving Oxygen and less than 1500g weight • Infants with apnoea requiring frequent stimulation • Infants receiving intragastric feedings, some with intravenous therapy • Infants whose weight is below 1600g, before commencement of 24 hour Kangaroo Mother Care	
	Special/Normal Care (infants nursed in bassinettes) • All infants who can not reasonably be expected to be cared for by their mothers. • Growing infants >1800g requiring feedings because their mother is not available to give 24 hour Kangaroo Mother Care • Infants who have no need for medical attention	

Comments:

Process Standard for Hourly Observations.

Expected outcomes: To detect changes in the condition of an infant and act appropriately.

Key: 01: observed (i.e. action conducted correctly while researcher was present)
02: not observed (i.e. action not conducted while researcher was present)
03: not applicable (i.e. action not applicable to this patient)
04: emergency situation, so not performed.
#: critical element. Deduct 30% if omitted or not correctly performed.

No.	Criteria.	Result
1	**PREPARATION**	
	Assess the need for observations • Although observations are recorded hourly, nurses should, at all times, observe the appearance of infants in their care noting the colour, respiration rate, temperature readout on the incubator display and the ventilator and saturation monitor readouts	
2	**REQUIREMENTS**	
2.1	The observation record/chart	
2.2	A temperature probe attached to the infant	
2.3	A telethermometer/servo-controlled incubator	
2.4	A saturation monitor	
2.5	Other equipment that may be at the bedside e.g. a ventilator and humidifier	
3	**PROCESS**	
3.1#	Avoid over-handling of the infant	
3.2	Assess the appearance of the infant	
3.3	Ensure that the endotracheal tube/nasal prongs are firmly secured	
3.4	Note the position of the tube – check for signs of displacement	
3.5	Avoid traction on the tube by supporting tubing and connectors	
3.6	Record the infant's temperature	
3.7#	Note differences from previous recordings - investigate	
3.8	Record the incubator temperature/ the temperature set on the incubator	
3.9#	Note differences from previous recordings - investigate	
3.10	Count the respirations for at least 15 seconds and multiply to 60 seconds	
3.11	Record	
3.12#	Note differences from previous recordings - investigate	
3.13	Apply the saturation monitor to the infant's hand or foot	
3.14	Wait until there is a satisfactory quality reading	
3.15	Record the reading of saturations	
3.16#	Take appropriate action to achieve saturations of 89-93%	
3.17	Record changes made	
3.18	Record the heartrate reading from the saturation monitor/cardiac monitor	
3.19#	Note differences from previous recordings - investigate	
3.20	Check that the blood pressure cuff is correctly applied	
3.21	Switch the blood pressure monitor on	
3.22#	Record the reading - note differences from previous readings - investigate	
3.23	Read the pressure display on the ventilator and record	
3.24#	Note differences from previous recordings - investigate	
3.25	Record the oxygen percentage of the ventilator/headbox oxygen analyzer	
3.26	Check that there is sterile water in the humidifier/puritan bottle – replenish if necessary	
3.27	Check the intravenous site – record the condition of the site	
3.28#	Take appropriate action to remedy problems	
3.29	Change the infant's position if necessary, taking care not to kink tubing	
3.30	Report any abnormalities or changes noted	
3.31	Sign for the observations recorded	

Comments:

Process Standard for Routine Care of an Incubated Infant

Expected Outcome: Routine care should be performed on a neonate in order to keep the umbilical cord clean, for the maintenance of hygiene and for the comfort of the infant.

Key: 01: observed (i.e. action conducted correctly while in the presence of the researcher)
02: not observed (i.e. action not conducted in the presence of the researcher)
03: not applicable (i.e. action not applicable to this patient)
04: emergency situation, so not performed.
#: critical element. Deduct 30% if omitted or not correctly performed.

No.	Criteria	Result
1	**PREPARATION**	
1.1	Establish the need for nursing care: • The infant has soiled his napkin • The infant needs to be turned and made comfortable	
2	**REQUIREMENTS**	
2.1	Dry gauze swabs	
2.2	Lotion e.g. Glycerine, for mouth care	
2.3	Applicable lotion for cord care	
2.4	A cord clamp cutter	
2.5	Warm wet swabs for buttock care	
2.6	A clean napkin	
2.7	Petroleum jelly or cream per hospital policy	
3	**PROCESS**	
3.1 #	Aseptic technique: • Wash hands	
	• Spray hands with antiseptic spray	
3.2	Moisten a dry swab with Glycerine	
3.3	Wipe the infant's lips with the swab	
3.4	Remove any debris that comes loose	
3.5	Discard the used swab	
3.6	Observe the condition of the infant	
3.7	Repeat steps 3.2 to 3.6 until satisfied that the lips are clean	
3.8	Spray 3 swabs with lotion for cord care	
3.9	Hold the cord perpendicular to the abdomen with one swab	
3.10	Wipe the base of the cord in a 180°arc with the second swab	
3.11	Discard the swab	
3.12	Use the third swab to wipe the remaining area at the base of the cord	
3.13	Discard the remaining swabs	
3.14	Repeat steps 3.8 to 3.13 until satisfied that the base of the cord is clean	
3.15	If the cord clamp is still on and can be removed because the cord is dry: • Spray the clamp cutter with Surgical spirits or Alcohol	
	• Remove the clamp by cutting through the loop of the clamp	
3.16	Loosen the napkin	
3.17	Remove the soiled napkin - discard	
3.18	Wipe the buttocks with the wet swabs till clean	
3.19	Dispose of the soiled swabs	
3.20	Place the clean napkin under the infant	
3.21	Apply petroleum jelly or cream, as per hospital policy, to the buttocks	
3.22	Stick the napkin closures down to secure the napkin	
3.23	Change the position of the infant: • **Roll** the infant onto his side or into prone position	
	• Turn the head appropriately	
3.24	Observe the infant to ensure that he is comfortable	
3.25	Wash hands	
3.26	Document the actions and findings	

Note: Napkin change may be done as needed.

