

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

Changing Rooms in NICU.

A comparative descriptive study of
parental perceptions of the physical environment of
neonatal intensive care units.

A thesis presented in partial
fulfilment of the requirements for the degree in
Master of Philosophy in Nursing.

Massey University, Auckland,
New Zealand.

Robyn Clare Wilkinson
2007

Abstract

The physical environment of a neonatal intensive care unit (NICU) is unique and can be challenging and stressful for families. As infant survival rates and technology improved, many NICUs became 'busy', overcrowded, noisy environments. New directions in the design of newborn nurseries highlight the potential for the physical environment to support parental needs and optimise the parenting experience. In October 2004 the NICU at National Women's Hospital (NWH) in Auckland (New Zealand), relocated to a new facility at Auckland City Hospital (ACH). A key principle in the design of the new NICU was improvement of family space at the cot side.

This non-experimental study sought to describe and compare parental perceptions of the physical environment of a traditional NICU configuration with a new custom built NICU. A sample of parents with infants hospitalised in NICU from NWH ($n = 30$) and a different group of parents from ACH ($n = 30$) completed a self report Likert-type questionnaire (with a scale from 1 = strongly disagree to 7 = strongly agree). Qualitative data was sought using open ended questions.

Significant differences were found between the old NWH NICU and the newly designed ACH NICU. Parents perception of the space at the cot-side was more adequate ($p = 0.001$), lighting levels more comfortable ($p = 0.002$), the cot-side was quieter ($p = 0.02$) and technology less intrusive ($p = 0.03$) at ACH NICU when compared to NWH NICU. Impact of these design changes on privacy, sense of belonging, and socialisation of parents did not show significant differences. Lack of cot-side space for NWH parents was the predominate theme from the open-ended questions. Parents viewed the family space and aesthetics of the new ACH rooms positively.

Providers of newborn services contemplating redesign need to consider that increasing cot side space and decreasing infant numbers in clinical rooms can significantly improve a parent's view of NICU and therefore provide an environment that is supportive to parent's needs.

Acknowledgments

Firstly I am indebted to all the parents that took time to participate in the study. Having an infant in a NICU can be a busy and stressful time and without their input this research would not be possible.

Thank you also to my first supervisor Dr Denise Dignam for starting me on this journey and to Dr Felix Ram and Dr Denise Wilson for seeing it to fruition.

To Dr Carl Kuschel, the Clinical Director of NICU at National Women's Hospital, your passion for NICU design and consistent advice were much appreciated.

A special thanks to Jean Bertram (Nurse Educator) and Bronwyn Jones (Nurse Practitioner) for their patience and encouragement. To the Family Liaison Nurses (Moirá Malarkey, Eleanor Lockwood and Pricilla Bilby) thank you for your assistance with recruitment. I am eternally grateful to my dear friends Margaret and Robert Aikman for their help and faith in my ability to complete this project.

Finally, to my family, and specially my husband Alan, thanks for the computer assistance and the love and support. I truly am lucky.

Table of Contents

Abstract	ii
Acknowledgments	iii
Table of Contents.....	iv
List of Tables	viii
List of Figures	ix
Glossary of Terms.....	x

Chapter One: Introduction.....	1
1.1 Background to the Study	2
1.1.1 Definitions.....	2
1.1.2 Significance of the Study	2
1.1.3 Family-Centred Care (FCC).....	3
1.1.4 Healing by Design	4
1.2 Changing Rooms in NICU	4
1.2.1 Personal Statement	5
1.3 Research Aim and Objectives.....	5
1.4 Overview of the Thesis	6

Chapter Two: The Literature Review.....	8
2.1. The Physical Environment of Healthcare	8
2.1.1 Nursing Perspectives	8
2.1.2 Healing Environments.....	11
2.1.3 Hospitals as Healing Spaces.....	12
2.2 The Design of NICU	15
2.2.1 NICU as a Healing Space	15
2.2.2 NICU Design Standards.....	16
2.2.3 NICU Redesign Research.....	19
2.3 Parental Experiences of the NICU Physical Environment	20

2.3.1	Visual Experiences.....	20
2.3.2	Auditory Experiences	23
2.3.3	Interior Design and Aesthetics	25
2.3.4	Influences of the Physical Environment on Psychosocial Aspects	26
2.3.5	Research Instruments.....	30
2.4	Summary	31

Chapter Three: Methodology 33

3.1	Research Design.....	33
3.1.1	Research Questions.....	33
3.1.2	Hypothesis	34
3.2	Methods	34
3.2.1	Justification of Methods.....	34
3.3	Sampling.....	35
3.3.1	Population.....	35
3.3.2	Criteria for Inclusion.....	35
3.3.3	Sampling Process	36
3.4	Settings.....	36
3.4.1	Level 3 Rooms	37
3.4.2	Level 2 Rooms	39
3.5	Ethical Approval.....	44
3.5.1	Ethical Considerations	44
3.6	Data Collection.....	45
3.6.1	The Instrument	45
3.6.2	Data Collection Process.....	48
3.7	Data Analysis.....	48
3.7.1	Rating Scale.....	49
3.7.2	Demographic Data.....	49
3.7.3	Open-ended Questions	49
3.8	Validity of Study	50
3.9	Summary	51

Chapter Four: Results.....	52
4.1 Statistical Analysis.....	52
4.1.1 Response Rates.....	52
4.2 Demographic Data.....	53
4.2.1 Auckland City Hospital Participants.....	53
4.2.2 National Women’s Hospital Participants	54
4.3 Rating Scale Data.....	57
4.3.1 Dimension A: First Impressions.....	57
4.3.2 Dimension B: You and Your Baby.....	59
4.3.3 Dimension C: Sights and Sounds of the NICU.....	62
4.3.4 Dimension D: Other Families	64
4.3.5 Subgroup Analysis.....	67
4.4 Responses to Open-ended Questions.....	70
4.4.1 “Need for space”	70
4.4.2 “The rooms are great”	72
4.4.3 “Ability to gain privacy”	73
4.4.4 “Bug Wise”	74
4.5 Summary	75
 Chapter Five: Discussion	 76
5.1 Dimension A: First Impressions.....	76
5.2 Dimension B: You and Your Baby.....	78
5.3 Dimension C: Sights and Sounds of NICU.....	81
5.4 Dimension D: Other Families	84
5.5 Model of Change.....	87
5.6 Study Strengths and Limitations.....	88
5.6.1 Research Design.....	88
5.6.2 Internal Validity	89
5.6.3 External Validity.....	90
5.7 Summary	91

Chapter Six: Conclusion	92
6.1 Review of the Research Aim and Objectives.....	93
6.2 Overview of Results	93
6.2.1 Hypothesis	95
6.2.2 Healing by Design	96
6.3 Recommendations:	97
6.4 Future Research.....	98
6.5 Nursing Implications	99
6.6 Concluding Statement	100
 Appendices	 101
Appendix A: Questionnaire	102
Appendix B: Massey University Human Ethics Approval	107
Appendix C: Auckland Ethics Committees Approval	108
Appendix D: Auckland District Health Board Approval	110
Appendix E: Maori Research Review Committee Approval.....	111
Appendix F: Information Sheet.....	112
Appendix G: Auckland Ethics Committee Amendment.....	114
 References	 115

List of Tables

Table 3.1:	Physical Characteristics of Infant Rooms at NWH and ACH NICUs...	38
Table 4.1:	Parental Characteristics from ACH and NWH	55
Table 4.2:	Infant Characteristics from ACH and NWH	56
Table 4.3:	Parental Perceptions of Dimension A: First Impressions	58
Table 4.4:	Parental Perceptions of Dimension B: You and Your Baby	61
Table 4.5:	Parental Perceptions of Dimension C: Sights and Sounds of NICU.....	63
Table 4.6:	Parental Perceptions of Dimension D: Other Families.....	66
Table 4.7	Summary of Results from Subgroup Analysis	69

List of Figures

Figure 3.1:	Floor map displaying room configuration of cot spaces in the Level 3 areas at NWH and ACH NICUs. Solid lines indicate a designated cot space and dotted lines denote flexible cot spaces.	40
Figure 3.2:	Photographs displaying a Level 3 room at NWH and one side of a Level 3 room at ACH.....	41
Figure 3.3:	Floor map displaying the room configuration of cot spaces in Level 2 areas at NWH and ACH NICUs. Solid lines indicate a designated cot space and dotted lines denotes flexible cot spaces.....	42
Figure 3.4:	Photographs displaying one side of the Level 2 rooms at NWH and ACH.....	43
Figure 4.1:	Median values, interquartile ranges, true ranges and outliers (o) from ACH and NWH parental perceptions to Dimension A.....	59
Figure 4.2:	Median values, interquartile ranges, true ranges and outliers (o) from ACH and NWH parental perceptions to Dimension B.....	61
Figure 4.3:	Median values, interquartile ranges, true ranges and outliers (o) from ACH and NWH parental perceptions to Dimension C.....	64
Figure 4.4:	Median values, interquartile ranges, true ranges and outliers (o) from ACH and NWH parental perceptions to Dimension D.....	66
Figure 5.1:	A schematic representation showing the relationships between themes from the parental responses to the open-ended questions at ACH and NWH NICUs.....	88

Glossary of Terms

Cot-side

Physical space surrounding the infant's bed (cot, incubator or heat table) that serves as area for parents, family members and staff to undertake care of the infant.

Decibel (dB)

Unit for measuring the intensity of sound.

Headwall System

Holds and delivers the mechanical requirements (equipment, electrical and gas) for each infant care space.

Level 3 Rooms

Intensive care area for medically unstable premature infants or critically ill newborn infants requiring mechanical ventilation or other intensive interventions.

Level 2 Rooms

Special care area for infants requiring less intensive respiratory support (such as Continuous Positive Airway Pressure (CPAP) or oxygen), infants requiring observation, infants recovering from acute illness and infants requiring less intensive interventions.

Luminance (Lux)

A measure of radiating or reflecting light.

Parent–Infant Nursery (PIN)

A low dependency area with an emphasis on supporting parenting prior to discharge.

Room Configuration

The number of infants in clinical rooms and placement of infant care spaces within the clinical rooms.

Skin to Skin Care

A care practice where a naked infant is rested semi-upright and prone on a parent's bare chest covered with a blanket.

1.0 Chapter One: Introduction

This chapter provides a background to the thesis and introduces a research project that explores parental perceptions of the physical environment of NICU. Background information is outlined that provides rationale for the study. Briefly introduced are the concepts and philosophies that lead to the development of the research aims and objectives. Finally, my personal interest for this research is explained, and an overview of the thesis chapters outlined.

Neonatal intensive care units (NICUs) are medically and technologically complex yet very human environments. These units evolved in the late 1970s and with advances in technology coupled with increased knowledge of preterm and newborn diseases, infant survival has markedly improved (MacFarlane & Mugford, 2005). Not purpose built as NICUs, the physical environment of many units now resemble overcrowded, busy, noisy environments that have been described as chaotic (Lupton & Fenwick 2001; Smith, 1994; White & Newbold, 1995). As extremely immature infants and their families now spend extended periods of time in a NICU, the effect of this physical environment is under scrutiny with a growing awareness that this situation is no longer acceptable (White & Newbold, 1995).

The focus of this thesis is the physical environment of NICU and how changes to this environment impact on parents, hence the title 'Changing Rooms in NICU.' Utilising a non-experimental comparative descriptive design and a questionnaire survey, this thesis presents the research that describes and compares parental perceptions of the physical environment of a traditional NICU configuration with that of a new custom built NICU.

1.1 Background to the Study

1.1.1 Definitions

The broad use of the term environment is said to refer to a combination of elements, both natural and artificial, which influence the surroundings of individuals and systems. It also encompasses social factors that affect living beings (European Environment Information and Observation Network, 2005). The word environment is often used interchangeably with the term physical environment. The physical environment, however, is described as a narrower subgroup that relates to the material objects and surroundings of individuals or systems (European Environment Information and Observation Network, 2005). It encompasses the focus of this study; the built environment. Venoila (1988), a prominent architect and writer on contemporary design of buildings, suggests that the influence of the built environment on well-being is considerable and often overlooked. The literature review (Chapter Two) expands on these definitions, and introduces the notion that quality design of buildings can enhance health and wellness.

1.1.2 Significance of the Study

The NICU setting is a coexistence of infant, family and health professionals, all with their own unique environmental needs. Growing evidence suggests that the physical environment, in particular light and sound levels, has negative impacts on the developing neurological system of the preterm infant (Als, 1986; Als et al., 1994; Symington & Pinelli, 2006; Taquino & Lockridge, 1999). Developmental problems of prematurity are now being attributed in part to environmental factors (Harrison, Lotas & Jorgensen, 2004). Consequently developmental care plans and strategies are now commonplace in NICUs (Taquino & Lockridge, 1999). Some strategies involve modifications to the physical environment, such as reduction of light and sound (Graven, 2000). Many NICUs, however, remain restricted by their very design; large open plan units resembling warehouses or multi-bed rooms with limited space between infant cots. The need to consider the infant's physical environment was, therefore, the first catalyst in advocating major changes regarding the way NICUs are now designed and built.

Intensive care environments, including NICU, are known to also be stressful for nurses (Ohler, Davidson, Starr & Lee, 1991). Environment stressors are frequently encountered and often related to technology (Gibbons, Geller & Glatz, 1997; Heuer, Bengiamin, Downey & Imler, 1996). There is little information on the environmental needs of NICU nurses apart from one study by Gibbons et al. (1997) where a need for nurses to talk and work together in NICU rooms was shown. Nurses, while attending to the environmental requirements of infants and families in their care, may have their own specific needs.

NICU has long been identified as a challenging environment for parents. Aspects of the physical environment, namely the sights and sounds of NICU, have been identified as a frequent stressor for parents (Miles, Funk & Kasper, 1991; Raeside, 1997) and an obstacle to parent-infant interactions (Hutchfield, 1999; Rushton, 1999). Some effects of the NICU physical environment seem enduring as mothers recalled disturbing images of NICU years later (Werezchzak, Shandor-Miles & Holditch-Davis, 1997). Given these factors and that some studies indicate the potential for increased levels of maternal anxiety, depression and distress after preterm birth (Doering, Moser & Dracup, 2000; Miles, Holditch Davis, Burchinal & Nelson, 1999), the effect of the physical environment cannot be taken lightly.

1.1.3 Family-Centred Care (FCC)

Family-centred care (FCC) is a philosophy that underpins health care delivered to children and families (Hutchfield, 1999). Recognition of the family as the constant in a child's life (Shelton & Stepanek, 1995) and health professionals caring for the baby and family as one unit (Beresford, 1997a) are fundamental views within descriptions of FCC. Once being viewed as visitors, parents are now the focus of care in NICU, along with the infant (Fenwick, Barclay & Schmied 2001; Hutchfield, 1999). Consequently, providers of neonatal care are now required to consider the impact of the NICU environment not only on the infant but also on the family.

Guidelines for practice of FCC philosophies reflect the above broad critical elements, but it is recognised that parents in NICU have unique issues (Hutchfield, 1999). For instance,

NICU parents have a new infant that they do not know and often parent and infant are separated (Dobbins, Bohlig & Stephen, 1994). Thus, establishing a parent-infant relationship and initiating care-giving by parents is said to be a prime focus of FCC practice in NICU (Siegal, Gardner, & Merenstein, 2004). Therefore the underlying principle of this research was how the NICU physical environment can promote active involvement of parents in the care of their infant.

1.1.4 Healing by Design

In the past hospital environments were designed for efficiency, and to incorporate technology in intensive care settings, Currently there is a philosophical shift to focus hospital design on the needs of patients and their families. Alongside these philosophies are recommended standards for hospital and NICU design. The notion that the quality of healthcare surroundings can improve patient and family outcomes, called 'healing by design', has been suggested by Horsburgh (1995). New directions in the design of NICUs highlight the potential for the physical environment to optimise family interaction with infants and encourage "...long stays at the bedside" (Philbin, 2004, p.340). Many of the current guidelines and standards for NICU design are based on expert opinion (White, 2006). The cost of new facilities within a financially constrained health care system means information on the effectiveness of NICU redesign projects is essential. Experts are therefore calling for evidence based redesign and for recommendations to be based on research (Shepley, 2002; White, 2003).

1.2 Changing Rooms in NICU

In October 2004 the NICU at National Women's Hospital (NWH) in Auckland, New Zealand relocated to the new Auckland City Hospital (ACH). The principal redesign objectives were to further support infant neurodevelopment, to improve family space at the bedside and to provide an efficient and functional unit for staff. Cot-space was increased in all levels of care throughout the new NICU. Provision of a designated parental chair and locker within each cot space offered a more defined family space. This relocation presented a unique opportunity, to not only seek parental perceptions of the

physical environment of NICU, but also to evaluate the impact of the new design concepts.

1.2.1 Personal Statement

My motivation for 'healing by design' began six years ago. In my role as a NICU nurse educator, it was customary to tour the Paediatric Intensive Care Unit (PICU). The PICU was not purpose built and the nine intensive care beds were all visible to each other. As we toured the unit it was difficult not to focus on the activity of a central bed. A boy had been admitted critically ill with meningococcal B meningitis. By the end of our tour it was obvious that the young boy had arrested and full resuscitation was in progress. A nurse hurried around the bed trying to achieve some privacy with an inadequate screen. The sound of his mother wailing is something I will never forget and the horrified look on the faces of the other parents in the rooms. As NICU nurses, one would think you would be somewhat desensitised to intensive care drama, however, we all left a little traumatised and thinking that in NICU we do better. Over the ensuing years there have been times when I have been reminded of this incident and how the NICU physical environment has fallen well short of a respectful and nurturing place for infants, parents and staff.

1.3 Research Aim and Objectives

The **aim** of the study was to describe and compare parental perceptions of the physical environment of two NICUs, with a focus on the infant rooms and the immediate infant cot space. Additionally, it is anticipated that insights into the effectiveness of changes in room design may be revealed. The specific **research objectives** were to:

1. Describe parental perceptions of the physical environment within the infant rooms at NWH and ACH NICUs.
2. Compare differences in parental perceptions between the physical environment of the original NICU at NWH and the redesigned NICU at ACH.

1.4 Overview of the Thesis

Chapter One has outlined the thesis and commences the discussion around the impacts that the physical environment has on health and the importance of quality design of healthcare facilities. The research study 'Changing Rooms in NICU' has been introduced to describe and compare parental perceptions of the physical environments of NWH and ACH NICUs. Justification for the study relates to environmental issues for the key participants in NICU: infants, nurses and parents. Finally, the purpose of the study and the research aims are outlined.

Chapter Two presents a review of three key areas of literature. Firstly reviewed is existing knowledge on the theories and guidelines relevant to the impact the physical environment has on health, and the design of hospitals. Secondly, the past and current design of NICU is discussed and new directions for NICU design examined. Finally, the previous research on parental perceptions of the physical environment of NICU is reviewed, ending with a discussion on the commonly utilised research instruments.

Chapter Three outlines the design of the study and the methods used to answer the research questions. Ethical issues relevant to this study are detailed and discussed. The physical characteristics of the two NICUs are outlined and illustrated. Data collection is described, along with justification and explanation of the analytical procedures used. Finally the validity of the study is discussed.

Chapter Four presents the results from the three parts of the questionnaire: parent and infant demographics, the rating scale and the responses to the open-ended questions. The rating scale and demographic data are summarised in tables and figures. Themes derived from the parental responses to the open-ended questions are presented and discussed further in Chapter Five.

Chapter Five discusses in detail the research findings from the rating scale and the open-ended questions in relation to the research questions, the literature and clinical practice. Strengths and limitations of the study are addressed.

Chapter Six concludes by summarising the key findings of the study and offers suggestions for the future design of NICUs. Practice implications for nurses are discussed and future research possibilities outlined.

2.0 Chapter Two: The Literature Review

This chapter presents the literature review related to the physical environment of NICU. It describes, critiques and analyses available literature related to the physical environment of healthcare facilities and its impact on health, with a focus on parents with an infant in a NICU. Also included is literature related to the design of hospitals and NICUs.

Although this literature search was undertaken prior to the commencement of the study, due to the topical nature of NICU design and the lack of information, an automatic Ovid search was established throughout the project with a constant update of the review. Medline, CINAHL and PsycINFO were the principal databases searched. The key words used to source literature were healing, healing environments, design of hospitals, design of ICUs and NICUs, as well as parents' perceptions, experiences and attitudes to NICU environment. Additionally, relevant medical, nursing and architectural texts were sourced.

The literature review is structured into three areas, commencing with a background on the impacts the physical environment has on health from a nursing and healthcare perspective. Theories, philosophies and guidelines related to the design of hospitals in general are briefly overviewed and discussed. The past and current designs of NICUs are then described and discussed along with an analysis of the new directions in design with links to the current study established. Lastly, research related to parents experience of the physical environment of NICU is examined and critiqued, and the frequently used research instruments discussed.

2.1. The Physical Environment of Healthcare

2.1.1 Nursing Perspectives

The environment is defined broadly in nursing literature and includes physical and psychological aspects that affect individuals (Keegan, 2005; Watson, 1979). Keegan

(2005) wrote that it is “Everything that surrounds an individual or group of people: physical, social, psychologic, cultural or spiritual...” (p. 276).

2.1.1.1. Florence Nightingale

Florence Nightingale was a visionary force in emphasising the role of the physical environment in health promotion and healing (Fontaine, Briggs, & Pope-Smith, 2001; Pfettscher, 2006; Stichler, 2001). As far back as 1859, Nightingale advocated that the patients’ external environment not only enhanced recovery but could prevent disease as well (Nightingale, 1924). Pfettscher (2006) suggests that although the term environment was never used or defined by Nightingale, six key environmental components (ventilation, light, warmth, cleanliness, diet and noise) were described in detail. Fontaine et al. (2001) credited Nightingale as one of the first to highlight issues such as the design of hospital wards and sensory stimulation in hospitals. For example, Nightingale (1924) advocated the beneficial effects of natural light and windows with outside views for patients. Also advocated was quietness as “...unnecessary noise hurts the patient” (Nightingale, 1924, p. 25), as well as the positive influence of beautiful objects (such as flowers) and colour.

Nightingale (1924) writings imply a responsibility by nurses for creating healthy physical surroundings for patients. Pfettscher (2006) proposes that Nightingale believed that: “The nurse had to control the environment to protect the patient from physical and psychological harm” (p.76). Nightingale, therefore, introduced the potential for nurses to heal by modifying the patient’s physical environment (Fontaine et al., 2001; Pfettscher, 2006).

2.1.1.2 Contemporary Theories and Models

The nurse theorist Jean Watson also identified the significance of the physical environment on health (Neil & Marriner Tomey, 2006). Based on ‘carative factors’, Watson’s theory (1979) advocated the “Provision for a supportive, protective and (or) corrective mental, physical, socio-cultural and spiritual environment” (p. 81). Included was privacy for patients with the need to provide “...protective private environments”

(Watson, 1979, p. 93). This entailed the psychological aspects of privacy, not just confidentiality of information or the physical exposure of patients (Watson, 1979). Later, Watson (1988) introduced the concept of hospital-related stress for patients that included sensory overload and identified that patients have a need for aesthetically pleasant surroundings, which have a therapeutic effect.

More recently, Watson (1999) claimed that the architectural design of many contemporary hospitals falls well short of healing environments. While encouraged by current perspectives for hospital design, Watson (1999) suggested a more radical and expansive shift, and urged nurses to become 'ontological architects' (p. 257) creating or facilitating healing spaces that embrace traditional and non traditional modalities of care.

Neil and Marriner Toomey (2006) identify a problem with Watson's theory (1979) and its refinements (1988, 1999). Increasing technology is identified as a specific challenge when applying Watson's theory to contemporary practice (Neil & Marriner Toomey, 2006). However, current healthcare design perspectives seem to be looking for ways where humanistic environments and technology can co-exist (Gordin & Johnson, 1999).

The impacts of the physical environment on health are included in other nursing theories but in a less explicit manner (Holaday, 2002; Roy & Zhan, 2006). Johnston's (1980) Behavioural System Model in Nursing Practice, Neuman's (1982) Systems Model and Roy's Adaptation Model (1984) all highlight the potential for an individual's health status to be affected by environmental stressors (Johnston, 1980; Neuman, 1982; Roy, 1984).

2.1.1.3 Holism and Healing

The holistic nature of nursing is a prevailing concept that draws nurses' attention to the physical environment of patients (Keegan, 2005; Nightingale, 1924; Watson, 1979). Yeldham (2000) described a holistic approach as a synergy of "...integrations of body-mind-spirit and the environment" (p. 22). Holistic care takes account of the 'whole

person' and in doing so includes the influence the physical environment has on health; it has unique connections to healing (Jackson, 2004; Kritek, 1997).

The creation of healing environments for patients, by modifying the physical surroundings, is advocated in nursing philosophy and theory (Nightingale, 1924; Watson, 1979). Healing is a familiar term in healthcare and features within discussions on how to design hospitals and NICUs (Altimier, 2004; Horsburgh, 1995). With a range of potential definitions, Kritek (1997) suggested that individuals and disciplines acquire their own meanings of healing based on worldviews and cultural expectations. While healing is often approached from a purely physiological level only (Hill, 1997), it is more commonly described as a process or activity that promotes the integrity of the whole person (Jackson, 2004; Kritek, 1997). Therefore, healing is relevant when considering hospital environments for patients and families as the impacts from the physical environment are not only physiological but psychological and social as well.

2.1.2 Healing Environments

Physical environments that promote healing are not new, with the early Greeks creating spas to restore health 2000 years ago (Stichler, 2001). Only recently, however, have concepts of healing been applied to the design of modern buildings. Much of the literature on healthy buildings is from Carol Venolia's 1988 seminal work. Venolia (1988) accentuated how the developed world has evolved into predominately an 'indoor world' (p. 5), with the plethora of factories and multistory buildings. Artificial physical environments are created, sealed off from the outside natural surroundings. Individuals rather than being enriched by these environments, can be adversely affected, commonly termed the 'sick building syndrome' (Venolia, 1988).

The merits of healing environments do extend beyond the definition of to 'do no physical harm' (Venolia, 1988, p.6). Venolia (1988) stated that "Physical places limit us, challenge us, support us, bore us, and excite us." (p. 3). It is not just the physical components of buildings that influence health but also how a place 'feels'.

Venolia (1988) maintained that you know when you are in a healing environment: "No analysis is required. You feel welcome, balanced and at one with yourself and the world. You feel relaxed and stimulated, reassured and invited to attend. You feel at home" (p. 7). Healing spaces are created out of an interplay of factors. Buildings that provide links with nature and culture, allow for privacy, offer meaningful and varying stimuli, and encourage relaxation are advocated as healing spaces (Venolia, 1988). Important design strategies for healing environments include the use of symbols (such as cultural icons) and environmental messages (connections with the outside world such as nature), the provision of suitable lighting and sound levels, good indoor air quality, a comfortable thermal environment, and the use of appropriate colours and art (Horsburgh, 1995; Ulrich, 1997; Venolia, 1988).

2.1.3 Hospitals as Healing Spaces

Hospitals, modern day centres of healing, have rarely been designed as healing centres. One reason for this could be that hospitals tend to focus on curing rather than healing. Landis (1997) stated that curing focuses on disease and treatments rather than restoring general well being and long term health for patients, or addressing psychological issues such as stress. Another impediment to healing hospital environments is the current pressures hospitals face. As providers drive services into outpatient and community settings, hospital patients are sicker these days and many healthcare services resemble critical care units (Ulrich, 1997). Consequently, hospitals are planned to encompass increasing technology and staff functional efficiency. Horsburgh (1995) described some present day hospitals as large technological factories that are dehumanising.

More commonly, hospital environments are identified as sources of physiological and psychological stress (Miles et al., 1991; Nightingale, 1924; Ulrich, 1992). Illness itself is often accompanied by stress for the patient and likewise can affect families (Anisaman & Merali, 1999; Ulrich, 1992). This is concerning as stress and emotions can in turn affect health and predisposition to disease. Mostly identified are associations between stress and impairment of the immune system. Possible health consequences are said to be susceptibility to infection, delayed wound healing and the more controversial,

progression of cancer (Lovallo, 2005). Consequently, instead of hospitals aiding recovery and fostering coping with stress, the opposite may occur: patients with additional stress from the physical environment. Interestingly, one suggested therapy for stress reduction in the literature is the provision of the healing environment (Lovallo, 2005).

Many critical care units, while life sustaining, still contain aversive physical environments (Donchin, 2002). Consequences include sleep deprivation and altered sensory input resulting in psychological problems called ICU syndrome, a well documented complication affecting patients (Dyer, 1995; Fountaine et al., 2001; Stichler, 2001). The American Association of Critical Care Nurses (AACN) has actively published environmental concerns of ICUs and promotes healing designs based on the needs of patients and families (Fountaine et al., 2001; Stichler, 2001). Commonly, however, when hospitals and services are rebuilt or remodelled, it is the recommended design standards that guide projects, not concepts of healing.

2.1.3.1 Design Standards

Standards on hospital design are evident in the healthcare literature but mainly with respect to adult ICUs and NICUs (Guidelines for Intensive Care Unit Design, 1995; Standards for Intensive Care, 1997; White, 2006). It was surprising to find only two published standards on the design of ICUs, with no evidence that they have been updated. The standards are comprehensive on the functionality, structure and safety aspects of ICUs. Allocation of space, the provision of privacy, use of colour and art and facilities for families are less emphasised and absent in the case of the Intensive Care Society (Standards for Intensive Care, 1997). It therefore needs to be questioned whether recommended design standards do guide the creation of healing physical environments in hospitals. Fountaine et al. (2001) suggested that while there has been some improvement, the provision of a healing environment, goes beyond most recommended standards.

2.1.3.2 Healing By Design

With the fairly recent collaboration of nursing, medical and architectural disciplines on hospital design, provision of a healing environment has emerged as an important element

(Bell, Graven, Shelpley, Rubin & Ulrich, 1997). The promise to 'heal by design' (Horsburgh, 1995) has begun to change how healthcare environments are rebuilt or modified (Stichler, 2001).

Despite this, only one theory guiding the design of healing hospital environments is evident in the literature. Robert Ulrich (1997), a prominent architect with a passion for healthcare design, proposed a theory of 'Supportive Design for Healthcare Facilities'. The theory is underpinned by a central concept of stress reduction for patients, family and friends. Broad concepts firstly incorporate enhancing the patient's sense of control through the provision of added privacy and the ability for the patient to control their own immediate environment, such as sound and light levels. Secondly providing access to social support by creating facilities that welcome visitors and enhance socialisation. Finally, offering positive distractions, such as views of nature and art to reduce patient stress (Ulrich, 1997). While Ulrich (1997) did not directly refer to healing, the theory's concepts (privacy, socialisation, aesthetic nature) correlate with the previously mentioned healing elements for hospital environments (Nightingale, 1924; Venolia, 1988; Watson, 1979). Ulrich (1997) emphasised the need for further research to substantiate the theory and that supportive design can improve patient outcomes.

2.1.3.3 Patient Outcomes

Claims that patient outcomes are improved from supportive hospital design have been made (Horsburgh, 1995; Rubin & Owens, 1996; Ulrich, 1997). Ulrich (1997) commented that research focused on physiological aspects, such as the effects of light and sound, and neglected psychological outcomes. The outcomes of good design leading to supportive healthcare environments include reduced stress and anxiety for patients and families, reduced pain, improved cognitive and mental functioning, improved patient satisfaction and the potential for shortened hospital stays (Bell et al., 1997; Rubin & Owens, 1996). Bell et al. (1997) acknowledged the lack of research on patient outcomes from supportive hospital design, seen as crucial as they also influence funding decisions.

2.1.3.4 Challenges to Healing by Design

Creating a healing environment is described as a daunting task in hospitals, and particularly challenging in high technological areas such as intensive care facilities like NICU (Fontaine et al., 2001). The large degree of technical details necessary for patient safety in intensive care settings can override more nurturing design aspects (for instance art and colour). The biggest challenge, however, is said to be cost. In financially constrained environments, design must be seen as beneficial as well as cost effective (Ulrich, 1997). The notion that design can improve health outcomes has been difficult to prove, and this influences what managers finance. Experts stress the need for research that elicits patient and family feedback (Bell et al., 1997) such as that proposed in this study. Nevertheless, some headway has been made with descriptions of newly designed facilities (Diaz Azculy, 1992; Horsburgh, 1995).

2.2 The Design of NICU

NICU is rarely recognised as a healing environment for parents. Early discussions in the literature about the design of the NICU environment were sparse and infant focused (Brown, 1984). It was not till the early to mid 1990s that parents were even mentioned in literature related to NICU design (Smith, 1994; White & Newbold, 1995). Documented are redesign goals, design, planning and implementation of reconfigurations of existing NICUs or relocation to new facilities (Altimier, 2000; Beresford, 1997 b; Bowie, Hall, Faulker & Anderson, 2003; Brown & Taquino, 2001; Hennessy, 2000; Loring, 1998; Vestral, 1999). That the need for increased parental accommodation and pleasant surroundings (Beresford, 1997 b; Loring, 1998) has moved to design projects based on family centred care principles (Bowie et al., 2003) indicates some progression. Although, the NICU as a healing environment, is still being questioned (Altimier, 2004).

2.2.1 NICU as a Healing Space

Typically NICUs are referred to as overcrowded, noisy, brightly lit, and chaotic environments that lack privacy for parents (Brown & Taquino, 2001; Smith, 1994; White,

& Newbold, 1995). Providing a more therapeutic environment for parents is seen as a quality measure aimed for within some current redesign initiatives (Forsythe, 1995; Loring, 1998; Vestal, 1999). Despite this, the only specific mention of 'healing in NICU' in the literature stems from Altimier's (2004) review on NICU healthcare facilities. Altimier (2004) implored providers when redesigning to consider elements (light, colour, noise reduction and privacy) that may be healing for anxious parents in NICU. As with adult ICUs, it is the recommended standards that tend to guide the design of NICUs.

2.2.2 NICU Design Standards

The United States of America (USA) leads the world in the formation of guidelines for NICU design. The American Recommended Standards for Newborn ICU Design were formed collaboratively by a group of neonatologists, nurses, architects, and health care planners and published in 1992, with regular updates since (White, 2006). Included in the comprehensive standards are space requirements at the infants' cot side, room configuration (number of infants per room), lighting, noise and thermal control, and the provision of facilities for parents that included privacy. One strength of these standards is the movement towards a healing environment for parents and staff reflected in the regular updates. The most recent update (White, 2006) recommends daylight in infant rooms, access to nature and the use of positive distractions, such as nature and art. In recognition of financial constraints within NICU design, White (2006) highlights that the standards are minimum and services need to strive for additional change.

Currently no New Zealand or Australian NICU design standards exist but there is agreement that appropriate guidelines are necessary (Kuschel & Roy, 2005). Kuschel and Roy (2005) offered no reason why the American standards may not be appropriate for Australasian NICUs. It has been suggested, however, that some of the American standards are a marketing strategy for the highly competitive private health care market (Stichler, 2001). Mostly discussed in the literature are the new directions in NICU design, some of which are said to be costly and controversial.

2.2.2.1 New Directions in NICU Design

Increasing space at the cot-side and reducing the number of infants in rooms are the new ideas in the design of NICU infant rooms. The impetus for these new directions stems from the beliefs that these design changes can support the developing preterm infants' fragile neurological system, chiefly by reducing sound and light levels (Harris, Shepley, White, Kolberg & Harrell, 2006; White, 2003). From the parental point of view, extra cot-side space and fewer infants in clinical rooms offers added privacy and confidentiality, and may increase a sense of belonging for parents in NICU (Altimier, 2004; White, 2006).

Space Allocation

While it is acknowledged that many NICUs are overcrowded (Brown & Taquino, 2001; Smith, 1994; White & Newbold, 1995), evidence is only apparent in one recent study. Kuschel and Roy's (2005) environmental audit of Australasian neonatal services revealed a median of 11.1m² (range 5.5-18 m²) per cot in Level 3 rooms, below the USA recommended standard of 14m² for intensive care beds (White, 2006). The median for Level 2 cot spaces was only 5.8m² (range 2.3-15.6m²), well under the suggested 11.2m² (White, 2006). As parental involvement in infant care in Level 2 rooms is greater due to impending infant discharge, this result is worrying.

Kuschel and Roy (2005), pointed to an inequality in space provision between newborn and other ICUs. Minimum recommended bed space allocation in adult and paediatric ICUs range between 14m² to 25m² much higher than NICUs. In the case of NICU there still remains an emphasis on room for the incubator only and not the family. This is concerning as the typical day stay in NICU is longer than adult and paediatric ICUs. The NICU also becomes a surrogate home for some parents while their infant is hospitalised (Kuschel & Roy, 2005).

There is no published research that deals specifically with NICU parents and space allocation at the infant cot side. However, when Dobbins et al. (1994) surveyed 207

families of preterm infants on parenting in NICU, the most frequent environmental concern was lack of space at the infant's cot-side. Fifty-four percent of parents reported lack of space as an impediment to assumption of their parental role. This is an important finding given that alteration of parental role is consistently the highest stressor for NICU parents (Miles et al., 1991; Miles, Funk & Kasper, 1992; Shields-Poe & Pinelli, 1997). Given the high construction cost of added space in NICU rooms, and only one study (Dobbins et al., 1994) suggesting space impairs parenting, it is not surprising that some neonatal services are still to be convinced about increasing space in NICU rooms. The current study will therefore seek information from parents about space at the cot-side and impacts of space on parenting.

Dobbins et al.'s (1994) study was conducted in one NICU setting, and with no descriptions of the physical characteristics of the infant rooms, it is difficult to generalise these results to other NICUs. Therefore detailed descriptions of the physical layout of the two NICUs settings involved within this project are provided and regarded as a vital aid for research consumers in interpretation of study results.

Room Configuration in NICU

Reducing the number of infants in NICU clinical rooms is another but controversial design direction. Some USA NICUs have moved towards single rooms (one infant per room) and report positively on the experience (Bowie et al., 2003; Brown & Taquino, 2001). White (2003) stated that while ideal, single rooms have many challenges. Firstly, the ability of nurses to monitor infants visually is compromised. Secondly there is the potential for this design to isolate staff from one another, reducing staff collaboration. Finally, single rooms are expensive and not affordable by all health care providers. Interestingly while the Consensus Committee (2002) design standards stopped short of advocating single room designs, the revised standards (White, 2006) go further in recommending this configuration.