Process Standard for Physiotherapy and Suctioning of an Intubated Neonate.

Expected outcome: The ability to determine the need for and to perform adequate chest physiotherapy and suctioning on an intubated infant.

Key: 01: observed (i.e. action conducted correctly in the presence of the researcher)
02: not observed (i.e. action not conducted in the presence of the researcher)
03: not applicable (i.e. action not applicable to this patient)
04: emergency situation, so not preformed.
#: critical element. Deduct 30% if omitted or not correctly performed.

No.	Criteria.	Result
1	**PREPARATION**	
	Assess the need for physiotherapy and suctioning • Do the lungs sound congested on auscultation • Does the infant appear distressed • Have the saturations dropped • Is the infant about to be extubated	
2	**REQUIREMENTS**	
2.1	Saturation monitor	
2.2	A clean suction machine in working order.	
2.3	A selection of suction catheters of three sizes: • French gauge 4 for size 2 endotracheal tube • French gauge 5 for size 2.5 endotracheal tube • French gauge 8 for size 3 endotracheal tube	
2.4	Plastic sterile gloves	
2.5	Suction tubing to attach the suction machine to the suction catheter	
2.6	An ampoule of normal saline for lavage in the endotracheal tube	
2.7	A bowl of sterile water to flush the suction tubing with on completion of the procedure	
2.8	Alcohol/surgical spirits	
2.9	Dry filamented cotton swabs	
2.10	Equipment available in case of an emergency: • A laryngoscope	
	• Clean endotracheal tubes	
	• Introducers pre hospital policy for the endotracheal tubes	
3	**PROCESS**	
3.1 #	Aseptic technique: • Wash hands	
	• Spray hands with antiseptic handspray	
3.2	Clear the ventilator circuit tubing of all condensation • Tap the tubing to accumulate condensation in the water trap Or • Disconnect the circuit from the inspiratory port on the ventilator and shake the condensation out. Reconnect.	
3.3	Obtain a baseline saturation reading	
3.4	Leave the saturation monitor on the patient for the duration of the procedure	
3.5	Increase the FiO2 by 10% for two minutes prior to suctioning if indicated	
3.6 #	Maintaining the sterility of the catheter, connect the suction catheter to the suction tubing	
3.7	Set the pressure of the suction to no more than – 20 bars on the gauge on the suction machine	
3.8	Prepare the glove: • Open the outer peel packing of the sterile glove	
	• Leave the glove folded in the sterile paper	
3.9	Apply percussion on the chest: • Using a Bennet mask and/or	

No.	Criteria	Result
	• Using the fingers of one hand in a drumming movement over the chest	
	• Percussion should radiate toward the midline of the chest	
3.10#	Assess the condition of the infant	
3.11	Increase the percentage of oxygen administered if necessary	
3.12	Using a filamented swab sprayed with alcohol/surgical spirits, clean the connection between the ventilator circuit and the endotracheal tube	
3.13	Loosen the connection between the ventilator and the endotracheal tube	
3.14	Set the ventilator alarm to 15 seconds delay	
3.15	Maintaining it's sterility, put the glove on	
3.16	Place the paper to which the glove was attached under the connection between the ventilator circuit and the endotracheal tube. This provides a sterile area on which to rest the connection during suctioning	
3.17 #	Taking care to maintain sterility, remove the wrapping from the suction catheter with the left (unsterile) hand, and hold the end of the catheter in the right (sterile) hand	
3.18	With the left hand, disconnect the ventilator circuit from the endotracheal tube	
3.19	Rest the ventilator end of the connection on the sterile paper	
3.20	Insert the suction catheter down the endotracheal tube until there is a reaction from the infant which indicates that the tip of the catheter has passed through the end of the endotracheal tube, or until you are satisfied that the tip of the catheter is as far down the endotracheal tube as necessary	
3.21	With the left hand close the pressure hole on the suction catheter so that there is suction at the tip of the catheter	
3.22	Rotate the catheter between fingers while withdrawing it from the endotracheal tube	
3.23	If the secretions are thick and sticky, normal saline 0.25 ml. may be instilled into the endotracheal tube before inserting the catheter	
3.24	Reconnect the ventilator circuit to the endotracheal tube	
3.25#	Assess the saturation status of the infant	
3.26	If the infant's condition is satisfactory, steps 3.18 to 3.25 may be repeated until you are satisfied that the secretions have been cleared	
3.27	If the infant has desaturated, allow time to recover before repeating steps 3.17 to 3.25	
3.28	If necessary, increase the oxygen percentage further to facilitate recovery of the saturation to a satisfactory level	
3.29	Once satisfied that all secretions have been removed from the endotracheal tube, you may suction the oro- and nasopharynx, and the mouth	
3.30	If there is a need to suction the endotracheal tube again, use a new sterile suction catheter and glove	
3.31	Clear the suction tubing by suctioning sterile water from the bowl at the bedside	
3.32	Check the saturations of the infant	
3.33	Wash hands	
3.34	Record the procedure on the infant's records	
3.35#	Monitor the infant until you are satisfied that the condition is stable and that the oxygen requirements have been stabilized	
3.36	Report any abnormalities to the patient's doctor	
3.37	Discard unused water from the bowl at the bedside, and send it for sterilizing	

Comments:

Process Standard for Endotracheal Intubation.

Expected outcome: The safe performing of effective endotracheal intubation to establish a patent airway for ventilation and/or suctioning.