Published research on single room designs is limited to a recent study by Harris et al. (2006) that compared single room designs with multiple room configurations. Harris et

al. (2006) found that parents in single bedded rooms actively sought privacy and controlled their own levels of privacy, compared to those in multi bedded rooms. In the multi-bedded rooms nurses were observed to be the main controllers of privacy. No details were offered on the number of parents observed and parents were not surveyed about their privacy needs. Notably, Harris et al. (2006) commented that parent to parent contact was uncommon in the single rooms. While White (2003) emphasised staff isolation in single room designs, the potential for parents to be isolated from other parents within single room designs also exists (Harris et al., 2006).

It seems locally that multi bedded NICU rooms still remain the norm. Kuschel and Roy's (2005) Australasian survey reported that the median number of infants in Level 3 rooms is 6.0 (range 1.6-20) and in Level 2 rooms 8.8 (range 3.5-20). There is a sense in the literature that reducing the number of infants in NICU rooms should be aimed for but that single room configuration needs more research (Kuschel & Roy, 2005).

2.2.3 NICU Redesign Research

Only one published study was found where research was integrated into a NICU redesign project, similar to the current study. Shepley (2002) reported on a pre-design and post occupancy analysis of a modification of a NICU. Infants previously located in closed bays (four to six infants per room) were relocated to an open plan unit; a departure from the current trend towards individual rooms (White, 2003). The new NICU, however, did have 60% more room with partial individualised bed-spaces. Results from the measurement of staff activity (using behavioural mapping) did not support the hypothesis ($p=0.01$) that more time would be spent with infants and families in the remodified NICU. Nevertheless, findings from the staff questionnaire regarding supportiveness of families, suggested the new facility was performing well (Shepley, 2002).

Shepley's (2002) study offers valuable insights into the complexities of research around unit redesign that guided the present study. One problem was the different sample sizes (12 staff members in 1993 compared to 27 in 1997) between the two time frames that undermined the integrity of the statistical analysis. Staff were asked to assess parental

perceptions of the new NICU. Previous research, however, has shown that staff assessment of issues for parents in NICU has not always been congruent with how parents feel (Hutchfield, 1999; Raeside, 1997; Rushton, 1990). The present study therefore intends to consult parents directly about their perception of the physical environment.

A number of additional flaws exist in the study by Shepley (2002) and therefore the results need to be interpreted with caution. The response rate was low (50%) with only ten questionnaires returned and staff participants chosen by the unit director. The staff questionnaire was performed only in the post occupancy stage and was not validated for NICU the environment.

2.3 Parental Experiences of the NICU Physical Environment

This section of the literature review examines and analyses information on the parental experiences of the visual, auditory and interior design of the NICU environment. Secondly, influences of the physical environment on the psychosocial aspects of being a parent in NICU are reviewed and critiqued. Finally, research instruments that provided the majority of information on parental experiences of NICU are discussed.

2.3.1 Visual Experiences

Light is a potent visual stimulus and has been mostly identified as a barrier to healing in hospitals (Fontaine et al., 2001; Venolia, 1988). The benefits of natural light in patient rooms and maintenance of natural patterns of lighting to enhance normal circadian rhythms has been shown (Fontaine et al., 2001; Ulrich, 1997; Venolia, 1988; Vinall, 1997). Artificial lighting has been criticised in the literature, particularly standard fluorescent lighting known to be glaring, stressful and leading to patient fatigue (Fontaine et al., 2001; Venolia, 1988).

Light levels in NICUs remain high, designed for technology and clinical activities. Lotas (1992) reported wide variations in the amount of light or luminance (lux) of 400-900,

higher than the recommended standard of 10-600 (lux) (White, 2006). Yet lighting needs in NICU are complex and the disparate needs of low lighting levels for infants, and the higher levels required for clinical activities, are challenges in achieving recommended goals (White, 2004). Therefore multiple adjustable options for lighting that can be individualised for each cot space are necessary to meet the multifaceted needs of infant, families and staff.

Less considered are comfortable light levels for families in NICU. Constant glaring lighting can contribute to the 'bewildering sight' (White, 2004, p.326). Low lighting can create mood, soothe the high tech environment and may also influence sound levels (Altimier, 2004; Rhea, 2004). Lighting along with other environmental and parental factors can also influence the overall visual image of NICU for parents.

Shields-Poe and Pinelli's (1997) large descriptive correlational study in two NICU centres used the Parental Stressor Scale: NICU (PSS: NICU), to measure parental stress levels, which were generally found to be moderate and infant related. One factor that aggravated stress was if parents first saw their infant in NICU ($p < 0.005$), rather than at birth. This introduces the proposition that initially the visual physical appearance of NICU is stressful for parents. The large sample ($n = 212$), included fathers and whether parents had prior experience of a NICU (16% of mothers and 14% of fathers). Interviews with 36 mothers of premature infants added support to these findings (Paddon & Glenn, 1997). Seventy percent of mothers described the first sight of NICU as frightening and daunting even through their infants were not medically fragile. However, the number of mothers who had a previous infant in a NICU, was not described, which may have influenced the maternal responses.

Mothers of preterm infants who previously had healthy newborns in Brady-Fryer's (1994) small phenomenological study, were also shocked by the initial appearance of NICU. The environmental aspects that mothers were distressed by included the appearance of their infant, and the sights and sounds of NICU (Brady-Fryer, 1994). Initial images of NICU may be lasting. Ninety percent of mothers portrayed first visits to NICU

as 'shocking' when interviewed three years after the discharge of their infants from NICU (Wereszczak et al., 1997). Infant related aspects were most distressing for mothers. Only one third of mothers recalled stress from initial impressions related to the physical environment. These results are retrospective and mothers' images of the NICU physical environment may have faded with time. Affonso et al. (1992) and Miles et al. (1991) also found that parental perceptions change overtime.

Whether parents had a preparatory tour of NICU was not reported in the previous studies and may have also had a bearing on the initial impressions. Griffin, Kavanaugh, Soto and White's (2003) naturalist study involving 13 parents showed that a tour of NICU was reassuring and reduced parental distress. Raeside's (1997) interviews with 12 mothers revealed that the preparatory tours helped, but did not protect from the initial disturbing perceptions. How useful preparatory tours are is rarely explored and compromised by small sample sizes mainly from a maternal point of view.

2.3.1.1 Technology

Multiple machines, bleeping lights and an array of wires and tubes attached to sick tiny babies form characteristic images of a NICU (Lupton & Fenwick, 2001). In Miles et al.'s (1991) study of 122 parents, using the PSS: NICU, the visual appearance of monitors and equipment was not found to be a significant stressor for parents. Affonso et al. (1992) asked 36 mothers to list and rate positive and negative stressors at different time periods during their infant's hospitalisation. In the second to third week of hospitalisation, technology was viewed as the fifth most stressful component and was an endless reminder to parents that their infants were sick. Yet technology was also seen positively as "...keeping my baby alive" (Affonso et al., 1992, p.69). Therefore, parents viewed technology, as both stressful and reassuring, essential for their sick infant (Affonso et al., 1992). Neither of these studies by Affonso et al. (1992) and Miles et al. (1991) explored how technology dominated and intruded on family space, and caused crowding in intensive care rooms. Gordin and Johnson (1999) argue that technology has increased since the early 1990s and has a greater environmental effect in NICU rooms.

While the experience of fatherhood in NICU is under represented in literature, the few published studies indicate that fathers have a heightened technical interest. Several studies (Miles, et al., 1992; Perehudoff, 1990; Shields- Poe & Pinelli, 1997) have found fathers less stressed from the sights and sounds of NICU compared to mothers. Lundquist and Jakobsson (2003) interviewed eight Swedish fathers of preterm infants and found fathers focused on equipment and technology in NICU. Technology was also an important vehicle for fathers to gather information and gain comfort and security from.

2.3.1.2 Other Sick Infants

Another visual influence often forgotten is the emotional impacts of seeing other critically ill infants, within close proximity to a parent's own sick infant. Parents rated other sick infants in clinical rooms as the most stressful sight in NICU (Miles et al., 1991). Retrospectively parents recalled "...all the sick and dying infants and the stress of knowing there was so much sadness in NICU" (Wereszczak et al., 1997, p.36).

2.3.2 Auditory Experiences

Noise is a known impediment to providing healing surroundings, particularly in ICUs and NICUs (Kellman, 2002; Philbin, 2004; Venolia, 1988). The main contributors of noise in hospitals are staff talking and machinery (Ulrich, 1997). NICUs have struggled to reduce noise with reports of mean sound levels between 61- 73 dBs (Johnson, 2003; Levy, Woolston & Browne, 2003), higher than the recommended 45 – 60 dBs (Philbin & Evans, 2006). As care becomes more critical in NICU, sound levels increase, confirmed by Levy et al. (2003) who compared sound levels in five Level 3 and Level 2 nurseries. Level 3 nurseries were significantly ($p=0001$) noisier than Level 2 nurseries.

Given the high rates of auditory loss in neonatal populations, research has tended to focus on sound levels for preterm infants (Philbin & Evans, 2006). Noise, however, as a stressor for parents, cannot be ignored. Some parents are exposed to the NICU environment for lengthy periods of time. The physiological effects of intense sound can result in sleep disruption, hypertension, headaches, mental fatigue and a reduced immune response (Kahn et al., 1998; Venolia, 1988). Thomas and Martin's (2000) review on

sound levels and NICU parents revealed that loud background noise can affect the quality of parent-nurse communications at the cot side. This is concerning, as listening and talking is vital for coping in NICU parents (Brady- Fryer, 1994).

Strategies to mediate the effects of noise in NICU include scheduled quiet times throughout nursing shifts, technological advancements (such as monitors with silent pagers) and modification of staff behaviours by education and environmental protocols (Johnson, 2003; Strauch, Brandt & Edwards-Beckett, 1993; Zwick, 1993). Despite all of this, Johnson (2003) maintains it still remains challenging to consistently reduce sound to the recommended levels.

Consequently, experts claim that most benefits are architectural in nature (Kellman, 2002; Philbin, 2004; Walsh-Sukys, Reitenbach, Hudson-Barr & DePompei, 2001). Philbin (2004) stated that decreasing the number of infants in rooms with greater space around each cot has the potential to reduce overall sound levels as well as moderate noise levels from monitors. Complementary to this is the use of acoustic ceiling tiles and sound absorptive surfaces such as carpet (Kellman, 2002).

Noise from alarms features highly within research of the parental experience of NICU. One mother in Brady-Fryer's (1994, p. 219) study recalls "...you see the lights flashing and buzzers sounding and when it involves your baby, it's a wrenching experience." Noise from monitors was reported as the second most stressful environmental component on the PSS: NICU (Miles et al., 1991, 1992). Similarly, Raeside (1997) found mothers rated noise from alarms the second most stressful environmental component next to heat intensity. The sample, however, was small ($n=12$). Of the 207 parents in Dobbins et al.'s (1994) survey, 44 percent indicated that noise from machinery was an impediment to their parenting role in NICU. Alteration in parental role is an acknowledged stressor for NICU parents (Miles et al., 1991, 1992; Perehudoff, 1990). Jamsa and Jamsa's (1998) interviews revealed parents were very disturbed by the audible signals from equipment. Given the small sample ($n = 7$) and that the infants were born at full term, it could be argued that parents of preterm infants may have different experiences. Memories of

noxious noise in NICU seems enduring, with one third of mothers recalling stress from noise levels and monitor alarms (Wereszczak et al., 1997). The age of these studies is an issue as Philbin and Evans (2006) acknowledged refinements in technology have reduced sound levels.

2.3.3 Interior Design and Aesthetics

Patients, parents and families may benefit from careful consideration of interior design and aesthetic issues within the design of hospitals (Rhea, 2004). The aesthetic nature of buildings, such as colour, art and access to nature, are said to influence emotions (Altimier, 2004; Shelpey, 2006; Ulrich, 1992). Aesthetic qualities are mostly referred to as positive distractions, elements that "...generate and reinforce positive experiences" (Shelpey, 2006, p. 35) to reduce patient stress and promote well being (Ulrich, 1992).

Utilising colour as an adjunct to lighting and a means of providing a healing decor has been suggested for health care settings (Roeder, 1996; Zagon, 1993). A small number of studies have indicated that specific shades in the colour spectrum may have different physiological and psychological effects (Roeder, 1996; Zagon, 1993). For instance, blue, violet and green are viewed as soothing and relaxing (Venolia, 1988; Zagon, 1993). Altimier (2004), claimed that colour does add to the feel and meaning of environments, while sound scientific evidence is lacking on colour as a means to healing.

Art work has also been recognised as a means of healing for patients in hospitals (Watson, 1979; Ulrich, 1997). Ulrich, Lunden and Etinge's (1993, as cited in Ulrich, 1997) study found post operative patients viewing artwork of nature scenes reduced the need for analgesia, decreased blood pressure and reduced length of hospital stay. However, not all art work is constructive, with abstract art not achieving the same benefits. Art that depicts diversity of cultures, connections with nature and everyday living are said to enhance healing (Ulrich, 1997), but further studies are required to support these assertions.

Discussions specific to NICU settings on interior decor is limited to a small number of descriptions on art and colour in newly designed or refurbished NICUs (Altimier, 2004; Shelpey, 2006). Neutral and cool colours seem more calming and may reduce anxiety levels in NICU parents (Venolia, 1988; Zagon, 1993), contrary, to the tendency for NICUs to use bold colours and nursery themes (Altimier, 2004). Shepley (2006) writes that soothing art, outdoors views from infant rooms, and soft music are supportive aesthetic qualities for parents and families. Memorable sayings and objects, such as pictures of previous infants and families also enhance a healing environment for parents (Johnson, Abraham, & Parrish, 2004).

2.3.4 Influences of the Physical Environment on Psychosocial Aspects

2.3.4.1 Privacy

Privacy, for patients in hospitals, while an important legal right (Birrell, Thomas & Jones, 2006), is less considered in the design of hospitals (Ulrich, 1992). Back and Wikbald (1998) found patients, particularly women and the elderly, valued privacy highly and Woogara (2005) described privacy as a basic need that is multidimensional. Mostly discussed is physical privacy, related to avoiding embarrassment and protecting modesty, and privacy of information (Birrell et al., 2006; Woogara, 2005). Less highlighted is the psychological nature of privacy, where periods of solitude or private experiences, can be emotionally unwinding and enhance an individual's self control (Rawnsley, 1980; Woogara, 2005). The provision of privacy may, therefore, assist with the stressful and challenging process of having an infant in NICU (Brady-Fryer, 1994; Fenwick et al., 2001; Hurst, 2001).

The provision of privacy relates in part to spatial concepts, also pertinent to the formal design of hospitals (Rawnsley, 1980; Ulrich, 1997; White, 2006). Hall's (1966) seminal work determined four important spatial zones, the intimate zone (0-18 inches), the personal zone (1.5 feet to 4 feet), the social zone (4 feet to 12 feet) and the public zone (12 feet to 25 feet) (cited in Evans, Lepore & Allen, 2000). Usually maintained for friends and family, intrusion of personal space is associated with discomfort, anxiety and depersonalisation (Curtin, 1992; Evans et al., 2000; Glen & Jownally, 1995). However in

healthcare settings including NICU, intrusion into the intimate zone is also likely. From a healthcare perspective, added space around the bedside and the configuration of patient rooms are key in the provision of added privacy, along with curtains and screens that can in part compensate for the loss of physical and personal space (Curtin, 1992).

More commonly discussed are cultural differences with respect to limits of privacy, and that privacy is predominately a western culture concept based on individualism (Evans et al., 2000; Giger & Davidhizar, 1990). Evans et al. (2000) warned against making such assumptions and along with Curtin (1992) concluded that privacy boundaries vary with culture, and with individuals.

Provision of privacy is only mentioned in two descriptive accounts of redesign projects (Vestal, 1999; Wood, 2005). White (2003) argued that some parents may desire privacy for more intimate parental interactions, such as, skin-to-skin care and breastfeeding. Nygvist, Sjoden and Ewala's (1994) study supported this, where 178 breast feeding NICU mothers determined that embarrassment and lack of privacy was a barrier to breastfeeding. This Swedish study was conducted with full term infants, only in NICU for 1-2 days, warranting further investigation.

How private NICUs are only emerges in recent literature. Kuschel and Roy (2005) performed a recent environmental survey of 26 Australasian neonatal units. Eighty percent of the clinical directors felt that privacy was an issue for parents within their units design. Five of the NICUs that reported no privacy concerns were built after 1997. However, judgement of levels of privacy was made by the clinical directors, and parents may view levels of privacy differently. Several maternal phenomenological studies suggest that privacy is an issue in NICU. A lack of privacy for mothers was revealed in Brady-Fryer's (1994) study and Jackson, Ternstedt and Schollin (2003) report that mothers desire a private area to be with their infants in NICU. Similarly, mothers in Wigert, Johansson, Berg and Hellstrom's (2006) study found it often impossible to be alone with infants. One mother claimed in Hurst's (2001) critical ethnographic study that "There were so many people watching the first feeding..." (p. 72). Other qualitative

works also describe mothers feeling 'watched' by nurses (Lupton & Fenwick, 2001; McHaffie, 1990). There is a real sense that parents in NICU have little opportunity to be by themselves and intimate with their infants within a safe clinical environment.

2.3.4.2 Confidentiality

Confidentiality is an element of privacy that relates to privacy of information. In many western countries healthcare consumers are protected from unwanted disclosure of information by legislation and professional codes (Curtain, 1992). Despite this, patients and their families still seem vulnerable to breaches of confidentiality by the conversations, particularly at bedsides, in overcrowded clinical rooms. The mothers in Fenwick et al.'s (2001) grounded theory study actively overheard, and 'listened' to, other conversations between nurses and other mothers in the nursery. This activity was perceived as information gathering on learning how to look after their infants, and determining 'what was expected' as a mother in NICU. Kowalski, Lawson and Oelberg (2003) surveyed 16 parents about confidentiality during ward rounds in one crowded NICU. Only half of parents felt that confidentiality was important, with 56 percent of parents stating that they did not overhear or even understand overheard information. Likewise, in a paediatric setting where half the study parents overheard information, only ten percent were concerned (Bramwell & Weindling, 2005). Evident from these small studies is that the potential exists for parents to hear confidential and sensitive information in crowded infant rooms, but whether confidentiality is a concern for parents needs further exploration.

2.3.4.3 Sense of Belonging

Increased space and the creation of discrete zones for families at the cot side, is said to enhance a sense of belonging for NICU parents (Johnson, et al., 2004; White, 2004). It is suggested in family centred care literature (Johnson, et al., 2004; Philbin, 2004) that parents 'personalise' incubators and cot spaces. For example, placing family photos and pictures around the incubator in an effort to make a more homelike environment and to enhance belonging. But mostly, increasing a parents sense of belonging in the NICU rooms is seen as encouraging 'long stays at the bedside' (Philbin, 2004, p. 340) thereby

encouraging increased parental caretaking of their infant. Apart from Wigert et al.'s (2006) phenomenological study, where mothers felt the NICU surroundings were not welcoming, research offers no further insight into this concept.

2.3.4.4 Parental Social Interaction in NICU Rooms

Social interaction and relationships between parents in NICU are viewed as a mechanism for strengthening social support for parents (Hughes, McCollum, Sheftel, & George, 1994; Zahr, 1991). The effect of social support in assisting individuals with stressful events has been highlighted by McHaffie (1992) and Miles, Carlson and Funk (1996). While studies have shown key support to be partners, family members and health professionals (Brazy, Anderson, Becker & Becker, 2001; Miles et al., 1996), the role of other parents in similar circumstances remains salient and warrants further exploration.