Key: 01: observed (i.e. action conducted correctly while researcher was present)
02: not observed (i.e. action not conducted while researcher was present)
03: not applicable (i.e. action not applicable to this patient)
04: emergency situation, so not performed.
#: critical element. Deduct 30% if omitted or not correctly performed.

No.	Criteria	Result
1	**PREPARATION**	
1.1	Assess the need for an endotracheal tube: • Is the infant not responding to mask ventilation during resuscitation • Has the infant aspirated meconium below the vocal cords • Does the infant require mechanical ventilation • Are there copious secretions that can best be removed by suction through the endotracheal tube • Has the doctor requested a tracheal aspirate	
2	**REQUIREMENTS**	
2.1	Laryngoscope as available in the hospital/area. Size 0 blade for infants up to 1500g, size 1 blade for infants larger than 1500g.	
2.2	Endotracheal tubes: • Size 2 for infants <1500g. length of tube 6 cm • Size 2.5 for infants 1500g – 2500g. length of tube 7cm. • Size 3 for infants >2500g. length of tube 8 cm.	
2.3	A copper wire introducer, or introducer per hospital policy	
2.4	Suction with the size suction catheters appropriate for the size of tube to be used: • French gauge 4 for size 2 endotracheal tube • French gauge 5 for size 2.5 endotracheal tube • French gauge 8 for size 3 endotracheal tube	
2.5	Oxygen supply available	
2.6	A bag and mask for ventilation	
2.7	Ventilator circuit and humidifier attached to prepared ventilator	
2.8	Cap to secure the endotracheal tube per hospital policy	
2.9	Stethoscope	
3	**PROCESS**	
3.1 #	Aseptic technique: • Wash hands	
	• Spray hands with antiseptic spray	
3.2 #	Maintain the sterility of the equipment during preparation	
3.3	Prepare the equipment • Insert introducer into endotracheal tube	
	• Bend the tube to the desired shape	
	• Check the length of the tube, position the flange at the correct length	
3.4	Attach the resuscitator to oxygen for use if necessary	
3.5	Position the patient: • on a flat surface	
	• neck slightly extended	
	• head in the midline	
3.6	Prepare the laryngoscope: • pull the blade to a 90° position to switch the light on	
	• check that the bulb is tightly screwed in	
3.7	Hold the laryngoscope in the left hand, the blade pointing away from you	
3.8	Open the mouth with the fingers of the right hand	
3.9	Introduce the blade into the mouth	

No.	Criteria.	Result
3.10	Keep the tip of the blade in the midline	
3.11	Stabilize the left hand against the patient's face	
3.12	Advance the blade over the tongue, pushing the tongue to the left	
3.13	The uvula will become visible	
3.14	Advance the blade a little further	
3.15	Apply gentle pressure to the larynx with the 5th finger of the left hand	
3.16	Advance the blade further	
3.17	The epiglottis will come into view	
3.18	Suction if required	
3.19	Identify landmarks: • the epiglottis	
	• the vocal cords	
	• the oesophagus posteriorly	
3.20	Introduce the endotracheal tube into the right side of the patients mouth with the right hand	
3.21	Keeping the vocal cords in view, advance the tube toward the larynx	
3.22	Pass the endotracheal tube 1 cm. through the vocal cords	
3.23	With the right hand, grip the endotracheal tube at the level of the lip	
3.24	Stabilize the right hand against the side of the patient's face	
3.25	Remove the laryngoscope with the left hand	
3.26	Carefully remove the introducer from the endotracheal tube	
3.27	Attach the resuscitator or the ventilator circuit to the endotracheal tube	
3.28	Assess the placement of the tube: • auscultate both sides of the chest for equal air entry	
	• observe chest movement	
	• auscultate the stomach and assess for distention	
3.29	When satisfied that the tube is correctly placed, secure as per hospital policy	
3.30	Position the patient so that he is comfortable	
3.31	Wash hands	
3.32	Document the procedure	
3.33	An x-ray may be taken to confirm the position of the tube	

Comments:

Process Standard for the Administration of Medications.

Expected outcome: The safe and correct administration of oral, intravenous or intramuscular medications to a neonate.

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02: not observed (i.e. action not observed while researcher present)
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04: emergency situation, so not performed.
#: critical element. Deduct 30% if omitted or not correctly performed.

No.	Criteria.	Result
1	**PREPARATION**	
	Assess the need for administration of medications • Is it the correct time for medication administration • Has a medication been ordered specifically i.e. a stat dose	
2	**REQUIREMENTS**	
2.1	The medication chart	
2.2	The required medications	
2.3	Appropriate syringes, needles and alcohol swabs for administration of medications	
2.4	Plasters for injection sites	
2.5	Dry swabs	
3	**PROCESS**	
3.1 #	Aseptic technique: • Wash hands	
	• Spray hands with antiseptic spray	
3.2 #	Identify the patient	
3.3	Check that the order has not expired	
3.4	Check that the medication is due at this time	
3.5 #	Check that the medication has not yet been given	
3.6	Check that the medication has not expired	
3.7	Calculate the required amount of medication according to the prescribed dose/doses	
3.8	Tilt the bottle repeatedly until suspensions are well mixed	
3.9	Using a 1ml syringe for doses of less than 1ml, draw up the oral medication(s). For doses of more than 1ml, use the appropriate syringe.	
3.10	Open the plug of the intra-gastric tube/disconnect the feeding tube, maintaining the sterility of the plug/feeding tube connection	
3.11	Insert the syringe end into the intra-gastric tube	
3.12	Inject the contents of the syringe into the intra-gastric tube	
3.13	If more than one medication is due, follow steps 3.8 to 3.12 again	
3.14	Close the intra-gastric tube end/reconnect the feeding tube	
3.15	Prepare the injection vial for use: reconstitute the contents per hospital policy	
3.16	Label the vial with the date, time and volume used to reconstitute, and signature	
3.17	Calculate the amount required for the injection	
3.18	Using an appropriate syringe, draw up 0.05ml more solution than needed from the vial	
3.19	Remove the syringe from the needle in the vial	
3.20	Fix a clean 26 gauge needle to the syringe	
3.21	Inject the extra 0.05ml drawn up to fill the needle with the medication	
3.22	Give intramuscular injections in the middle third of the anterior aspect of the thigh	
3.23	Prep the injection site as per hospital policy	
3.24	Immobilize the limb into which the injection is to be given	
3.25	Insert the needle at a 90° angle to the thigh	
3.26	Withdraw the plunger to ensure that the end of the needle is not in a blood vessel	
3.27	Inject the medication slowly	
3.28#	Apply gentle pressure to the site after giving the injection if it is bleeding	
3.29	Apply the plaster to the puncture site	
3.30	Prepare drugs for intravenous administration as for steps 3.15 – 3.17	

No.	Criteria.	
3.31	Draw up the required amount of injection	
3.32	Check the intravenous site for inflammation or oedema and patency of the line	
3.33	Clean the injection port in the administration set with an alcohol swab	
3.34	Clamp the intravenous line distal to the injection port	
3.35	Insert the injection needle into the injection port	
3.36	Slowly administer the injection	
3.37	Observe the infant while injecting	
3.38	Withdraw the needle on completion of the injection	
3.39	Release the clamp on the intravenous line	
3.40#	Sign for administration of the medication	
3.41	Observe the infant to ensure that the infant is comfortable	
3.42#	Dispose of sharps per hospital policy	

Comments:

Process Standard for Giving Headbox Oxygen Therapy.

Expected outcome: The hypoxic infant should have the required percentage of oxygen safely administered via a headbox.

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02: not observed (i.e. action not performed in the presence of the researcher)
03: not applicable (i.e. action not applicable to this patient)
04: emergency situation, so not performed.
#: critical element. Deduct 30% if omitted or not correctly performed.

No.	Criteria.	Result
1	**PREPARATION**	
1.1	Assess the need for oxygen therapy: • Is the infant cold • Is the infant displaying signs of respiratory distress – grunting, cyanosis, tachypnoea, recession	
2	**REQUIREMENTS**	
2.1	Headbox	
2.2	Oxygen monitor	
2.3	Saturation monitor	
2.4	Oxygen and compressed air blender	
	Both air tubes correctly fitted into the wall sockets	
2.5	Clean puritan bottle attached to the blender	
	With water to humidify the air	
2.6	Clean tubing connecting the puritan bottle to the headbox	
3	**PROCESS**	
3.1 #	Aseptic technique: • Wash hands	
	• Spray hands with antiseptic spray	
3.2	Place the infant in an incubator	
3.3	Check the saturation of the infant – leave the probe attached to the infant	
3.4	Set the percentage of oxygen on the blender to 50%	
3.5	Turn the flowmeter to 5l to allow CO_2 to wash out of the headbox	
3.6	Allow the headbox to fill with oxygenated air	
3.7	Place the headbox over the infant's head	
3.8	Check that the opening of the headbox is not too big – will allow air to mix with the oxygenated air from the blender. If too big, replace	
3.9	Check that the opening of the headbox is not too small – will be uncomfortable for the infant, and won't allow flow of air out of the headbox	
3.10	Wait for the infant to benefit from the oxygen - +/- 2 minutes	
3.11#	Read the saturations. Assess whether the oxygen is sufficient – the saturations should be 89 – 93%	
3.12	Adjust oxygen percent according to saturations	
3.13	Position the sensor of the analyzer near the face of the infant	
3.14	When satisfied that the amount of oxygen is sufficient, remove saturation monitor probe, wash hands	
3.15	Document the procedure	

Comments:

Process Standard for the Initiation and Care of an Infant with Intravenous Therapy.

Expected outcome: To identify infants who require intravenous (IV) therapy, to successfully initiate intravenous therapy and care for an infant with intravenous therapy.

Key: 01: observed (i.e. action conducted correctly while researcher was present)
02: not observed (i.e. action not conducted while researcher was present)
03: not applicable (i.e. action not applicable to this patient)
04: emergency situation, so not performed.
#: critical element. Deduct 30% if omitted or not correctly performed.

No.	Criteria.	Results
1	**PREPARATION**	
	Assess the need for IV therapy • Is the patient too small to have oral feeds • Is the patient too sick to have gastric feeds • Is the patient hypoglycaemic • Does the patient need IV medications	
2	**REQUIREMENTS**	
2.1	The IV solution ordered	
2.2	A giving set appropriate for the control pump used	
2.3	A Buretrol if needed	
2.4	IV cannulae	
2.5	Alcohol prep swabs	
2.6	A splint to immobilise the limb if necessary	
2.7	Strapping to fix the cannula in place	
2.8	The control pump to be used	
3	**PROCESS**	
3.1 #	Aseptic technique: • Wash hands	
	• Spray hands with antiseptic spray	
3.2 #	Prepare the IV solution and giving set: • Attach the giving set to the IV solution bag	
	• Flush the IV solution through the giving set making sure that there are no bubbles in the tubing	
	• Cover the patient end of the giving set to maintain sterility	
	• Place the patient end of the giving set near the infant	
	• Set the infusion rate on the control pump	
3.3	Warm the infant if he is cold	
3.4	Select the vein	
3.5	Cover the infant to prevent unnecessary exposure	
3.6	Apply gentle pressure or a tourniquet to the limb	
3.7	Stabilise the area of puncture	
3.8	Prep the area of the puncture site	
3.9	Puncture the skin at +/- 30° angle	
3.10	Use a more acute angle for superficial veins	
3.11	Advance the needle to puncture the vessel	
3.12	If a haematoma develops, remove the needle and apply pressure to the area until haemostasis occurs	
3.13	If resistance is met, or the vessel is not punctured, withdraw the needle slowly to below the puncture site, locate the vessel and advance the needle again	
3.14#	If unsuccessful twice, ask another qualified person to attempt	
3.15	When blood returns into the needle, remove the needle, leaving the cannula in place	
3.16	Advance the cannula into the vein	
3.17	Attach the IV line to the cannula – stabilise the position of the connection	
3.18	Open the control on the IV line to ensure the free flow of fluid	