It is not clear how helpful social interaction within NICU rooms is for parents. Hurst's (2001) critical ethnographic study, found interaction with other parents was beneficial. This is supported by Dobbins et al. (1994) who found that parents have an overwhelming desire to talk with other NICU parents. Yet opinions of mothers varied in Brady-Fryer's (1994) phenomenological study group, pointing to perhaps the individualistic nature of socialisation. Other investigations also indicated that support from other parents does not rate highly. Miles et al.'s (1996) study in three USA NICUs found that the helpfulness from 'other parents in NICU' rated the lowest, although maternal scores did increase overtime. A similar finding emerged in Ward's (2001) parental needs analysis where 42 mothers and 10 fathers in NICU rated infant focused needs first. Talking to other parents with an infant in a similar situation was rated within the least important needs. McHaffie (1992) commented that there is little consensus on how to appropriately examine social support. The characteristics of the participants involved in the research are mainly white, educated, married, and middle class, hence findings are not reflective of wider NICU client groups. How helpful other parents are in NICU rooms warrants further exploration given the potential for parents, to be isolated in room designs with fewer infants (Harris et al., 2006).

2.3.5 Research Instruments

The majority of information on how parents perceive the physical environment of NICU is provided by the PSS: NICU, a tool developed in the USA by Miles and Carter and modified for NICU in 1991 (Miles & Funk, 1998). This instrument is a 50 item self report instrument with four dimensions: infant appearance, parental role, sight and sounds and staff behaviours and communication. The five point Likert scale measures occurrence and intensity of stressors, and the 'sights and sounds' subscale measures environmental stressors. It contains five items related to technology, noise and other sick infants in NICU rooms. The PSS: NICU has been tested for reliability with high test-retest reliability correlations (0.87) and internal consistencies that measure well, with Cronbach alpha coefficients ranging from 0.89-0.94 (Miles & Funk, 1998). More recently Franck, Cox, Allen and Winter (2005) tested the PSS: NICU in nine NICUs in the United Kingdom, with similar internal consistencies found.

Studies using The PSS: NICU have consistently identified infant related aspects, such as alteration in parental role and infant's appearance and behaviour, as most stressful for parents. Environmental stressors, while frequently reported, were not highly stressful (Duber-Shriber, 2004; Franck et al., 2005; Miles et al., 1991, 1992; Perehudoff, 1990; Shields-Poe & Pinelli, 1997). Spencer and Edwards (2001) comment that these findings are predictable as the PSS: NICU seeks to explore the entire experience for parents, and parents are known to put their infant needs first (Bioloskurski, Cox & Wiggins, 2002). Yet conclusions that the physical environment has only a minor part to play in overall stress for parents have been drawn from the PSS: NICU (Miles et al., 1991, 1992) and may have influenced how NICUs are designed. Not emphasised is the ability to change the physical environment to support parenting and reduce parental stress.

Furthermore, the five items on the sights and sounds dimension (PSS: NICU, Miles et al., 1991) are not a comprehensive environmental survey. Physical environments of NICU have changed since the tool was developed in 1991 (Gordin & Johnson, 1999). Raeside's (1997) stress tool (adapted from the PSS: NICU) sought to be more explicit regarding the physical surroundings with 11 environmental items. Notably lacking in both instruments

is the impact of space and room configuration in infant rooms and how the physical surroundings support parental psychosocial needs. The absence of a research instrument that includes the new design directions necessitates the development of a tool specifically for this study.

2.4 Summary

Chapter Two has presented a review of the literature within three areas: The physical environment of healthcare, NICU design and parental experiences of the NICU physical environment. From the literature, nurses are interested in the physical environment of their patients. Modern buildings, including hospitals, can be adverse environments and architects now advocate 'healthy' building designs. In the case of hospitals, 'healing by design' can work as a therapeutic tool, though it seems some hospital environments induce stress rather than relieving it. In sum, healing elements enhance the physical, emotional, and social environment of patients and families (Ulrich, 1997; Venolia, 1988). Despite this, hospitals seem slow to adopt healing concepts when rebuilding or modifying, possibly due to the increased cost and lack of evidence of patient outcomes. With the exception of light and sound, expert opinion and anecdotal accounts of new facilities form the basis of research. Many of the current recommendations for design of hospitals focus only on functional and technological components, and the need for design theory and healing concepts to be integrated into recommendations is evident (Ulrich, 1997; Venolia, 1988).

NICU as a healing environment has been criticised, though current design recommendations include elements of healing (White, 2006). New directions for NICU design include increasing space at the cot-side and fewer infants in NICU rooms, with one study suggesting lack of space impacts on parenting (Dobbin et al., 1994). The new design directions are said to have effects on the psychosocial environment of parents. Increased privacy and a greater sense of belonging is suggested by these design changes (White, 2004), although decreased social interaction is a concern (Harris et al., 2006). However these recommendations are based on a few relatively small maternal studies of

the NICU experience (Brady-Fryer, 1994; Hurst, 2001; Jackson et al., 2003) and expert opinion (Johnson et al., 2004; White, 2006).

Parents found the sight of other sick infants in infant rooms distressing (Miles et al., 1991; Wereszczak et al., 1997) and other researchers found first impressions of NICU stressful (Brady-Fryer, 1992; Padden & Glenn, 1997; Shields-Poe & Pinelli, 1997). The most frequently reported environmental concern, however, was noise from monitors (Brady-Fryer, 1994; Jamsa & Jamsa, 1998; Miles et al., 1991, 1992) that was a barrier to parenting (Dobbins et al., 1994), although technology was found to be paradoxically reassuring for parents (Affonso et al., 1992). Technology was less stressful for fathers (Miles et al., 1992; Perehudoff, 1990; Shields-Poe & Pinelli, 1997) and an important means of comfort (Lundquist & Jakobsson, 2003).

Gaps in the research on parents' perceptions and the NICU environment are apparent. Research directly on the impact of space at the cot side is not evident in the literature. The current study will explore parent's perceptions of space at the cot-side including privacy, confidentiality, sense of belonging and socialisation of parents. Research integrated into NICU redesign such as the current study is rare and a unique opportunity to describe and compare two differently configured NICUs.

While earlier studies show noise from monitors was stressful, technological developments may reduce noise levels. The present study also seeks to examine parent's perceptions of noise from monitor alarms between the two NICUs. Parent's views of the overall sound levels in NICU rooms, and whether technology intrudes on family space, have not been explored and warrants investigation. It will also be interesting to examine whether the design changes influence parents' first impressions of NICU. The following chapter details the research design and method chosen to describe and compare parental perceptions of the NICUs at National Women's Hospital and Auckland City Hospital.

3.0 Chapter Three: Methodology

This chapter details the design of the study and the methods utilised to describe and compare parental perceptions of National Women's Hospital (NWH) and Auckland City Hospital (ACH) NICUs. Descriptions of the physical characteristics of the research settings are outlined and illustrated to enable comparison of the two NICUs. Data collection and analysis techniques are described to assist with interpretation of results. Finally the validity of the study is discussed.

3.1 Research Design

The research was a non-experimental study with a comparative descriptive design that utilised a structured self-report questionnaire. Research design can be approached from a theoretical perspective, influenced by world views or perspectives on reality and the meaning of truth (Appleton & King, 2002; Guba & Lincoln, 1994). Polit and Beck (2004) and Hek (2006) advocate that research questions, derived from the aims and objectives of the research, are central to planning the research enquiry. Furthermore it is suggested that ultimately the research questions can determine the most fitting research design (Hek, 2006; Peat, 2001).

Therefore this research was approached from a need to address specific problems identified through the researcher's clinical experience and subsequent exploration of the literature (Hek, 2006; Hott & Budin, 1999) on the physical environment of NICU and NICU redesign. The following research questions guided the research design.

3.1.1 Research Questions

The first research question asked *"What are the parental perceptions of the physical environment within the NICU rooms and around the infant's proximal cot space?"* As relatively little is known about the physical environment of NICU it was necessary to adopt a descriptive approach. Such an approach is appropriate when clarification of the nature of a situation is required (Hott & Budin, 1999; Polit & Beck, 2004).

The second research question asked: “*Are there differences in parental perceptions of the physical environment of the NICU rooms and cot spaces at National Women’s Hospital and at Auckland City Hospital?*” Descriptive designs also have the added advantage of allowing comparison of groups (Hott & Budin, 1999), such as the two physical environments of the NICUs.

3.1.2 Hypothesis

The research hypothesis adopted is that there will be no significant differences in parental perceptions between the physical environments of the NICUs at NWH and ACH. This type of prediction is a null hypothesis (H_0) and while proposing no significant differences between the two physical environments, it can be statistically accepted or rejected. Rejection of the null hypothesis permits the researcher to accept the alternative hypothesis (H_A), that there is a significant difference between the research variables (Peat, 2001; Polit & Beck, 2004).

3.2 Methods

A self-report questionnaire was the chosen method of data collection for the study (Appendix A). The questionnaire had three distinct parts: Part One was a rating scale developed by the researcher, Part Two open-ended questions and Part Three included parental and infant demographic data.

3.2.1 Justification of Methods

The advantage of employing a self-report questionnaire was the potential to capture a large sample size, therefore increasing the degree of generalisability of the study findings. Additionally, to justify any increased cost outlay with NICU redesign funding, providers traditionally require evidence of improved outcomes from a large group of parents. Questionnaires are also less expensive and easily administered (Peat, 2001; Polit & Beck, 2004). A known weakness of questionnaires is the potential for a low response rate, critical for a representative sample (Peat, 2001). This, may not be the case in NICU, as it

is known that in such specialist groups there can be greater incentive to complete questionnaires and response rates can be high (de Vaus, 1999).

Contextual factors also impacted on the decision to use self-report techniques. Anonymity for parents could be offered as parental responses could be influenced by the fact that their infants are still being cared for in the NICU. Consequently, parents may tend to give responses that they believe staff may want (Hott & Budin, 1999).

The self-report method also provided anonymity and detachment of the researcher from the participants. Objectivity and minimising any influence on study participants were seen as important factors. Firstly, the researcher was a member of the design team and therefore had vested a interest in the outcome (Polit & Beck, 2004). Secondly, the researcher was employed in the NICUs at the time of the study. This is also discussed from an ethical standpoint later in the chapter.

3.3 Sampling

3.3.1 Population

Participants for the study were derived from a population of parents with infants in NICU. The intention was to recruit a total of 60 parents, 30 each from ACH and NWH. It was recommended to attain significant results that a statistic, a power analysis, is used to determine the sample size required (Peat, 2001). However, in this case, time restraints around the relocation to the new hospital and the ethical approval process, placed restrictions on the NWH sample. Practical constraints are known to restrict sample size (Polit & Beck, 2004) and in reality 60 parents was the largest number that could be obtained.

3.3.2 Criteria for Inclusion

To be included in the study parents must have had an infant in NICU at NWH or ACH for greater than 72 hours, parents must be aged 18 years or older, have comprehension in written English, and visited their infant in NICU on at least three occasions. Parents

excluded were those whose infants were identified as terminally or acutely ill or parents who were unduly upset. Also excluded were parents of infants who had been admitted to other neonatal nurseries prior to transfer to NWH or ACH.

3.3.3 Sampling Process

Parental eligibility for the study was initially established by the researcher from the infant admission records. Further assessment of suitability of parental inclusion was made in conjunction with the Family Liaison Nurse (FLN). The FLNs role is a form of case management in NICU at NWH and ACH with a primary focus on supporting parental and family needs. FLNs were therefore the best resource to assess parental language ability, clinical condition of infant and emotional status of parents.

3.4 Settings

Both NWH and ACH NICUs had three distinct clinical areas: Level 3, Level 2 and Parent Infant Nursery (PIN). The Level 3 area includes intensive care cots for infants born less than 30 weeks gestation, infants that require ventilation and other infants that need high-dependency care. The Level 2 area (or special care) is for infants requiring less intensive respiratory support such as Continuous Positive Airway Pressure (CPAP) or oxygen, infants receiving intravenous therapy or antibiotics and infants recovering from acute illness. PIN is a low dependency area with an emphasis on supporting parenting prior to discharge. It was not considered useful to compare the NWH and ACH PIN areas as the NWH PIN was operating temporarily with reduced numbers of infants. This situation resulted in atypical room configurations and may have unduly influenced the study results.

The NICU at NWH was a 52 bed tertiary referral centre with 16 Level 3 and 36 Level 2 cots. On average 1400 infants were admitted to this unit annually. The hospital was 40 years old and the NICU was refurbished in 1991. In the new ACH NICU there was a reduction in cots to 46 beds, with the 16 Level 3 cots retained and Level 2 cots reduced to 30. Parent facilities, such as waiting areas, interview rooms, mother's rooms and the

parent- parent support group office, remained similar in both NWH and ACH NICUs. In addition there were no alterations to parental access to NICU, visiting rules and sibling visiting.

The original NICU at NWH and the new unit at ACH have contrasting features in the infant rooms (Table 3.1). While the rooms in both NICUs had the benefit of natural light, fluorescent lighting was the principal form of artificial lighting at NWH. Lighting design in the infant rooms at ACH included multiple options (wall lights, examination lights, cot-side lights) that were individualised for each cot-space, and were non-fluorescent and dimmable. To assist with sound reduction, acoustic ceiling tiles were included in the design at the new ACH facility. The interior design and aesthetics of the infant rooms changed from bright colours and a 'nursery' theme at NWH, to more neutral colours reflecting the desired 'Sleeping growing infants' image at ACH. Table 3.1 details the features of the Level 3 and Level 2 clinical rooms at NWH and ACH. The biggest difference, however, between the two NICUs was space allocation at the cot-side and the number of infant cots in clinical rooms, described in detail below.

3.4.1 Level 3 Rooms

Cot spaces in the old NWH facility were flexible, with the Level 3 rooms while containing four cots, could expand up to six, with a subsequent reduction in care space (Table 3.1, Figures 3.1 & 3.2).

**Table 3.1 Physical Characteristics of Infant Rooms at NWH and ACH
NICUs**

Features	NWH		ACH	
Room Configuration	Level 3 4-6 infants Flexible spaces	Level 2 5-6 infants	Level 3 2 infants Defined cot space	Level 2 4 infants
Space Measurements per cot	10.3 m ²	7.3 m ²	17 m ²	10.3m ²
Lighting	Natural light in each room. Views to outside park Rooms positioned for sunlight- curtains and blinds drawn Room lights fluorescent No individual lights except for examination light Facility to dim lights at night		Large windows with natural light except one room Views to city and park Rooms positioned for shade Lighting non-fluorescent with multiple individual options All lights dimmable	
Sound	No objective measurement of sound levels		No objective measurement of sound levels Acoustic ceiling tiles	
Interior design/Aesthetics	Cream wall colour and pale blue cabinetry with bright pink doors Curtains with nursery style fabric Artwork a variety of donated prints-nursery theme throughout unit		Wall colour lavender and cream with blue cabinetry Blinds a neutral shade Theme 'Sleeping growing infants' Short Poem or words reflecting the theme stencilled onto walls	
Technology	Mounted on fixed head wall		Bedside management system allowing greater flexibility	
Family facilities	Limited defined family space		Defined family space Mothers chair at each space Locker for storage	

This flexibility during high occupancy times is advantageous from an organisational point of view, but restricts the care space for parents and staff. It was therefore difficult to provide parents with an identified 'family space' and at times over-crowding compromised access to their infant. At the new ACH NICU, the number of infants in the Level 3 rooms was reduced with the rooms being two bedded and no facilities for added infants (Table 3.1, Figures 3.1 & 3.2). Hence the cot spaces at ACH offered a clearly identified family space with a chair and a locker for parents.

Space allocation in the NWH Level 3 rooms of 10.3m^2 at each cot-side was below the recommended standards of 14m^2 for intensive care cots (White, 2006). There was a further reduction in cot-side space when additional infants occupied the room. In contrast, cot-side space increased significantly in ACH Level 3 rooms to 17m^2 , within the recommended standards (Table 3.1, Figures 3.1 & 3.2).

3.4.2 Level 2 Rooms

The Level 2 rooms at NWH were five bedded that extended to six cots when required (Table 3.1, Figures 3.3 & 3.4). In the Level 2 rooms at ACH the number of cots was reduced to four with defined cot spaces and no facilities for added infants.

Of note is the space allocation at NWH Level 2 rooms of 7.3m^2 for each cot-side which was below the recommended standard of 11m^2 (White, 2006). It was not always possible to offer parents sufficient room around their infant's cot-side for holding their infant and breastfeeding. On occasion it was necessary for parents to move to other rooms for these activities. While there was a more modest increase in space allocation in the ACH Level 2 rooms to 10.3m^2 (marginally below recommendations), each cot-side had a predefined area with a mother's chair and a locker for parents (Table 3.1, Figures 3.3 & 3.4).

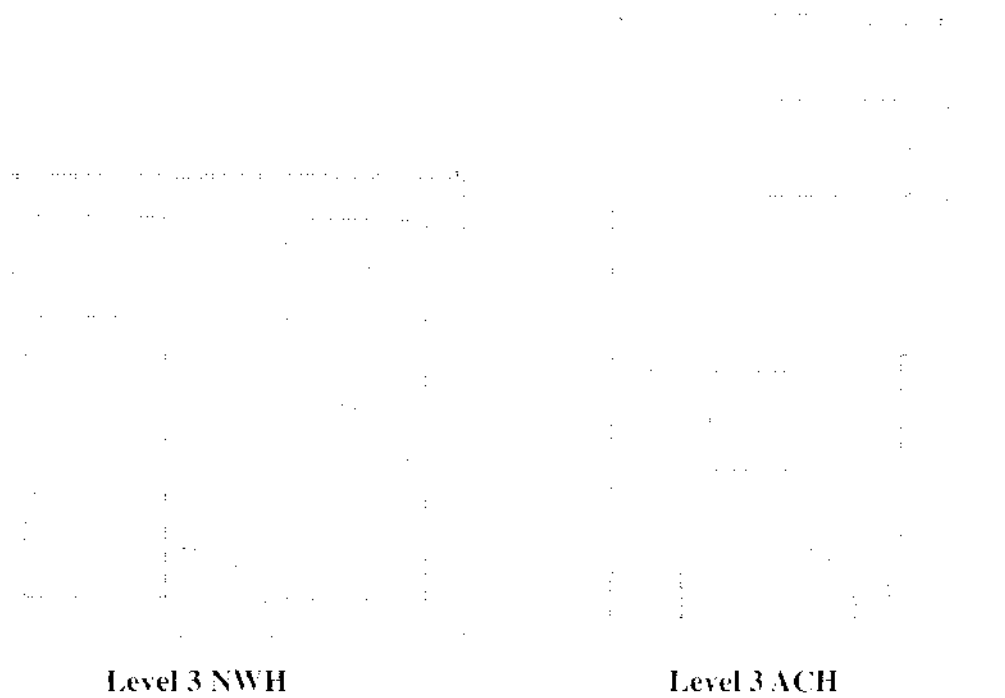


Figure 3.1. Floor map displaying room configuration of cot spaces in the Level 3 areas at NWH and ACH NICUs. Solid lines indicate a designated cot space and dotted lines denote flexible cot spaces



NWH NICU Level 3



ACH NICU Level 3

Figure 3.2. Photographs displaying a Level 3 room at NWH and one side of a Level 3 room at ACH

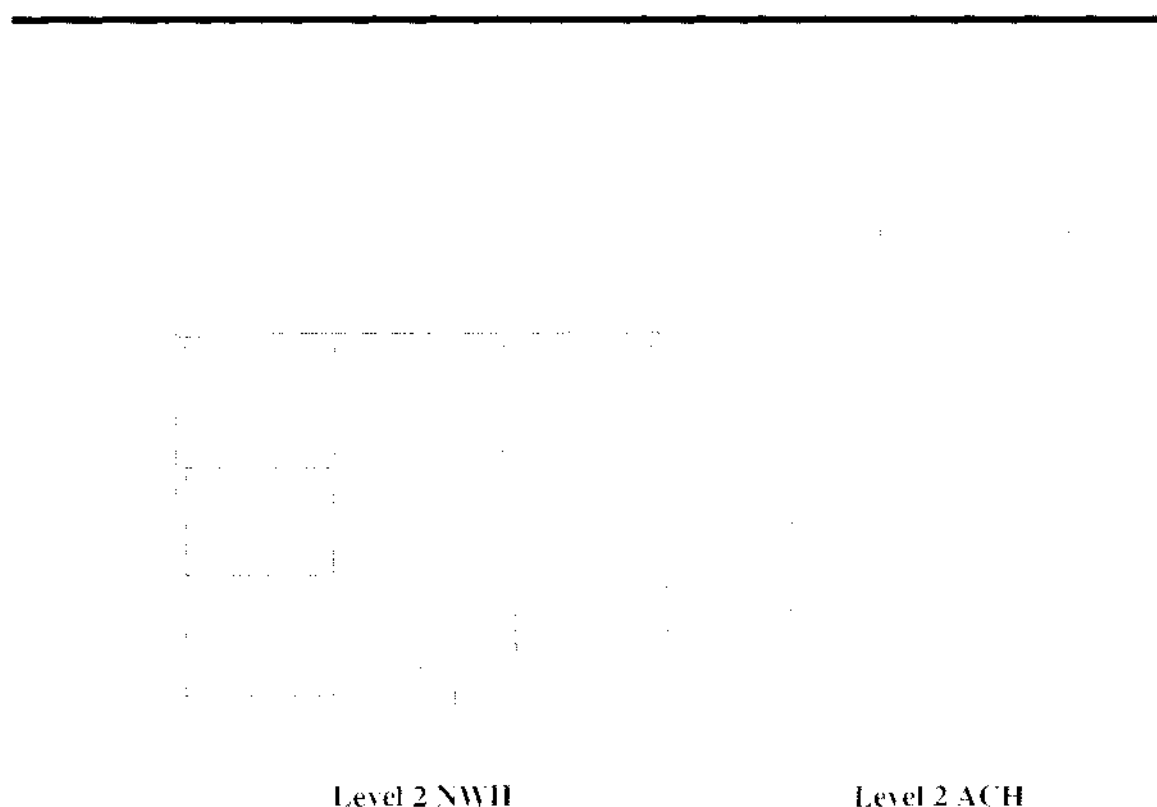


Figure 3.3. Floor map displaying the room configuration of cot spaces in Level 2 areas at NWH and ACH NICUs. Solid lines indicate a designated cot space and dotted lines denotes flexible cot spaces



NWH NICU Level 2



ACH NICU Level 2

Figure 3.4. Photographs displaying one side of the Level 2 rooms at NWH and ACH

3.5 Ethical Approval

Ethical consent for the study was sought and granted from Massey University Human Ethics Committee (Appendix B) and the Auckland Ethics Committee (AKX/04/03/059) (Appendix C). Approval was also granted by the Auckland District Health Board (ADHB) and the Maori Review Committee from ADHB (Appendix D & E).

3.5.1 Ethical Considerations

3.5.1.1 Informed Consent

Potential participants voluntarily decided whether to participate or not in research and be fully informed about the study (Polit & Beck, 2004). Parents received an information sheet along with the questionnaire describing the study and detailing their rights (Appendix F). The information sheet clearly outlined that participation was voluntary and that declining participation in the study would result in no negative consequences. Potential participants were advised to take time in considering participation. Once involved, the participants had the right to refuse to answer any particular question. Completion of the questionnaire was viewed as implied consent for the study.

The researcher's role required closer ethical consideration as the researcher was employed as a staff nurse in the NICU. Polit and Beck (2004) point to the potential for exploitation of the nurse-patient relationship around the research process and in particular pressure for patients to participate with penalties if they elect to not. Therefore, the questionnaire was left at the infant's cot side, a strategy to separate the researcher from the participant decision.

3.5.1.2 Privacy

Participants must be protected from privacy intrusions throughout the research process (Parsons, 1999). Participants were informed that the questionnaire was anonymous and that no information on the questionnaire would be identifiable. While anonymity rarely can be absolutely guaranteed in the clinical situation (Parsons, 1999), due to the size of

the neonatal units involved, with a high turnover of infants and the number of parents sampled, confidence in this principle remained high.

3.5.1.3 Protection from Harm

Sensitive ethical issues were acknowledged within this project and the need for participants to be protected from potential risks associated with the research process considered. Firstly, the experience of having an infant in NICU is recognised as a stressful event and an emotional time (Miles et al., 1991, 1992; Shields-Poe & Pinelli, 1997). Hence the Family Liaison Nurse was consulted before parents were approached to be included in the study. As previously mentioned, parents whose infants were terminally or acutely ill, and parents who were unduly upset at the time, were excluded during this period. The questionnaire was kept intentionally concise so not to tire potentially stressed parents. Psychological effects of research can be subtle and require heightened sensitivity (Polit & Beck, 2004) and unanticipated consequences of research do occur (Parsons, 1999). Therefore, in the unlikely event of the questionnaire causing emotional discomfort, support for parents was planned and clearly described on the information sheet (Appendix F).

3.6 Data Collection

3.6.1 The Instrument

An exhaustive search failed to locate a validated tool for examining parental perceptions of the NICU physical environment that included new directions in design; hence the questionnaire used in this study was formulated by the researcher (Appendix A). As the quality of the questionnaire is paramount to ensure reliability and validity of the study (de Vaus, 1999; Peat, 2001), extensive resources and time were devoted to developing the instrument.

3.6.1.1 Rating Scale

Different types and styles of rating scales can be employed but a Likert Scale seemed valuable for eliciting information on attitudes and opinions (de Vaus, 1999; Murphy-

Black, 2006). Likert scales "...measure direction, intensity and extremity of attitudes" (de Vaus, 1999, p. 346). Utilising structured or closed questions, the Likert scale can provide numeric data (Peat, 2001). Additionally the value of this type of scale within this study was its capacity not only to describe and compare the two NICU environments, but also test the hypothesis.

Key resources for developing questionnaires were sourced and utilised (Fowler, 2001; Oppenheim, 1992). Fundamental concepts were derived from qualitative studies around parental experience in NICU, redesign literature, relevant aspects of the Parental Stress Scale NICU: PSS (Miles & Funk, 1998), a questionnaire from the Institute for Family Centred Care of America, consultation with peers and experts in the field and the researcher's own clinical experience. These concepts were then grouped into four dimensions: first impressions, parent–infant relationship, visual and auditory, and the presence of other infants and families. On the questionnaire these dimensions were referred to as: first impressions, you and your baby, sights and sounds of NICU and other families. Finally items related to each dimension were formulated.

Phrasing clear, well-worded items that adequately measure the intended concept (validity) and produced consistent measures (reliability) was paramount and a challenge (de Vaus, 1999; Fowler, 2001). The sequence of the items also required close attention. Oppenheim (1992) proposed the presentation of factual items first then leading onto deeper attitudinal ones. Positively and negatively worded items around the same concept were also advocated, as there is an acknowledged tendency for respondents to agree rather than disagree (Fowler, 2001; Polit & Beck, 2004). Finally, the overall layout of the questionnaire needed to be appealing, well structured, have clear instructions and be meaningful to participants (Oppenheim, 1992).

Respondents were asked to rate their reactions to a series of items on a Likert-type rating scale (1= strongly disagree to 7= strongly agree). Usually items in a Likert scale have five point response alternatives, but providing seven to ten points can detect finer differences between respondents and allow for greater discrimination (Oppenheim,

1992). A 'don't know' alternative was not offered as it was deemed that all subjects should be familiar with all the questions. This approach is said to reduce unusable responses (Fowler, 2001; Oppenheim, 1992).

3.6.1.2 Open -Ended Questions

The greatest disadvantage of a structured questionnaire is the potential to overlook important aspects of the phenomena (Polit & Beck, 2004). Therefore a section with two open-ended questions was included for respondents to add further comments on the NICU environment, and to suggest any improvements. Unstructured questions are said to add richness and clarity to the findings (Oppenheim, 1992).

3.6.1.3 Demographic Information

Describing the respondents' characteristics is important principally so that comparison of the similarities and differences between the sample groups can be made. Additionally, demographic and health data are vital for interpretation of findings and to reveal the population to whom the results can be generalised (Polit & Beck, 2004). Furthermore, this information can be used to make additional comparisons between variables or subgroups within the study (Peat, 2001; Polit & Beck, 2004). Important subgroups identified were: gender, whether parents have had a previous infant in NICU, differences between levels of care, and the time period at which the parent participated in the study. Therefore, demographic and health information was sought from parents about themselves and their infants.

3.6.1.4 Instrument Validity and Reliability

With a non validated instrument, piloting the questionnaire is advocated as the research tool itself can be a source of error (Oppenheim, 1992). Unfortunately the logistics of the relocation (an uncertain move date) prevented a formal pilot of the questionnaire. Therefore, a pre-test trial of questions was administered as recommended by de Vaus (1999) and Oppenheim (1992). Judgement by peers and experts is said to enhance face and content validity of an instrument (Polit & Beck, 2004). Five veteran NICU parents, peers and one NICU unit design expert completed the questionnaire and provided

feedback. Particular attention was paid to questions that had non- responses and sections where there was predominance of middle scores (Oppenheim, 1992). After careful assessment and consideration of all feedback the questionnaire was revised, requiring only minor changes.

3.6.2 Data Collection Process

The first stage of the project commenced in May 2004 at NWH prior to the relocation to the new site in October 2004. After meeting the study inclusion criteria, parents were invited to participate by completing anonymously the questionnaire left at their infant's cot side. Three weeks after commencement of sampling only four out of seventeen questionnaires (24%) had been returned. Feedback from staff suggested that parents saw the study as somewhat removed from NICU and lacked personal interaction. After an ethical amendment to the research procedures (Appendix G) the questionnaire and information sheet was offered to parents with a brief explanation of the study by the researcher. Parents were encouraged to complete the questionnaire from their own point of view and not consult each other. Parents were also asked to complete the questionnaire while their infant was hospitalised. Questionnaires were returned into boxes provided in the clinical rooms or posted to the researcher, using self- addressed envelopes.

The second stage of the data collection commenced in April 2005 at ACH and as at NWH, the questionnaire and information sheet was offered to parents by the researcher. Data collection was completed by July 2005.

Raw data from the rating scale and the demographic information was entered into an Excel spreadsheet after being checked for accuracy. Parental responses from the open-ended questions were transposed on to a Microsoft Word document for analysis.

3.7 Data Analysis

As this was a descriptive comparison study, exploratory data analysis was carried out to test the accuracy of the data entry and assess distributional properties of data.

3.7.1 Rating Scale

It was anticipated that the rating scale data could be analysed in two ways, depending on the distribution of the data. If the majority of the data was normally distributed, the mean is the preferred measure of central tendency and the variability or spread of data measured by the Standard Deviation (SD) and the range (Kuzma & Bohnenblust, 2005; Wright, 2002). A parametric procedure, the *t* test would have been utilized to determine statistical difference between the two groups (responses from NWH and ACH parents). An analysis of variance (ANOVA) would assess differences between three or more groups (Kuzma & Bohnenblust, 2005; Wright, 2002).

However, the majority of the data values from the rating scale were not normally distributed. Therefore as Kuzma and Bohnenblust (2005) state the median is a better measure of central tendency. Results are reported using median values and variability of data by the interquartile range (Kuzma & Bohnenblust, 2005; Wright, 2002). With a non-normal distribution, non-parametric tests were required, such as a Mann-Whitney U test to compare the two independent groups. When more than two groups were compared, a Kruskal-Wallis test was utilised (Peat, 2001; Wright, 2002).

3.7.2 Demographic Data

Comparison of demographic data was made using a Chi-squared test, the Fisher's Exact test and the Mann-Whitney U test where appropriate. A Chi-squared test is a non-parametric statistical procedure used to test relationships between nominal level data. With smaller samples (30 or less), a Chi-squared test was not appropriate and therefore the Fisher's Exact test was used for data comparison. Where the dependent variable was on the ratio level, the Mann-Whitney U test was used to assess differences (Peat, 2001).

3.7.3 Open-ended Questions

Open-ended questions were analysed by thematic analysis. This technique has a variety of interpretations, however, for this project a relatively simplistic process was applied based on qualitative research strategies (Coffey & Atkinson, 1996; Miles & Huberman, 1994). A systematic search, that compares similar and different key factors or concepts

from the parental accounts, was undertaken. Concepts were then re-examined for overarching themes. “*In vivo*” labels, using the participant’s own words that captured the essence of what the participants were saying, was used to name the themes (Grbich, 1999).

3.8 Validity of Study

Threats to the internal validity of this study existed as control of confounding variables is difficult to achieve in non-experimental studies (Hott & Budin, 1999), and likewise within the context of unit redesign research (White, 2003). Notably so was the extraneous effects of the relocation, and where possible, strategies to moderate these effects were instituted. Data collection ceased in the NWH parental group two weeks prior to relocating to ACH. Staff adjustment to the new unit could impact on the ACH parental sample hence, the six-month adjustment period prior to sampling.

Pre-existing characteristics of parents could influence their impressions of the environment rather than the NICU environment itself. The inclusion/exclusion criteria can partially act as a control mechanism (Polit & Beck, 2004). As a result, parents whose infants have been transferred to NWH and ACH after being admitted to another neonatal nursery were excluded from the study. Differences in parental characteristics can be determined from demographic information and significant subgroups identified. For instance, parental gender and parents who have had other infants in a NICU.

3.9 Summary

Chapter Three has examined and provided rationale for the non-experimental comparative descriptive design chosen to answer the research questions. Justification for the research method is described and a questionnaire was developed and pre-tested to collect data from the intended 60 parents from both NWH and ACH NICUs (30 from each). The characteristics of the two physical NICU settings involved in the study have been described and compared. The most noteworthy difference between the two NICUs was space allocation at the cot-side and the number of infants in rooms. Study procedures to ensure ethical standards were met are detailed and sensitive issues raised by this research discussed. The manner in which data was collected and the techniques of analysis employed are described. Finally, comments on the validity of the research have been made. The following chapter (Chapter Four) presents the research results from the rating scale, open-ended questions and the demographic data.

4.0 Chapter Four: Results

Chapter Four outlines a summary of results and analysis of data derived from the questionnaire that explored parental perceptions of the physical environments of Auckland City Hospital (ACH) and National Women's Hospital (NWH) NICUs. Results are reported in three sections: parental and infant demographic data, rating scale data and finally the open-ended responses.

4.1 Statistical Analysis

Statistical analysis of the rating scale and demographic data was prepared by using SPSS Microsoft (version 16) with the assistance of a bio statistician. A 5% level of significance ($p < 0.05$) was considered significant.

Demographic data was analysed using a Chi-squared test and the Fisher's Exact test where appropriate. A Mann-Whitney U test was utilized when the variable was on the ratio level.

The majority of the data values from the rating scale were not normally distributed. Forthofer and Lee (1995) state that non-normal distributions can result from small sample sizes. Descriptive results were therefore reported using percentages, median values and inter-quartile ranges to provide an overview of the parental perceptions of the two physical environments (Wright, 2002).

As data was not normally distributed, non-parametric tests were required to test for statistical differences between groups. The Mann-Whitney U test was used to compare two independent groups, such as the ACH and NWH parental responses to items on the rating scale. When more than two groups were compared, a Kruskal-Wallis test was required (Kuzma & Bohnenblust, 2005; Peat, 2001). For example, assessing the differences between parental responses, levels of care and the two NICUs.

4.1.1 Response Rates

Sixty questionnaires were analysed. From the ACH sample 30 questionnaires were returned out of 36, (83% response rate) and from the NWH sample 30 questionnaires were returned out of

41 (73% response rate). Overall the non-response to individual items (missing data) within the questionnaire was 1.6%.

4.2 Demographic Data

This section presents the results of the Chi-squared test, Fisher's Exact test and Mann-Whitney U test (Kuzma & Bohnenblust, 2005) that compared the parental and infant characteristics from ACH and NWH hospitals. Table 4.1 and 4.2 lists a full description of parent and infant characteristics from ACH and NWH samples. No socio-economic information was sought. The results confirmed that no significant differences existed between the groups of ACH and NWH on any parent or infant demographic data.

4.2.1 Auckland City Hospital Participants

4.2.1.1 Parental Characteristics

The majority of the sample were mothers (67%) with ten fathers (33%) participating. Parents were aged 18-29 years (37%), 30-36 years (33%) and 37-45 years (30%). Although most of the parents were married (77%), or partnered (13%) three parents (10%) were non-partnered. A considerable proportion of parents were NZ European (73%), with further ethnicities described as Maori (7%) and Pacific (10%). Three parents (10%) detailed their ethnicity as other. Over half (60%) of the parents had other children with five (17%) parents having had a previous child in NICU or SCBU. Table 4.1 details the characteristics of all participants from ACH.

4.2.1.2 Infant Characteristics

Nearly half of the infants (48%) were born between 27-32 weeks gestation with seven (30%) born between 33- 37 weeks gestation. Four (18%) of the infants were born less than 26 weeks gestation, with one (4%) infant born at greater than 38 weeks gestation. Five infants (22 %) weighed less than 999g at birth, seven infants (30%) weighed between 1000-1499g with six (26%) infants weighing between 1500-1999g. Three infants (13%) weighed between 2000-2499g, with only two infants weighing greater than 2500g. Nearly half (48%) of the infants required artificial ventilation and CPAP, eight infants (35%) required CPAP only, and four infants (17 %) required no ventilatory support. The median infant age on completion of questionnaire was 26 days (inter-quartile range 11-27 days). Table 4.2 details the characteristics of all infants born to the participants from ACH.

4.2.2 National Women's Hospital Participants

4.2.2.1 Parental Characteristics

The majority of the sample were mothers (70%) with ten fathers (30%) participating. Parents were aged 18-29 years (30%), 30-36 years (57%) and 37-45 years (13%). A substantial proportion of respondents were married (67%), or partnered (30%), with one parent described as non-partnered (3%). NZ European (67%) was the predominant ethnicity of respondents, with further ethnicities described as Maori (13%) and Pacific (13%). Two parents (7%) detailed their ethnicities as other. Over half (57%) of the parents had other children with six of the parents (20%) having had a previous infant in NICU or Special Care Baby Unit (SCBU). Table 4.1 details the characteristics of all the participants from NWH.

4.2.2.2 Infant Characteristics

The majority of infants (54%) were born between 27-32 weeks gestation with eight infants (31%) born between 33 -37 weeks gestation. Three (11%) of the infants were born less than 26 weeks gestation with one infant born at greater than 38 weeks gestation. Five infants (19%) weighed less than 999 grams (g) at birth, six infants (23%) weighed between 1000-1499g, with eight infants (31%) weighing 1500-1999g. Five infants (19%) weighed between 2000- 2499g with two infants (8%) weighing greater than 2500g. Indication of severity of infant illness was assessed by need for and type of respiratory support. Fourteen infants (54%) required a respirator and CPAP, seven infants (27%) required CPAP only, and five infants (19%) required no support. The median infant age on completion of questionnaire was 24 days (inter-quartile range 9-30). Table 4.2 details the characteristics of all the infants born to the participants from NWH.