No.	Criteria	Results
3.19	Check that there is no sign of fluid infiltrating the tissues	
3.20	Pass the IV tubing through the control pump and secure	
3.21	Set the pump to infuse	
3.22	Secure the cannula per hospital policy	
3.23	Observe the infant to make sure that he is comfortable	
3.24	Wash hands	
3.25	Document the procedure	
3.26	The IV site and the patency of the line is checked hourly	

Comments:

Process Standard for Capillary Blood Sampling.

Expected outcome: The collection of an adequate, uncontaminated capillary blood sample from a heelprick, for investigations.

Key: 01: observed (i.e. action conducted correctly while researcher present)
02: not observed (i.e. action not observed while researcher present)
03: not applicable (i.e. action not applicable to this patient)
04: emergency situation, so not performed.
#: critical element. Deduct 30% if omitted or not correctly performed.

No.	Criteria.	Result
1	**PREPARATION**	
	Assess the need for the collection of a blood sample • The infant may require blood glucose measurement • The infant may appear jaundiced • The infant may require a blood test e.g. IgM, TSB	
2	**REQUIREMENTS**	
2.1	Alcohol swabs	
2.2	Sterile lancets	
2.3	Sharps container	
2.4	Capillary tubes	
2.5	Putty to seal one end of the capillary tube	
2.6	Labels for the specimens collected	
2.7	Dry cotton swabs to stop bleeding	
3	**PROCESS**	
3.1 #	Aseptic technique • Wash hands	
	• Spray hands with antiseptic spray	
3.2	Check and prepare equipment	
3.3	Warm the heel if it is cold	
3.4#	Select puncture site on the lateral or medial aspect of the heel	
3.5	Prep the selected area as per hospital policy and allow to dry	
3.6	Puncture the heel at right angles to the skin-maximum depth of 2mm	
3.7	Collect the blood drops in the capillary tube	
3.8	Gentle “milking” of the foot above the puncture site may encourage bleeding	
3.9	Seal one end of the capillary tube with putty once the specimen is collected	
3.10	Stop the bleeding by compressing the puncture site with the dry swab	
3.11	Discard the lancet in the sharps container	
3.12	Comfort the infant	
3.13	Wash hands	
3.14	Label the specimen	
3.15	Document the procedure	

Comments:

Process Standard for Capillary Blood Glucose Measurement.

Expected outcome: The collection and testing of a capillary blood sample with the Reflolux meter.

Key: 01: observed (i.e. action conducted correctly while researcher present)
02: not observed (i.e. action not conducted while researcher present)
03: not applicable (i.e. action not applicable to this patient)
04: emergency situation, so not performed.
#: critical element. Deduct 30% if omitted or not correctly performed.

No.	Criteria.	Result
1	**PREPARATION** Assess the need for blood glucose measuring • Large for gestational age infants >4300g birthweight • Infants of diabetic mothers • Growth retarded infants • Preterm infants • Infants with respiratory distress • Polycythaemic infants • Hypothermic infants	
2	**REQUIREMENTS**	
2.1	Alcohol swabs	
2.2	Sterile lancets	
2.3	Sharps container	
2.4	Glucose test strips	
2.5	Glucose meter. Check that the code number on the container of test strips matches the code number displayed on the meter. If not, calibrate the meter with the bar-coded strip provided with the test strips	
2.6	Dry cotton swabs to stop bleeding and to wipe test strip	
3	**PROCESS**	
3.1 #	Aseptic technique • Wash hands	
	• Spray hands with antiseptic spray	
3.2	Check and prepare equipment – switch the Reflolux meter on	
3.3 #	Select puncture site on the lateral or medial aspect of the heel	
3.4	Warm the heel if it is cold	
3.5	Prep the selected area as per hospital policy and allow to dry	
3.6	Puncture the heel at right angles to the skin – maximum depth of 2mm	
3.7	Discard the lancet in the sharps container	
3.8	Collect the drops of blood on the reagent block of the test strip	
3.9	Completely cover the reagent block with blood	
3.10	Do not squeeze the heel to hasten bleeding	
3.11	Gentle “milking” of the foot above the puncture site may encourage bleeding	
3.12	Press the blue ‘time’ key on the Reflolux meter to start the 60 second count	
3.13	At 60 seconds, wipe the blood off the reagent block	
3.14	Insert the strip into the Reflolux meter	
3.15	After another 60 seconds, the meter will display the blood glucose concentration	
3.16	Record the reading	
3.17	Switch the meter off	
3.18	Take appropriate action regarding the result	

Comments:

Process Standard for passing a Intra-gastric Tube.

Expected outcome: To pass an Intra-gastric tube for the management of preterm and sick neonates.

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02: not observed (i.e. action not observed while researcher present)
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04: emergency situation, so not performed.
#: critical element. Deduct 30% if omitted or not correctly performed.