Table 4.1 Parental Characteristics from ACH and NWH

Characteristic	Auckland City n = 30		National Women's n = 30		P Value
	n	%	n	%	
Female	20	67%	21	70%	0.78 ^a
Male	10	33%	9	30%	
Age (years)					0.14 ^a
18-29	11	37%	9	30%	
30-36	10	33%	17	57%	
37-45	9	30%	4	13%	
Marital Status					0.21 ^a
Non-partnered	3	10%	1	3%	
Partnered	4	13%	9	30%	
Married	23	77%	20	67%	
Ethnicity					0.83 ^b
NZ European	22	73%	20	67%	
NZ Maori	2	7%	4	13%	
Pacific	3	10%	4	13%	
Other	3	10%	2	7%	
Previous infant in NICU/ SCBU	5	17%	6	20%	0.74 ^a
Other children	18	60%	17	57%	0.79 ^a
Number					0.82 ^a
0	12	40%	13	43%	
1	9	30%	6	20%	
2	4	13%	6	20%	
3	2	7%	1	3%	
4 or more	3	10%	4	13%	

Note. SCBU = Special Care Baby Unit; NICU = Neonatal Intensive Care Unit.

^a Chi-squared test, ^b Fisher's Exact test.

Table 4.2 Infant Characteristics from ACH and NWH

Characteristic	Auckland City n = 23		National Women's n = 26		P Value
	n	%	n	%	
Gestational age					0.96 ^b
<26 weeks	4	18%	3	11%	
27-32 weeks	11	48%	14	54%	
33-37 weeks	7	30%	8	31%	
>38 weeks	1	4%	1	4%	
Birth weight (g)					0.96 ^b
<999	5	22%	5	19%	
1000-1499	7	30%	6	23%	
1500-1999	6	26%	8	31%	
2000-2499	3	13%	5	19%	
>2500g	2	9%	2	8%	
Respiratory support					
Respirator and CPAP	11	48%	14	54%	0.45 ^a
CPAP only	8	35%	7	27%	0.45 ^b
No support	4	17%	5	19%	0.45 ^b
Infant age (days)					0.91 ^c
Median	26		24		
Inter-quartile range	9 - 30		11 - 27		

Note. CPAP = Continuous Positive Airway Pressure; SD = Standard deviation; g = grams. ^a Chi-squared test; ^b Fisher's Exact test; ^c Mann-Whitney U test.

4.3 Rating Scale Data

The rating scale had four dimensions and a summary of parental responses are reported under each item. Results are reported as median and interquartile ranges. Also outlined, the results of the Mann-Whitney U Test (Peat, 2001) conducted to determine differences between parental responses from ACH and NWH NICUs, on each item of the rating scale. Summaries of the results from each dimension are presented in tables and graphs. Finally, further analysis of selected variables (or subgroups) identified from the literature review, are presented.

4.3.1 Dimension A: First Impressions

The first item determined what percentage of parents had a preadmission tour of the NICU.

Item A.1 *Were you shown around NICU before the birth of your baby?*

Response: Only 33% (n = 10) of participants from ACH and 36% (n = 11) from NWH had a preadmission tour of the NICU.

The following items were on a modified Likert-type scale with scores ranging from 1 to 7 with 1 representing strongly disagree and 7 strongly agree (Appendix A). Medians and interquartile ranges of responses from parents to the *First impressions* dimension are summarised in Table 4.3 and Figure 4.1.

Item A.2 *The tour of NICU prepared me for the appearance of the NICU infant rooms.*

Response: At ACH and NWH helpfulness of the tour was rated 6 (4-6) and 5 (4-5), respectively. There was no significant difference between ACH and NWH ($p = 0.45$).

Item A.3 *Nothing, even a tour of NICU could have prepared me for the first visit to the NICU rooms.*

Response: Parental responses to this item scored values of 4 (2.5-5.5) at ACH and 3 (1-5) at NWH with no significant difference between the two NICUs ($p = 0.72$).

Item A.4 *My first sight of the NICU rooms was pretty much as I expected.*

Response: Parents in ACH rated this item with a median value of 4 (3-5) compared to 5 (4-6) at NWH. There was a trend towards significant difference in values between the two groups ($p = 0.05$).

Item A.5 *At first, the appearance of the infant rooms in NICU is shocking for parents.*

Response: Values of 3.5 (2-6) at ACH and 3.5 (3-5.5) at NWH. No significant difference was noted between the two NICUs ($p = 0.87$).

Table 4.3 Parental Perceptions of Dimension A: First Impressions

		Auckland City Hospital			National Women's Hospital			
	Item	n	Median score	Inter quartile range	n	Median score	Inter quartile range	P value
A.2	Tour of NICU helped	10	6	4-6	11	5	4-5	0.45
A.3	Nothing can prepare	10	4	2.5-5.5	11	3	1-5	0.72
A.4	First sight as expected	30	4	3-5	30	5	4-6	0.05
A.5	First sight can be shocking	30	3.5	2-6	30	3.5	3-5.5	0.87

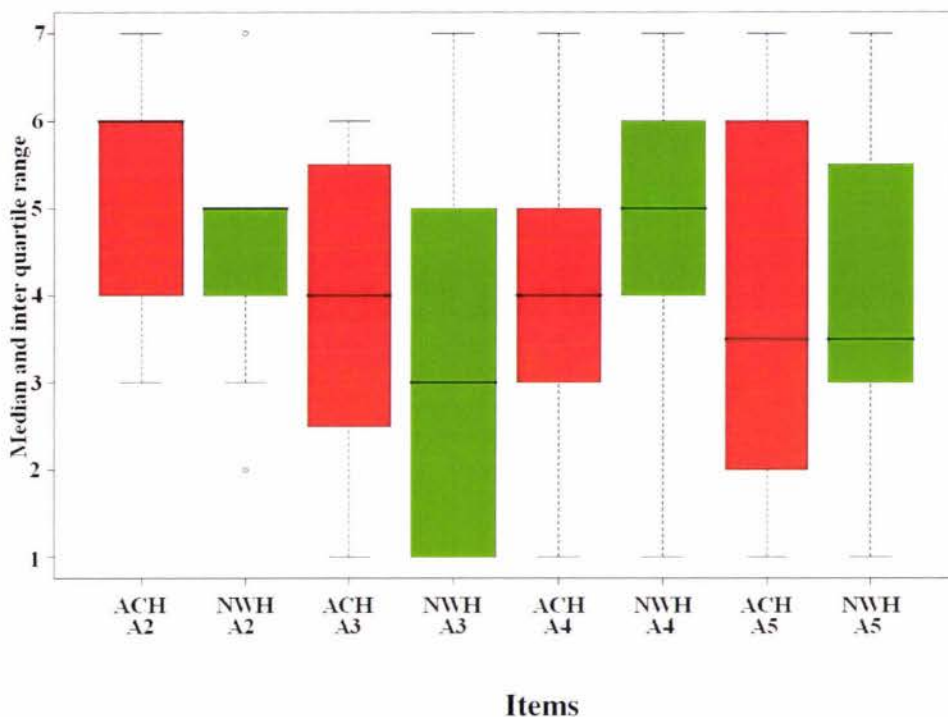


Figure 4.1. Median values, interquartile ranges, true ranges and outliers (o) from ACH and NWH parental perceptions to Dimension A

4.3.2 Dimension B: You and Your Baby

Median values and interquartile ranges from the *Parent-Infant Relationship* dimension are reported under each item and summarised in Table 4.4 and Figure 4.2.

Item B.1 *The amount of space around my baby's incubator (or cot) is adequate for me and my family.*

Response: The only significant difference in parental perceptions between the two NICUs in this dimension was adequacy of space at the cot-side. Parents rated the ACH unit significantly ($p = 0.001$) higher with values of 6 (5-7) compared to the NWH results of 3.5 (2-6).

Item B.2 *I try to make the area around my baby's incubator (or cot) sort of like his/her room at home.*

Response: Values of 3 (2-5) from ACH and 3 (2-5) from NWH were found in response to this item from ACH and NWH respondents. No significant difference between hospitals was demonstrated ($p = 0.85$).

Item B.3 *The area around my baby's incubator (or cot) has become our 'family space' within the NICU room.*

Response: Values of 6 (3-6) at ACH and 4.5 (2-6) at NWH resulted from parental replies to this item. On comparison between hospitals, no significant difference was found at the 5% level but there was a trend towards significance ($p = 0.08$).

Item B.4 *It's hard for me as a parent to feel a sense of belonging in the NICU rooms.*

Response: In NICU at ACH and NWH responses to this negatively worded item scored values of 3 (2-3) and 3 (2-5) respectively with no significant difference ($p = 0.69$) between the two NICUs.

Item B.5 *Even though my baby is in NICU and needs care, I still can have private moments with my baby.*

Response: Median values of 6 (4-7) at ACH and 6 (4-6) at NWH were found in response to this item. No significant differences ($p = 0.60$) existed between the responses from both hospitals.

Item B.6 *Uninterrupted times with my baby help us feel close.*

Response: The final item resulted in values of 6 (6-7) from ACH and 6 (6-7) from NWH. No differences were noted between the ACH and NWH groups ($p = 0.49$).

Table 4.4 Parental Perceptions of Dimension B: You and Your Baby

		Auckland City Hospital n = 30		National Women's Hospital n = 30		P value
Item		Median Score	Inter quartile range	Median Score	Inter quartile range	
B.1	Space adequate	6	5-7	3.5	2-6	0.001*
B.2	Making the space homelike	3	2-5	3	2-5	0.85
B.3	Family space	6	3-6	4.5	2-6	0.08
B.4	No sense of belonging	3	2-3	3	2-5	0.69
B.5	Private moments possible	6	4-7	6	4-6	0.60
B.6	Uninterrupted moments	6	6-7	6	6-7	0.49

* p < 0.05

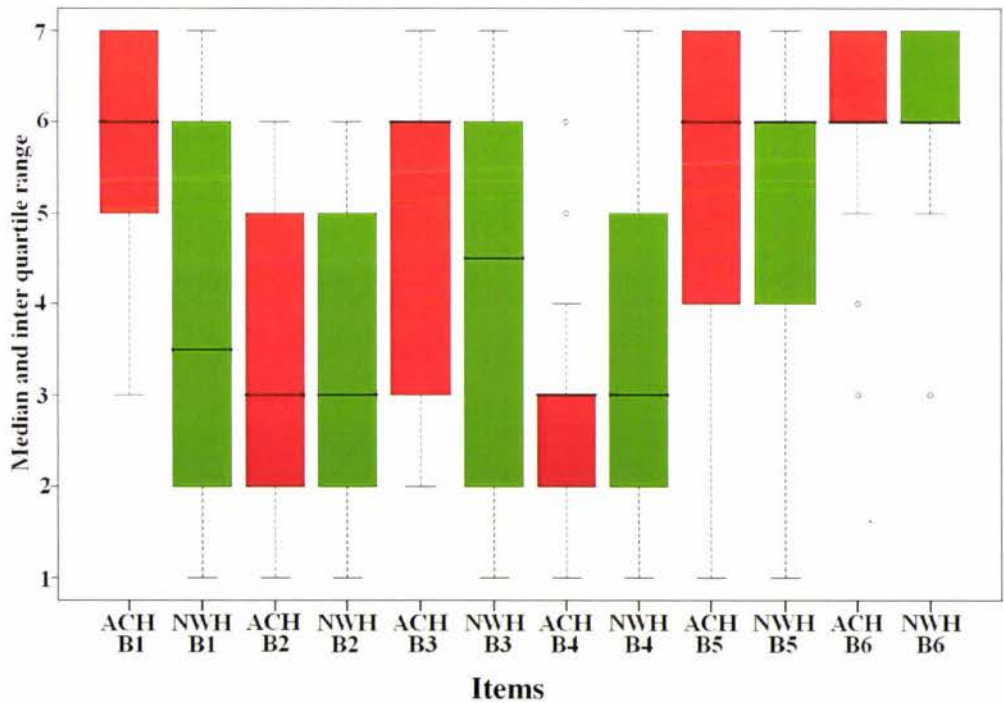


Figure 4.2. Median values, interquartile ranges, true ranges and outliers (o) from ACH and NWH parental perceptions to Dimension B

4.3.3 Dimension C: Sights and Sounds of the NICU

Median values and interquartile ranges from the *Visual and Auditory* dimension are reported under each item and shown in Table 4.5 and Figure 4.3.

Item C.1 *The lighting levels in the NICU rooms are comfortable for me.*

Response: Lighting levels at ACH scored significantly higher ($p = 0.002$) compared to NWH, with values of 6 (5-7) at ACH compared to 5 (4-6) at NWH.

Item C.2 *The area around the incubator (or cot) is a quiet place for me to be with my baby.*

Response: Sound levels around the cot-side were significantly quieter at ACH ($p = 0.02$) compared to NWH, with values of 5.5 (4-6), and 4 (2-6) respectively.

Item C.3 *Overall, the sound levels in the NICU rooms are higher than I would like.*

Response: This (negatively worded) item was rated by respondents with values of 3 (2-5) at ACH and 3 (3-5) at NWH. There were no significant differences noted between the two NICUs ($p = 0.33$).

Item C.4 *The monitors are comforting and reassure me that my baby is doing ok.*

Response: In response to this item, values of 6 (5-7) were found from the ACH and 6 (5-7) from the NWH participants. On comparison there was no significant difference in the values between the two NICUs ($p = 0.73$).

Item C.5 *The monitors constantly alarm in the infant rooms.*

Response: Parents rated the frequency of alarms from monitors at 5 (3-6) at ACH and 5 (4-6) at NWH with no difference ($p = 0.55$) between the two groups.

Item C.6 *I hardly notice the machinery and equipment around my baby's cot.*

Response: A significant difference ($p = 0.03$) was seen between responses to this item with higher values of 4 (2-6) at ACH compared to 2.5 (2-4) at NWH.

Item C.7 *The sound of the monitors alarming in the infant rooms is stressful for me.*

Response: Parents rated stress from alarming monitors at 3.5 (3-6) at ACH and 4 (2-5) at NWH with no significant differences ($p = 0.91$) determined between the two NICUs.

Table 4.5 Parental Perceptions of Dimension C: Sights and Sounds of NICU

Item	Auckland City Hospital n = 30		National Women's Hospital n = 30		P value
	Median Score	Inter quartile range	Median Score	Inter quartile range	
C.1 Lighting level comfortable	6	5-7	5	4-6	0.002*
C.2 Quiet enough	5.5	4-6	4	2-6	0.02 *
C.3 Sound levels too high	3	2-5	3	3-5	0.33
C.4 Monitors reassuring	6	5-7	6	5-7	0.73
C.5 Monitors constantly alarm	5	3-6	5	4-6	0.55
C.6 Hardly notice equipment	4	2-6	2.5	2-4	0.03 *
C.7 Monitor alarms stressful	3.5	3-6	4	2-5	0.91

* $p < 0.05$

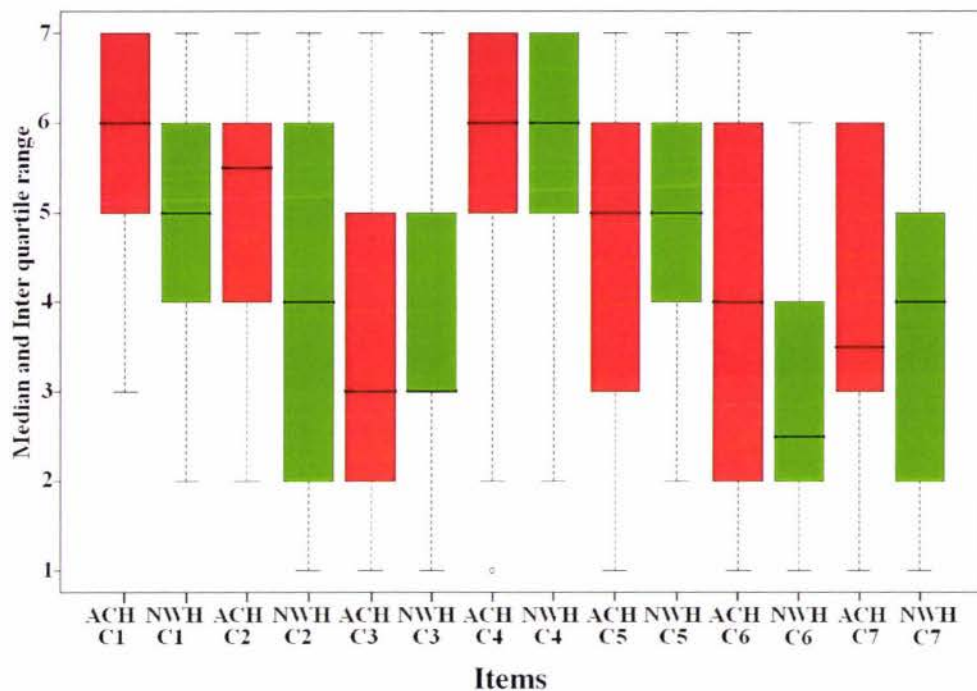


Figure 4.3. Median values, interquartile ranges, true ranges and outliers (o) from ACH and NWH parental perceptions to Dimension C

4.3.4 Dimension D: Other Families

Median values and interquartile ranges from the *Other Infants and Families* dimension are reported under each item and shown in Table 4.6 and Figure 4.4.

Item D.1 *It's helpful for me to have other babies and their families in the rooms.*

Response: Helpfulness of parental contact in the NICU rooms scored values of 4 (4-5) at ACH and 5 (4-6) at NWH. No significant differences ($p = 0.29$) existed between the two groups.

Item D.2 *I worry that other parents and families will overhear personal information about me or my baby.*

Response: The item concerning confidentiality at ACH and NWH was rated 3 (3-4) and 3.5 (2-6) respectively with no significant differences ($p = 0.99$) between the two NICUs.

Item D.3 *Sharing a room with other babies and their families makes me feel less alone in NICU.*

Response: Values of 5 (5-6) at ACH and 5.5 (5-7) at NWH resulted from parental responses to this item. No significant differences ($p = 0.36$) were noted between the parental responses from both hospitals.

Item D.4 *I prefer to mix with parents in other parts of NICU (parent lounge/mothers lounge) rather than within the infant rooms.*

Response: Parents scored the above item with similar values of 4 (3-4) at ACH and 4 (2-4) at NWH. No significant differences ($p = 0.61$) were demonstrated between the two groups.

Item D.5 *It can really affect you when other babies in your room are really sick.*

Response: Parents rated this item in the ACH rooms with values of 6 (4-7) compared to 5 (4-7) at NWH. No significant differences ($p = 0.68$) was demonstrated between the two NICU's.

Item D.6 *I prefer to focus on my own baby, not other infants and families in the rooms.*

The final item was rated similarly in both sites with values of 6 (4-7) at ACH and 6 (5-7) at NWH. No significant differences ($p = 0.34$) existed between the two groups.

Table 4.6 Parental Perceptions of Dimension D: Other Families

Item	Auckland City Hospital n = 30		National Women's Hospital N = 30		P value
	Median Score	Inter quartile range	Median Score	Inter quartile range	
D.1 Other contact helpful	4	4-5	5	4-6	0.29
D.2 Worry about confidentiality	3	3-4	3.5	2-6	0.99
D.3 Felt less alone	5	5-6	5.5	5-7	0.36
D.4 Prefer to mix in other parts of NICU	4	3-4	4	2-4	0.61
D.5 Affected when other infants sick	6	4-7	5	4-7	0.68
D.6 Prefer to focus on own infant	6	4-7	6	5-7	0.34

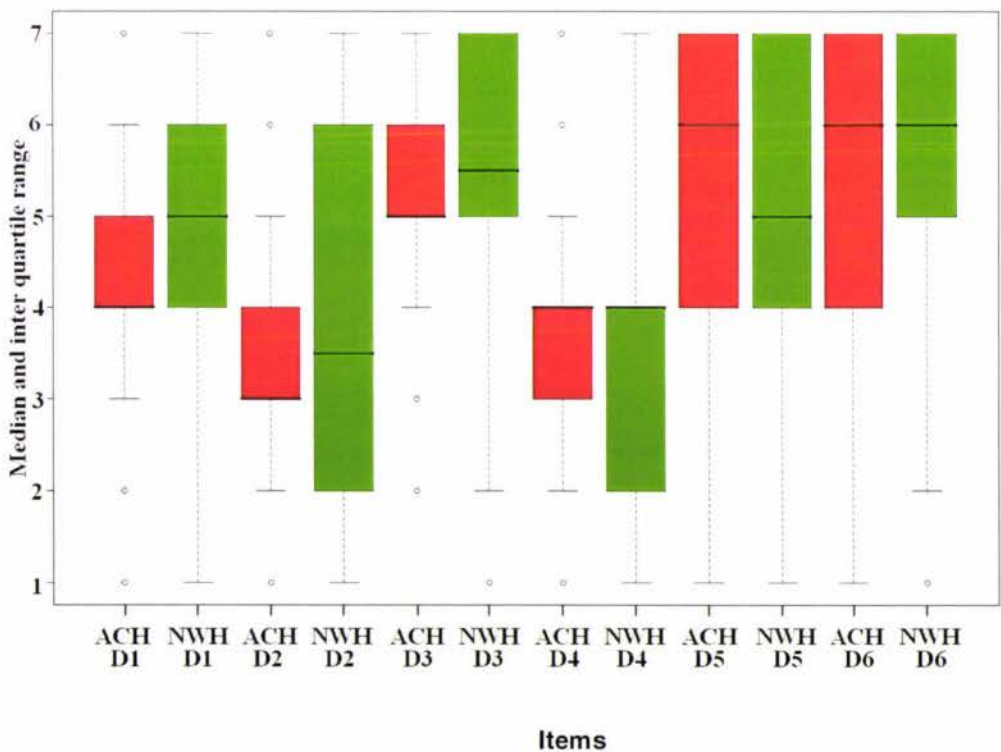


Figure 4.4. Median values, interquartile ranges, true ranges and outliers (o) from ACH and NWH parental perceptions to Dimension D

4.3.5 Subgroup Analysis

Presented below are the results of the Kruskal-Wallis test (Peat, 2001) that compared selected important variables with the parental responses from items on the rating scale. Table 4.7 provides a summary of the subgroup analysis.

4.3.5.1 Gender Influences

There were no significant differences in maternal and paternal responses at the 5% significance level. There was a trend towards significance with mothers rating one item, *"first sight of NICU can be shocking"*, higher than fathers ($p = 0.08$).

4.3.5.2 Preadmission Tour

There were no significant differences demonstrated in any of the responses between those parents that had experienced a tour and those who had not ($p = 0.10$).

4.3.5.3 Previous Infant in NICU

There were no significant differences at the 5% level. However parents who had a previous infant in NICU rated the item, *worry about confidentiality*, higher compared to parents who had not ($p = 0.07$).

4.3.5.4 Levels of Care

Between hospitals

The subgroup analysis on differences between Level 3 infant rooms at ACH and NWH showed that ACH parents in Level 3 rated the item, *uninterrupted moments with infant*, higher than Level 3 parents at NWH, although significance was not reached ($p = 0.06$). Furthermore, the Level 3 rooms at ACH were rated significantly quieter ($p = 0.04$) compared to Level 3 at NWH.

On comparison of Level 2 rooms between ACH and NWH hospitals, there were no significant results shown at a 5 % level. There was a trend towards a significant result ($p = 0.06$) when NWH parents in Level 2 rooms scored the item, *worry about confidentiality*, higher than ACH parents in Level 2 rooms.

Within hospitals

There were two significant differences shown between Level 3 and Level 2 care at ACH. A significant result ($p = 0.038$) was identified on the item: *prefer to mix else where in NICU*. Values for this item were rated higher by parents in the ACH Level 3 rooms compared to parents in the Level 2 rooms. There was a further significant difference ($p = 0.005$) in responses to the item: *it can really affect you when other babies in your room are really sick*. Parents in Level 3 rooms rated this item higher compared to the parents in Level 2 rooms. There was a trend towards a significant result ($p = 0.08$) on the item: *the area around my baby's incubator (or cot) has become 'our family space' within the NICU room*. Parents in Level 3 scored this item higher than Level 2 parents at the ACH NICU. There were no significant differences between levels of care on any item at NWH.

4.3.5.5 Time of Completion of Questionnaire

Parents completed the questionnaire at different times in their NICU experience. In order to determine whether parental responses are different at different stages, seven time periods were selected and analysed.

When the item, *the sound of monitors alarming in the infant rooms is stressful*, was analysed it demonstrated a trend towards significance ($p = 0.09$) with median values highest during the initial periods of stay and lowest in latter periods. There was also a trend towards a significant result ($p = 0.09$) on the item: *at first the appearance of the infant rooms is shocking for parents*. Highest medians were evident in the initial period in NICU compared to the latter period of hospitalisation.

Table 4.7 Summary of Results from Subgroup Analysis

Subgroup	Item	Result	P value
1	Gender	A.5 <i>First sight of NICU shocking</i>	Maternal values higher than paternal 0.08
2	Preadmission Tour		No significant items N/S
3	Previous Infant in NICU/SCBU	D.2 <i>Worry about confidentiality</i>	Rated higher by parents 0.07
4	Levels of Care Between Hospitals		
(a)	Level 3 ACH/ NWH	B.6 <i>Uninterrupted moments with infant</i> C.2 <i>Rooms quiet</i>	Rated higher by ACH parents Rated higher by ACH parents 0.06 0.04*
(b)	Level 2 ACH/ NWH	D.2 <i>Worry about confidentiality</i>	Rated higher by NWH parents 0.06
(c)	<u>Within Hospitals</u> ACH Level 3/2	D.4 <i>Prefer to mix elsewhere</i> D.5 <i>Affected by other sick babies</i> B.3 <i>Family space</i>	Values higher in Level 3 Values higher in Level 3 Values higher in Level 3 0.038* 0.005* 0.08
(d)	NWH Level 3/2		No significant items N/S
5	Time of completion of questionnaire	C.7 <i>Monitors alarming stressful</i> A.5 <i>First sight of NICU shocking</i>	Values higher in initial hospitalisation than in later periods Values higher in initial hospitalisation than in latter periods 0.09 0.09

Note. NICU= Neonatal Intensive Care; SCBU= Special Care Baby Unit.

* p < 0 .05. N/S = Not significant.

4.4 Responses to Open-ended Questions

Parents were asked to comment at the end of the survey about the NICU rooms and make suggestions for improvements. Twenty-six ACH parents (86%) and 25 NWH (83%) parents provided comments. Four themes emerged from the thematic analysis described in Chapter Three. The themes (in brackets) were given the following 'in vivo' labels. "*Need for space*" (More space), "*The rooms are great*" (Feeling good about the space), "*Ability to gain privacy*" (Privacy) and "*Bug wise*" (Protective space). The themes are described below with some examples of parental comments and a short description of the respondent provided in brackets. The significance of the findings are discussed in Chapter Five.

4.4.1 "Need for space"

More space emerged as a theme within parental comments from the old NWH NICU. Most parents consistently described deficiencies in space at the cot side. Many parents explicitly stated:

More space needed.

(NWH, father)

More space around the cot.

(NWH, mother)

Make spaces bigger.

(NWH, mother)

More space between cots.

(NWH, mother)

Amount of space around the incubator could be bigger.

(NWH, father)

A few mothers described the effect that lack of space had on them. As one mother stated, she wanted:

More space so when mums are wheeled in on a bed we don't have to feel rushed out because we take up too much space.

(NWH, mother)

Lack of room even led to feelings of resentment between mothers as illustrated by this comment:

When my baby was dying and needed lots of machinery and equipment the other mothers resented the amount of space we took up in the room.

(NWH, mother)

Benefits of added space at the cot-side were described by a few mothers in relation to quality of family contact. For example:

Bigger spaces would allow parents to spend quality time with their infants.

(NWH, mother)

More space around the cots would make the 'family interaction' more comfortable.

(NWH, mother)

Some parents also commented on the lack of room for cot-side seating at NWH NICU. For example:

A designated chair at each space.

(NWH, mother)

Room for recliners at every space.

(NWH, father)

Furthermore mothers described the need for storage facilities at the cot side. Mothers stated they wanted:

Provision for parents to store personal items.

(NWH, mother)

Some sort of space for you to put things in especially when expressing.

(NWH, mother)

Use of a cupboard to keep personal items in.

(NWH, mother)

4.4.2 “The rooms are great”

Feeling good about the space was the predominant theme from the ACH participants. Parents commented positively on the aesthetic nature or feel of the ACH infant rooms. Such descriptions included:

I thought the rooms were very lovely.

(ACH, father)

The rooms are bright.

(ACH, mother)

The rooms are big and bright with beautiful wording which made me smile.

(NWH, mother)

For another mother natural light and views to the exterior were pleasing as:

Windows that open into the street are less claustrophobic.

(ACH, mother)

Parents described the layout of the infant rooms as useful and carefully planned. In support of this parents said:

I thought a lot of planning and attention to detail has gone in to the planning and a well thought out use of space.

(ACH, mother)

The rooms were practical and well laid out.

(ACH, father)

One exception, however, to the positive comments about NICU at ACH became apparent. Several parents experienced uncomfortable seating at ACH and suggested:

Better chairs for Kangaroo cuddles would make a big difference.

(ACH, mother)

More comfortable chairs for the mothers.

(ACH, mother)

Good comfortable seating for both parents for the long periods of being at the bedside.
(ACH, father)

4.4.3 “Ability to gain privacy”

Privacy was a recurrent theme expressed by parents in both ACH and NWH NICUs. NWH mothers experienced privacy intrusions described as:

While I was breast feeding and trying to bond with my baby a five year old was staring and I had to tell him to go away.
(NWH, mother)

Curiosity of other baby’s visitors.
(NWH, mother)

Parents also commented that privacy was necessary for confidentiality, special moments with their infant and intimate times.

Where a doctor can relay personal information.
(ACH, father)

Privacy to have special times with my baby.
(NWH, mother)

Space to express milk in private with my baby.
(ACH, mother)

Both ACH and NWH parents described strategies for added privacy within the NICU rooms: For instance:

Draw a curtain to close off for certain times.
(NWH, mother)

More privacy screens available if required.
(ACH, father)

Movable partitions to make cubicle like spaces around your baby.
(NWH, mother)

Some sort of partition.
(ACH, father)

Potential to screen off cot temporarily.
(NWH, mother)

Another suggested strategy described solely by NWH parents to enhance privacy, related to the number of infants and families in the rooms.

If more than 2 families are in the room –it's a bit uncomfortable.

(NWH, father)

Keep the cot spaces to 4 per room.

(NWH, mother)

For some parents privacy interrelated with the theme “Need for more space” illustrated by:

More room for privacy at the bedside for your family when your baby is really sick.

(NWH, mother)

Make spaces bigger and place furniture in a place to allow for maximum privacy.

(NWH, father)

4.4.4 “Bug Wise”

A further theme of *Protective space* transpired within the comments from both ACH and NWH parents. Parents described a desire for their infants to be insulated from potential infections from other children. Some parents explicitly stated:

No other children in the rooms-you do not know what they have got bug wise.

(ACH, mother)

Yes I was upset by other families visiting even though they clearly have colds.

(NWH, mother)

I was a bit unimpressed with young kids being in NICU with coughs and colds.

(ACH, father)

One parent commented on the role of the nurse as a custodian, highlighting:

The nurses are not wardens and I know they are limited by how much force they can use.

(ACH, father)

4.5 Summary

Chapter Four has outlined the results of the questionnaire that explored parental perceptions of the physical environment of two NICUs. The characteristics of the ACH and NWH parents and infants have been described with no significant differences between the two groups. Results from the rating scale found four significant differences between the ACH and NWH infant rooms. ACH parents perceived the space at the cot-side was more adequate ($p = 0.001$), lighting levels more comfortable ($p = 0.002$), the cot-side quieter ($p = 0.02$) and technology less intrusive ($p = 0.03$), compared to parents at NWH. The analysis of variables (subgroups) showed a number of significant findings and trends towards significance. Four themes emerged from the parental responses to the open-ended questions: *More space*, *Feeling good about the space*, *Privacy and Protective space*. The following chapter discusses all the findings from the results and identified themes in relation to the research questions, the literature review and clinical practice.

5.0 Chapter Five: Discussion

This chapter discusses in detail results of the research questionnaire that explored parental perceptions of the physical environments at ACH and NWH NICUs. All results from the rating scale and relevant parental responses to open-ended questions are examined in relation to the research questions and the literature review. Results are reported under the four dimensions of the rating scale on which parents were asked to rate their reactions (1= strongly disagree to 7 = strongly agree) to 20 items. Findings from the open-ended questions are summarised and presented in a schematic model (Figure, 5.1). Finally, strengths and limitations of the study are outlined.

5.1 Dimension A: First Impressions

Analysis of the first item (A.1) revealed that only one third of parents had an opportunity to tour the NICU prior to their infant's birth at both ACH and NWH (Table 4.3). This result suggests that unplanned delivery and maternal illness preclude preadmission tours as a previous study by Griffin et al. (2003) found.

Previous research has shown that preadmission tours of NICU are helpful for parents (Griffin et al., 2003; Raeside, 1997). The current study confirms this finding with ACH and NWH parents expressing moderate agreement that the tour was helpful (Table 4.3 & Figure 4.1, Item A.2). The result is further strengthened by lower values on the next item (A.3), that nothing can prepare parents for the first sight of NICU (Table 4.3 & Figure 4.2, Item A.3). However, this item provoked a wide range of responses. These results need to be interpreted with caution as the preadmission tour sample was small (n = 10 at ACH and n =11 at NWH) and uncharacteristic findings can result from small samples (Polit & Beck, 2004). However, given that the preadmission tour was helpful and not always possible, alternative ways of preparing parents such as using computerised visual aids, require consideration.

First impressions of highly technological environments are said to be powerful images (Gordin & Johnson, 1999). In this study parents agreed that the first sight of NICU was as

expected (Table 4.3 & Figure 4.1, Item A.4). This supports suggestions by Miles et al. (1991) that due to increased media and television exposure of intensive care environments, people may become desensitised to such environments. However, there was a trend towards a significant difference in this item between the two NICUs ($p = 0.05$). NWH parents expressed greater agreement that the first sight of the old NICU was as expected. Perhaps the typical portrayal of a standard NICU as a cramped, equipment filled, noisy environment fits with descriptions of many present day NICUs (Lupton & Fenwick, 2001; Smith, 1994; White & Newbold, 1995). Alternatively, the quieter and roomy ACH NICU may have been unlike the expected image of a NICU.

Earlier studies have suggested that the first sight of NICU can be shocking for parents (Brady-Fryer, 1994; Padden & Glenn, 1992; Wereszczak, et al., 1997). However, the findings of this study differs as the first sight of NICU was not shocking for parents at ACH or NWH (Table 4.3 & Figure 4.1, Item A.5). There was also no difference in parental responses between the two NICUs. Middle scores on this item could imply a neutral response, however, a range of responses (2-6 at ACH & 3-5.5 at NWH) were evident, confirming that parental responses were varied. Parents not shocked by the first sight of NICU, is further supported by the result from the previous item, where parents rated the first impressions as expected (Table 4.3 & Figure 4.1, Items A.4 & A.5).

The results regarding first impressions of NICU may have been influenced by the duration of NICU stay and when during the stay parents completed the questionnaire. Parent's who completed the study questionnaire in the early part of their NICU stay, perceived first impressions of NICU as "more shocking" compared to parents from latter periods (Table 4.7, Subgroup 5, item A.5). Parental recall of early experiences of NICU maybe modified with time as reported in previous studies (Affonso et al., 1992; Miles et al., 1992).

Mothers reported to be more shocked at the first sight of NICU than fathers (Table 4.7, Subgroup 1, Item A.5). This could indicate that to some extent fathers are more comfortable with technology and are less stressed by the sight and sounds of NICU

(Lindquist & Jakobsson, 2003; Miles et al., 1992; Perehudoff, 1990; Shields-Poe & Pinelli, 1997).

The preadmission tour did not appear to influence parental responses to other items on first impressions of NICU. There was no difference in responses from parents who had received a preadmission tour on whether the NICU was as expected (A.4) or shocking (A.5), as compared to parents who had not (Table 4.7, Subgroup 2). As previously mentioned, the preadmission tour sample was small, and a larger study may be required to confirm these findings.

5.2 Dimension B: You and Your Baby

Provision of added space at the cot-side was central to the changes of the physical environment at ACH. Parents at ACH strongly agreed that the space at the cot-side was adequate in contrast to the lower scores and disagreement by parents at NWH (Table 4.4 & Figure 4.2, Item B.1). It could be argued that NICU parents are too intent on focusing on their infant to notice spatial issues. Nevertheless, in this study parents were aware of the amount of space at the cot-side. These results are important as a lack of space is perceived as a barrier to parents attaining their parental role in NICU (Dobbins et al., 1994). The impacts of space allocation at the cot-side are not just isolated to this item (B.1), with further influences apparent within the other items and parental responses to the open-ended questions.

More space was a key theme from the parental responses to the open-ended questions at NWH NICU (Chapter Four, p. 66). Most comments from NWH parents reflected the many deficiencies in space. Also included were references to the potential for enhanced quality of infant and family interaction with a roomy cot-side. For example “*More space around the cots would make ‘family interaction’ more comfortable*” and “*Bigger spaces would allow parents to spend quality time with their infants*” (Chapter Four, p. 67).

Parents in this study disagreed that they tried to make the cot-side homelike (Table 4.4 & Figure 4.2, Item B.2), contrasting with the advice of NICU redesign proponents (Johnson

et al., 2004; Philbin, 2004). There was also no difference in parental responses between the NICUs. There could be a number of possible explanations for this result. Home could be seen as a special place, not like NICU at all. Alternatively, for some parents of very premature or sick infants the preparation of the nursery at home may not have occurred. Despite this result, many parents are observed to decorate the incubator and cot spaces with items from home and the intended infant's nursery. A differently worded item may have yielded different results, and more research is warranted to elucidate whether making the cot-side homelike is supportive for parents.

It is argued by White (2004) that added space and attention to room configuration provides a more defined family space that may promote longer stays at the cot-side by parents. In this study parents agreed that the area around the incubator or cot was a family space at both ACH and NWH. However, there was a trend toward a significant difference ($p = 0.08$) between the two units, with lower values reported at the NWH (Table 4.4 & Figure 4.2, Item B.3). Additionally, ACH parents perceived their family space larger in the roomy two bedded Level 3 rooms, compared to parents in the four bedded ACH Level 2 rooms (Table 4.7, Subgroup 4 (c), Item B.3). These results are encouraging and imply that increased space and fewer infants in rooms at ACH positively influenced the perception of family space at the cot-side.