No.	Criteria	Result
1	**PREPARATION**	
1.1	Assess the need for a Intra-gastric tube: • Is the infant too immature to suck • Is the infant too sick to suck • Does the infant need to have a stomach washout	
2	**REQUIREMENTS**	
2.1	The appropriate size Intra-gastric tube: • Weight less than 1500g. a French Gauge 5 tube • Weight 1500 – 2500g. a French Gauge 6 tube • Weight more than 2500g. a French Gauge 8 tube	
2.2	A syringe to test the position of the tube	
2.3	A stethoscope	
2.4	Strapping to fix the tube in position	
2.5	Blue litmus paper	
3	**PROCESS**	
3.1 #	Aseptic technique: • Wash hands	
	• Spray hands with antiseptic spray	
3.2	Wrap the infant firmly in a blanket to reduce movement during the procedure if necessary	
3.3	Measure the desired length of the tube before removing it from the packing: • Measure the distance from the suprasternal notch to the xiphisternum • Double this measurement • Add 2,5 cm to the length • Mark the total length measured Or • Measure the length from the nostril to the base of the ear • Add the length from the base of the ear to halfway between the Xiphiod process and the umbilicus • Mark the total length measured	
3.4	Prepare the strapping to fix the tube to the top lip and cheek or chin per hospital policy	
3.5	Support the head and flex the neck slightly	
3.6	Gently insert the tube into the nostril/mouth	
3.7	Pass the tube through the nostril/mouth to the required length	
3.8	If there is difficulty passing the tube, try the other nostril	
3.9	If difficulty is still experienced, ask someone with more experience to assist	
3.10	Fix the tube in place with the strapping per hospital policy	
3.11 #	Assess the condition of the infant	

No.	Criteria.	Result
3.12	Confirm the position of the tip of the tube: Aspirate some of the gastric contents with the syringe. Place a drop of the aspirated fluid on the litmus paper • If the paper turns pink, the fluid is acidic and the end of the tube is in the stomach Or Inject 0,5 - 1ml air through the tube while listening over the epigastric area with the stethoscope. • The characteristic sound of air entering the stomach can be heard if the end of the tube is in the stomach.	
3.13	If the tests do not confirm that the tube is in position, remove the tube and repeat the procedure.	
3.14	Collect a specimen for laboratory examination if requested	
3.15	Observe the infant to ensure that he is comfortable	
3.16	Wash hands	
3.17	Document the procedure	

Comments:

Standard for Performing a Gastric Lavage.

Expected outcome: To identify infants who require a gastric lavage and to perform a gastric lavage without detrimental effects on the infant

Key: 01:observed (i.e. action conducted correctly in the presence of the researcher)
02: not observed (i.e. action not conducted in the presence of the researcher)
03: not applicable (i.e. action not applicable to this patient)
04: emergency situation, so not performed.
#: critical element. Deduct 30% if omitted or not correctly performed.

No.	Criteria.	Result
1	**PREPARATION**	
	Assess the need for a gastric lavage: • Is the infant meconium stained • Does the history of the labour and delivery indicate that there was meconium or blood in the liquor	
2	**REQUIREMENTS**	
2.1	The appropriate size naso-gastric tube: • Weight less than 1000g. a French Gauge 5 tube • Weight 1000 – 2500g. a French Gauge 6 tube • Weight more than 2500g. a French Gauge 8 tube	
2.2	A 5 ml syringe	
2.3	A stethoscope	
2.4	Strapping to fix the tube in position	
2.5	Blue litmus paper	
2.6	Sodium Bicarbonate 2% solution (Soda Bic.) at room temperature	
2.7	A receptacle for the aspirate and the returned solution	
3	**PROCESS**	
3.1 #	Aseptic technique: • Wash hands	
	• Spray hands with antiseptic spray	
3.2	Wrap the infant in a blanket, or immobilize the infant to reduce movement during the procedure if necessary	
3.3	Measure the desired length of the tube before removing it from the packing: • Measure the distance from the suprasternal notch to the xiphisternum • Double this measurement • Add 2,5 cm to the length • Mark the total length measured Or • Measure the length from the nostril to the base of the ear • Add the length from the base of the ear to halfway between the Xiphiod process and the umbilicus • Mark the total length measured	
3.4	Prepare the strapping to fix the tube to the top lip and cheek or chin per hospital policy	
3.5	Support the head and flex the neck slightly	
3.6	Gently insert the tube into the nostril	
3.7	Pass the tube through the nostril to the required length	
3.8	If there is difficulty passing the tube, try the other nostril	
3.9	If difficulty is still experienced, ask someone with more experience to assist	
3.10	Fix the tube in place with the strapping per hospital policy	
3.11#	Assess the condition of the infant	

No.	Criteria	Result
3.12	Aspirate some of the gastric contents with the syringe Place a drop of the gastric fluid on the litmus paper • If the paper turns pink, the fluid is acidic and the end of the tube is in the stomach Or Inject 2ml air through the tube while listening over the epigastric area with the stethoscope • The characteristic sound of air entering the stomach can be heard if the end of the tube is in the stomach	
3.13	If the tests do not confirm that the tube is in position, remove the tube and repeat the procedure with a new tube	
3.14	Aspirate as much of the gastric contents as possible • Collect a specimen for laboratory examination if requested, per hospital policy	
3.15	Discard the rest of the aspirate in the receptacle	
3.16	Draw up 5 ml of the Soda Bic.	
3.17	Gently inject the solution through the intra-gastric tube into the stomach	
3.18	Withdraw the solution via the intra-gastric tube	
3.19	Take care not to pull hard on the plunger as this will traumatize the stomach lining	
3.20	Note the volume of return fluid, and do not allow excess Soda Bic. to remain in the stomach	
3.21	Discard the aspirate in the receptacle	
3.22	Repeat steps 3.16 to 3.21 until the return fluid is clear	
3.23	When satisfied that the undesirable residue has been adequately removed, discard the return solution and the remaining Soda Bic.	
3.24	Decide if the intra-gastric tube is to remain in situ: • If the infant is to be tube fed because the infant has respiratory distress and requires oxygen therapy • If the infant will be tube fed at a later stage, to eliminate the need to pass another intra-gastric tube	
3.25	Observe the infant to ensure that he is comfortable	
3.26	Wash hands	
3.27	Document the procedure	

Comments:

Process Standard for Jaundiced infants and for Infants under Phototherapy.

Expected outcome: The ability to recognize the need for phototherapy, to commence phototherapy and to care for infants receiving phototherapy.

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04: emergency situation, so not performed.
#: critical element. Deduct 30% if omitted or not correctly performed.

No.	Criteria.	Result
1	**PREPARATION**	
	Assess the need for phototherapy • Is the infant jaundiced • Is the TSB raised	
2	**REQUIREMENTS**	
2.1	The infant's TSB result	
2.2	Charts per policy for determining the need for phototherapy	
2.3	A phototherapy unit in good working order	
2.4	A bassinet or incubator for infants < 2000g to lie in	
2.5	Eye covering with tape/plaster to secure to the infant's face	
2.6	Thermometer to monitor temperature	
3	**PROCESS**	
3.1	Explain the need for phototherapy to the mother	
3.2#	Aseptic technique: • Wash hands	
	• Spray hands with antiseptic spray	
3.3	Position the bassinet under the lights	
3.4	Undress the infant and remove the napkin	
3.5	Place the infant in the cot Or Place the infant in the incubator	
3.6	Cover the eyes with the eye pad – make sure that it is properly secured to the infants face	
3.7	Place the infant under the lights	
3.8	Check and record the temperature of the infant hourly	
3.9	If infant becomes cold while under phototherapy in a cot, place in an incubator	
3.10	Turn the infant regularly while under phototherapy	
3.11	Encourage the mother to continue caring for the infant	
3.12	Remove eye pads when feeding	
3.13	Clean the buttocks whenever a stool is passed to prevent excoriation of buttocks	
3.14	Continue with routine care as per policy	
3.15#	Clean eyes 3 hourly if they develop a discharge while covered	
3.16	Check TSB within 24 hours of commencement of phototherapy	
3.17	Continue with this care until phototherapy is no longer needed	
3.18#	Check the TSB within 24 hours of stopping phototherapy	

Comments:

Process Standard for Hand washing in the NICU

Standard: the nurse should have an adequate hand washing technique

Expected outcome: to wash hands whenever necessary in a manner that will allow for disinfection of the hands.

Key: 01: observed (i.e. action conducted correctly while in the presence of the researcher)
02: not observed (i.e. action not observed while researcher present)
03: not applicable (i.e. action not applicable to this patient)
04: emergency situation, so not performed.

No.	Criteria.	Result
1	Identify the need to wash hands: • Has the nurse just come on duty • Has the nurse just returned from outside of the NICU • Has the nurse handled excreta e.g. suction, napkin change, vomitus • Is the nurse about to perform a procedure on an infant	
2	**Requirements**	
2.1	Appropriate disinfectant hand soap with hand pump spray	
2.2	Tap with lever type handle for ease of closing	
2.3	Paper towels in holder for ease of access	
2.4	Plastic pedal bin for disposal of paper towel	
3	**Process**	
3.1	Remove rings and jewellery except wedding bands	
3.2	Turn on tap	
3.3	Wet hands	
3.4	Spray soap onto hands	
3.5	Rub hands together to work up a lather	
3.6	Rub upper surface of one hand with lower surface of other hand	
3.7	Repeat using opposite hands	
3.8	Rub between forefinger and thumb of one hand with other hand	
3.9	Repeat using opposite hands	
3.10	Rub between fingers of one hand with other hand	
3.11	Repeat using opposite hands	
3.12	Rub around wrists of both hands	
3.13	Rinse soap off holding fingers pointing toward the source of the running water	
3.14	The procedure should take at least 2 minutes	
3.15	Keep hands above level of elbows	
3.16	Turn water off	
3.17	Using paper towel, dry both hands	
3.18	Dispose of towel in bin	

Comments:

14 Jeffcoat Avenue
Bergvliet 7945
25 February 1999

The Assistant Director of Nursing
PENINSULA MATERNITY AND NEONATAL SERVICES
GROOTE SCHUUR HOSPITAL
FAX: 021-4044304

Dear Miss Thomas

Re: Request for access to Neonatal Intensive Care Units for research purposes.

As a student on the M.Cur program at the University of Stellenbosch I am required to undertake research for my thesis this year. The title of my research is to be 'An Evaluation of Neonatal Nursing Care in Selected Hospitals in the Western Cape'. I write to request your permission for me to have access to the Neonatal Intensive Care Units of Groote Schuur Maternity and Mowbray Maternity Hospitals so that I may conduct the research.

I propose to develop product, process and outcome standards, which I will personally evaluate as the fieldworker. This will neither impact on the manpower nor have financial implications for the service. The research will not have any ethical implications for the patients, as there will not be any treatment applied or withheld. The patient is not involved during any stage of the process. The expected time required for gathering of material is six (6) months, and I should like to begin the evaluations in April, completing by the end of September of this year (1999). I shall also require access to certain records for the gathering of data related to the outcome standards.

My supervisors, Prof EB Welmann and Dr ME Bester can be contacted at the University of Stellenbosch at (021)-9389297.

I look forward to your reply.

Yours faithfully

Hilary Barlow.

Telephone number:
(021)758984 (H)
(021)6853026 x 231 (W)

14 Jeffcoat Avenue
Bergvliet 7945
4 May 1999

The Assistant Director of Nursing
PENINSULA MATERNITY AND NEONATAL SERVICES
GROOTE SCHUUR HOSPITAL

Dear Miss Thomas

Re: Request for access to Neonatal Units for research purposes.

My letter of 25 February and our telephonic conversation of mid March refer. Enclosed please find a protocol for my proposed research as requested by you. I emphasize that the research will not have any ethical implications, as there will be no care withheld and that there will be no demands made on the staff of the Neonatal Intensive Care Units during the gathering of data. I confirm that I am requesting access to the Neonatal Units of Groote Schuur and Mowbray Maternity Hospitals in order to undertake the research.

I eagerly await your response.

Yours faithfully

Hilary Barlow.

Telephone numbers:
(021) 758984 (H)
(021) 6853026 x 231 (W)

ENQUIRIES
NAVRAE Mrs. S Esau
IMIBUZO In Service Coordinator

TELEPHONE 659 – 5588/7
TELEFOON
IFOWUNI

REFERENCE
VERWYSING 9/2/03
ISALATHISO

DATE
DATUM 11 February, 2003
UMHLA

PROVINCIAL ADMINISTRATION: WESTERN CAPE
Health and Social Services
MOWBRAY MATERNITY HOSPITAL

PROVINSIALE ADMINISTRASIE: WES-KAAP
Gesondheid en Maatskaplike Dienste
MOWBRAY KRAAMHOSPITAAL

ULAWULO LWEPHONDO: INTSHONA KOLONI
Lezempilo Neenkonzo Zentlalo
MOWBRAY ISIBEDLELE SOBELEKISO

Ms Hilary Barlow
14 Jeffcoat Avenue
Bergvliet
7945

Dear Ms Hilary Barlow

RE: An Evaluation of Neonatal Nursing Care in Selected Hospitals in the Western Cape.

The MMH Research Committee has granted approval for you to do the above research study at Mowbray Maternity Hospital from 1 July to 30 September 1999 .

- Have you commenced/completed your research?
- If completed, kindly furnish us with your feedback/report.

Forward report/feedback to Education Department, Attention: Mrs. S Esau

Yours sincerely

Dr. SR Fawcus
Chairperson: Research Committee
Consultant Head: Obstetrics
Mowbray Maternity Hospital

Reference: F/9/1/2
Enquiries: C Thorpe
Date: 3 June 1999

Mrs Hilary Barlow
14 Jeffcoat Avenue
Bergvliet 7945

Dear Mrs Barlow

REQUEST FOR ACCESS TO NEONATAL INTENSIVE CARE UNITS FOR RESEARCH PURPOSES

Your letters dated 25 February and 24 May 1999 have reference.

There will be no objection from the Nursing Division to your undertaking your research project in the Neonatal Intensive Care units at Groote Schuur Hospital and Mowbray Maternity Hospital . Permission will however have to be obtained from the Medical Superintendent before you commence as you are wishing to make use of patient documents. You will also have to obtain the permission of the Head of Department, Prof. Woods.

Once you have obtained the necessary permission you may make arrangements to visit the Nurseries at a time suitable to you. Kindly contact Mrs Ryan at Groote Schuur Hospital and Miss Neutt at Mowbray Maternity Hospital to make these arrangements.

I trust your research will provide useful information which will lead to improvement of care in the future.

A copy of your findings must be forwarded to this office on completion.

I attach a copy of the RAMS criteria for Intensive Care Units for your information as discussed.

Yours sincerely

C THORPE (MISS)
ACTING HEAD: NURSING DIVISION
For Chief Medical Superintendent
GROOTE SCHUUR HOSPITAL

Cc Miss Neutt
Cc Miss Thomas

14 Jeffcoat Avenue
Bergvliet 7945
17 October 2000

The Medical Superintendent
Groote Schuur Hospital
Observatory

Dear Sir

Re: Request for access to Patient Records for research purposes.

As a student on the M.Cur program at the University of Stellenbosch I am required to undertake research for my thesis this year. The title of my research is 'An Evaluation of Neonatal Nursing Care in Selected Hospitals in the Western Cape'. I write to request your permission for me to have access to the patient records in the Neonatal Intensive Care Unit of Groote Schuur Maternity Hospital so that I may conduct an aspect of the research.

I have developed structure, process and outcome standards, which I will personally evaluate as the fieldworker. I shall require access to records for the gathering of data related to the outcome standards. The expected time required for gathering of material is five (5) months, and I should like to begin the data collection in October, completing by the end of February of next year (2001).

I enclose a copy of the Research Protocol for your perusal.

My supervisors, Prof EB Welmann and Dr ME Bester can be contacted at the University of Stellenbosch at (021)-9389297.

I look forward to your reply.

Yours faithfully

Hilary Barlow.

Telephone number:
(021)7158984 (H)
(021)6853026 x 2231 (W)
082 9247566 (cell)

14 Jeffcoat Avenue
Bergvliet 7945
17 October 2000

The Medical Superintendent
Mowbray Maternity Hospital
Mowbray

Dear Sir

Re: Request for access to Patient Records for research purposes.

As a student on the M.Cur program at the University of Stellenbosch I am required to undertake research for my thesis this year. The title of my research is 'An Evaluation of Neonatal Nursing Care in Selected Hospitals in the Western Cape'. I write to request your permission for me to have access to the patient records in the Neonatal Intensive Care Unit of Mowbray Maternity Hospital so that I may conduct an aspect of the research.

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