White (2004) also implied that with increased space at the cot-side and the creation of a more defined family zone, parents feel a greater sense of belonging in NICU. Parents in this study did not agree that it was difficult to feel a sense of belonging at ACH or NWH (Table 4.4 & Figure 4.2, Item B.4), with no significant difference between the two units. This is not surprising as a sense of belonging is a broad concept not just related to the physical environment. Other influences such as parental emotional state and social interactions, particularly with health care professionals, may have influenced the parent's responses (Brady-Fryer, 1994).

Added space at the cot-side is now recommended to allow for privacy for infants and parents (White, 2006). Parents perceived private moments with infants as achievable in both NICUs, evident by the high scores (Table 4.4 & Figure 4.2, Item B.5). It was

striking to find no significant difference given the identified lack of space at NWH coupled with parents rating adequacy of space significantly greater at ACH. This may point to privacy being a spatial as well as a psychological concept (Rawnsley, 1980).

Although the rating scale result indicated that privacy was not an issue, the responses from parents to the open-ended questions were at odds with this finding with *Privacy* emerging as a theme. Privacy intrusions were described in the parental responses from both ACH and NWH NICUs that were similar to previous qualitative research findings (Brady-Fryer, 1994; Hurst, 2001). Mothers revealed a lack of privacy for intimate functions. Maternal accounts included: "*Space to express milk in private*" and "*While I was breastfeeding...a five year old was staring*" (Chapter Four, p. 69). Comments such as these concur with Nygqvist et al.'s (1994) study where mothers also indicated a need for privacy during breastfeeding and expressing breast milk.

Parental suggestions from both ACH and NWH parents also showed the need for temporary privacy that could be created by screens and curtains. For example "*Draw a curtain to close off for certain times*" and "*More privacy screens available if required*" (Chapter Four; p. 69). It is possible that with the increased space and less infants in clinical rooms at ACH, nurses felt that parents had less need for the available mobile screens. In particular, the parental comments around privacy support Curtin's (1992) and Ulrich's (1997) views that an individual's control over their levels of privacy is essential.

A few NWH parents did see the relationship between room configuration and lack of space compromising their privacy. They said "*More room for privacy at the bedside...*" and "*Make spaces bigger and place furniture in a place to allow for maximum privacy*" (Chapter Four, p. 70). These views are supported by current NICU design tenets (White, 2004). Overall given these conflicting results and the multifaceted and complex nature of privacy, additional items on this concept in the questionnaire may have further elucidated privacy for NICU parents.

Associated with privacy are how parents achieve intimacy with their infants in NICU and how the physical environment can best support this. There was strong agreement from

parents that uninterrupted times enhanced closeness to their infant in both NICUs. The high scores with small interquartile ranges reflect the consistency of the parental opinion (Table 4.4 & Figure 4.2, Item B.6). While there was no overall difference between the two NICUs, further analysis revealed that undisturbed moments scored higher in Level 3 rooms at ACH compared to Level 3 at NWH (Table 4.7, Subgroup 4 (a), Item B.6). One possible explanation for this is that it may have been more difficult for parents in the crowded NWH NICU to have uninterrupted times. While the subgroup sample is small ($n = 15$ at both ACH & NWH), this result alludes to further influences of increased space and fewer infants in clinical rooms. Another explanation for this result is that the Level 3 rooms at ACH are quieter as discussed in the next dimension.

The result that uninterrupted parent-infant times enhanced closeness is important as intimacy has not been explicitly explored in NICU. Within family-centred care literature, nurse–parent communication and information sharing are emphasised (Cox & Bialoskurski, 2001). While nurses may feel that their role is to constantly interact with parents, this study suggests that moments alone with infants are also essential.

5.3 Dimension C: Sights and Sounds of NICU

There were notable changes to lighting in the ACH infant rooms based on NICU design recommendations (White, 2006). For example no fluorescent lighting, multiple lighting options for infant, parent and staff that were dimmable and softened lights on the walls. This study found that the lighting levels at ACH were perceived to be significantly more comfortable for parents compared to NWH (Table 4.5 & Figure 4.3, Item C.1). Lighting may have also contributed to a pleasant aesthetic feel of the ACH NICU, discussed within the responses to the open-ended questions (Chapter Four, p. 68). This result is unique, as parental lighting needs have not been considered within previous research and points to a further positive influence of the NICU design changes at the new ACH facility.

Historically, intensive care settings including NICU are known to be noisy (Kahn et al., 1998; Levy et al., 2003). Parents strongly agreed that the area around the cot-space was

quieter at ACH than at NWH (Table 4.5 & Figure 4.3, Item C.2). Furthermore, ACH parents found Level 3 rooms were significantly quieter compared to the NWH Level 3 rooms (Table 4.7, Subgroup 4 (a), Item C.2). With no changes in technology and few changes in personnel in the new unit, it seems that increases in space at the cot-side at ACH and fewer infants in rooms had a positive impact on reducing sound levels. Another contributor may have been the acoustic ceiling tiles and also the softened lighting. This result supports the notion that sound levels may reduce within such environments (Kellman, 2002; Philbin, 2004).

Although parents found ACH a quieter NICU, it was surprising that they then disagreed that the sound levels were too high in both units (Table 4.5 & Figure 4.3, Item C.3). With no difference between the NICUs, this may indicate that sound levels are not of concern to parents. Further research, however, is required before any conclusions can be drawn given that the physiological effects of unwanted noise include hypertension, headaches and mental fatigue (Kahn et al., 1998; Venolia, 1998). Furthermore, noisy NICU rooms may impact on communication at the cot-side (Thomas & Martin, 2000).

Technology is a significant physical feature within the environment of NICU rooms with monitoring equipment said to have the greatest impact on parents (Jamsa & Jamsa, 1998; Miles et al., 1991, 1992; Raeside, 1997). In this study monitors were seen as reassuring by parents as Affonso et al. (1992) and Lindquist and Jakobsson (2003) have also shown. Parents rated strong agreement to this item in both NICUs as evidenced by the high median values and small interquartile ranges (Table 4.5 & Figure 4.3, Item C.4). This finding supports Gordin and Johnson's (1999) notions that modern day health care consumers may even 'expect technology'; therefore it is not surprising that monitors were seen as reassuring by parents.

Parents reported that monitors frequently alarm in both the NICUs with no difference between ACH and NWH (Table 4.5 & Figure 4.3, Item C.5). The finding is in agreement with Miles et al. (1991) and Jamsa and Jamsa (1998) studies, where parents also reported that monitors alarm constantly in NICU. This appears to refute claims that added space and fewer infants in rooms may moderate and reduce the frequency of alarms (Kellman,

2002; Philbin, 2004). It was not surprising to find that monitors alarmed frequently even at ACH. For safety reasons, when a nurse is absent from a clinical room, monitor alarms are diverted to adjacent rooms. This then contributes to the frequency of alarms in those other rooms. Whilst it is possible to reduce the intrusion of alarms using technology such as vibrating pagers and or greater use of visual signals (for example flashing lights), these technologies are not yet in use in the ACH NICU.

Parents reported monitors alarming as stressful but the median values (median 3.5 at ACH & median 4 at NWH) imply low levels of parental stress from alarms (Table 4.5 & Figure 4.3 Item C.7). There was no significant difference between ACH and NWH. Previously published parental stress studies have consistently found low to moderate stress from monitors alarming (Miles et al., 1991, 1992; Raeside, 1997). This result may have been influenced by the point during their infants' hospitalisation parents completed the questionnaire. Further analysis showed that parents perceived alarms as more stressful at first and in the medium term rather than in the later periods of hospitalisation (Table 4.7, Subgroup 5, Item C.7), suggesting that parents acclimatise to monitors alarming. While previous research has identified different stressors at various stages of the NICU experience, monitors' alarming has been shown as a consistent stressor over time (Affonso et al., 1992; Miles et al., 1992). The most likely explanation is that in the later stages of hospitalisation, with the improvement in the infants' physiological status monitoring of most infants is lessened, thereby influencing the results on this item.

Overall, it seems that while monitors alarm frequently and are somewhat stressful for parents, they are also comforting. This is an important finding as new innovations in monitor technology now include silent alarm messages via a paging system. The results from this study show that it is also important for NICU parents to be alerted to changes in their infant's physiological condition. Therefore, future technological developments need to centre on visual indicators of infant instability, as well as quieter audible warnings.

The mere presence of technology can have an impact on the physical spaces within NICU rooms. NWH parents disagreed that equipment was "hardly noticeable". Conversely, ACH parents perceived equipment significantly less noticeable, although the responses

did vary (Table 4.5 & Figure 4.3, Item C.6). This was an interesting finding as the bedside management system of the new ACH unit, particularly in Level 3, is rather large. It is, however, a more efficient system for containing equipment with fewer wires and cables draping between NICU beds and therefore technology was less noticeable to parents. It also provides greater flexibility especially for parental activities, such as taking their infant out of the incubator for cuddles and skin-to-skin care. Another possible explanation for this result is that added space may have given technology a less intrusive feel within the rooms. Parents noticing the presence of technology could be seen to contrast with results from previous parental stress studies where the visual appearance of equipment was not a significant stressor (Miles et al., 1991, 1992). The different result maybe due to increases in technology since these earlier studies (Gordin & Johnson, 1999). Importantly, the values around the presence of technology were low for both hospitals indicating that there is still progress to be made in this area.

While a previous result (Table 4.7, Subgroup 1, Item A.5) indicated that mothers were more shocked at the first sight of NICU, this study found no further gender differences within the sights and sounds dimension. This is in contrast to prior studies where fathers were reported to be less stressed by the sights and sounds of NICU than mothers (Miles et al., 1992; Perehudoff, 1990; Shields-Poe & Pinelli, 1997). Given the small sample ($n=10$ at ACH & $n=9$ at NWH) and father's in NICU having been rarely studied, additional research is necessary to reveal fathers' reactions to technology in NICU more fully.

5.4 Dimension D: Other Families

The presence of other families, particularly in crowded infant rooms, has highlighted the potential for information being overheard in NICU and consequently breeches in confidentiality. In this study parents from both NICUs disagreed that confidentiality was concerning within the rooms. Overall there was no difference shown between ACH and the more crowded NWH, although responses did vary widely in the NWH sample (Table 4.6 & Figure 4.4, Item D.2). The result is supported in part by other studies (Bramwell & Weindling, 2005; Kowalski et al., 2003) where only one fifth to half of parents thought confidentiality was important during ward rounds, a well known time when breeches can

occur (Rylance, 1999). However, in the context of this study, confidentiality included reference to informal conversations between health professionals, as well as the more formal discussions during ward rounds.

Parents' lack of concern about confidentiality is further supported by Fenwick et al.'s (2001) qualitative exploration where mothers seemed unconcerned by breeches of confidentiality. It may be that the need for confidentiality is undermined with the many other priorities parents of sick premature infants face during their time in NICU.

It was interesting to find that parents who had a previous infant in NICU were more worried about confidentiality than parents who had not (Table 4.7, Subgroup 3, Item D.2). Perhaps during their previous experience of NICU, parents became aware of the potential for information about themselves or their baby being overheard. On further comparison, parents in the NWH Level 2 rooms were more concerned about confidentiality than parents in the ACH Level 2 rooms (Table 4.7, Subgroup 4 (b), Item D2). This could imply that with five to six infants in the Level 2 rooms at NWH compared to four infants at ACH with more room around the cot-side, space and configuration of rooms has a part to play in provision of confidentiality. Overall, the differing results around confidentiality indicate the need for further research with possibly retrospective designs proving more beneficial.

It was an important premise within the current study to explore social contact between NICU parents given the concern that they may be more isolated within room configurations with fewer infants. In this study parents agreed that contact with other families was helpful (Table 4.6 & Figure 4.4, Item D.1), although the scores were not high (median 4 at ACH and median 5 at NWH). Notably there were no differences between the hospitals and levels of care. Social interaction between parents has been shown to be beneficial by Hurst (2001) and Dobbins et al. (1994). However in other studies (Miles et al., 1996; Ward, 2001) helpfulness of other parents was not rated highly. This current study was unique, as previous research has focused on parental interaction within the entire NICU and on formal support programs (Jarrett, 1996; Jensen, 1999; Lindsay et al., 1993). The next result adds to the finding that contact with other families

is helpful. Parents from both NICUs agreed that sharing a room with other families makes the NICU experience less lonely (Table 4.6 & Figure 4.4, Item D.3).

In contrast to contact in the rooms being helpful, parents agreed that mixing in other parts of NICU such as in the parent and mothers' lounge was preferable (Table 4.6 & Figure 4.4, Item D.4). While parents preferred social contact outside the NICU rooms, the values for this item were not high (Median 4 at ACH and NWH). Importantly, ACH Level 3 parents significantly ($p = 0.038$) preferred to mix outside of the NICU rooms compared to ACH Level 2 parents (Table 4.7, Subgroup 4 (c), Item D4). While the reason for this result is not completely clear, from a design perspective it needs to be considered as the ACH rooms are only two bedded, parents may have needed more opportunity to meet other parents. Lounges are available in the ACH NICU for informal parental contact with coffee mornings also offered by the parent-to-parent support group.

Overall, the above parental responses may have been tempered by perceived disadvantages of other families in infant rooms. *Protective space* emerged as a theme from the parental responses to the open-ended questions from both ACH and NWH. Parents wanted their infants insulated from infections and saw children as potential carriers. Sentiments expressed included: "*I was a bit unimpressed with young kids being in NICU with coughs and colds*" and "*No children in the rooms –you do not know what they have got bug wise*" (Chapter Four, p.70). Understandably NICU parents are anxious about infections, as some premature sick infants are more susceptible, particularly to respiratory infections (Greenough & Milner, 2005). Sibling visiting was unrestricted in both study NICUs, although parents are advised not to bring children with infections to visit. Sibling visiting policies vary in neonatal units. While there are documented advantages of increased family interaction there are also concerns around infection and supervision of children (Meyer, Kennally, Zika-Berres, Cashmore & Oh, 1996). The observation that children in infants' rooms noticeably impacts on parents warrants further investigation.

Clearly parents were strongly affected by other sick infants in rooms (Table 4.6 & Figure 4.4, Item D.5). Support for these results is evident from parental stress research (Miles et

al., 1991) and maternal accounts (Wereszczak et al., 1997). Predictably due to the more critical nature of care, ACH Level 3 parents were significantly more affected by other sick infants than parents in Level 2 (Table 4.7, Subgroup 4 (c). Item D.5). Added to this on the last item, parents strongly agreed that focusing on their own infant was best (Table 4.6 & Figure 4.4, Item D.6). While there was no difference between the two NICUs on either of these items, values were highest within this dimension.

5.5 Model of Change

The themes derived from the parental responses to the open-ended questions are displayed in a schematic model (Figure 5.1) designed to show not only the themes, but also their relationships. As depicted in Figure 5.1, the NWH responses were dominated by a need for *More space*, with poignant descriptions of the impacts of lack of space and many suggestions regarding what added space could offer parents. Importantly, parents stated “*Bigger spaces would allow parents to spend quality time with their infants*” and “*More space around the cots would make family interaction more comfortable*” (Chapter Four, p. 67).

In contrast, at ACH many parents expressed positive thoughts about the new unit, *Feeling good about the space* (Figure 5.1). Parents appreciated the aesthetic qualities as well as the layout of the infant rooms. For example “*I thought the rooms were very lovely*” and “*The rooms are big and bright with beautiful wording which made me smile*” (Chapter Four, p. 68). This was an interesting finding as the questionnaire did not specifically seek information on the aesthetic nature of the units and yet parents clearly noticed this aspect. Such comments also fit with the influence that the physical environment can have on mental and emotional well being (Altimier, 2004; Venolia, 1988) and imply a movement towards a healing environment at ACH.

Despite this, not all environmental issues highlighted by parents were altered by design changes. Uncomfortable seating at the cot side at ACH and NWH was reflected in remarks such as “*Better chairs for Kangaroo cuddles would make a big difference*” and “*More comfortable chairs for mothers*” (Chapter Four, p. 68). Already discussed, some

parents still desired further *Privacy* (Figure 5.1), even in the new NICU. And as previously stated parents from both NICUs wanted a *Protective space* shielded from possible infections (Figure 5.1). Interestingly, as with our nursing founder Nightingale (1924), one father saw nurses as protectors of the environment by stating “... *I know they are limited by how much force they can use*” (Chapter Four p. 70).

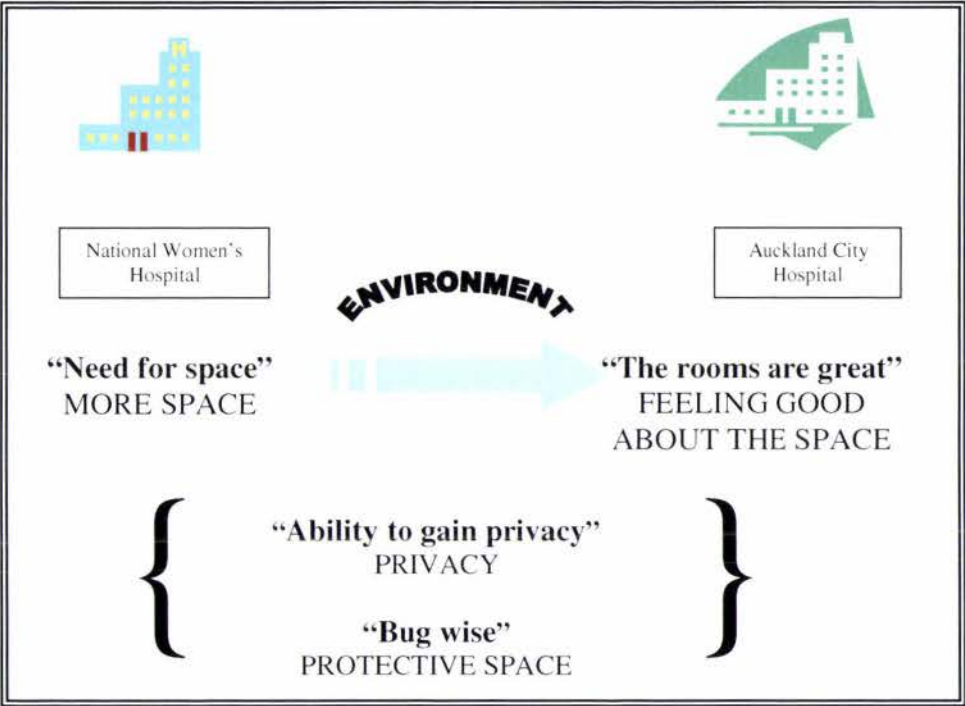


Figure 5.1. A schematic representation showing the relationships between themes from the parental responses to the open-ended questions at ACH and NWH NICUs

5.6 Study Strengths and Limitations

5.6.1 Research Design

The greatest strength of the research was the comparative design of the study that allowed for evaluation of the NICU redesign changes. As relocation and redesign of hospitals and services is rare, and research in this area restrained to a small number of projects, investigating the impacts of design modifications was vital.

5.6.2 Internal Validity

Ensuring that the parental perceptions were solely influenced by the physical environments of the NICUs (internal validity) is a known challenge within redesign research (White, 2004). One of the strengths of the study was the measures undertaken to minimise the actual impact of relocation on parental responses. For example, sampling at NWH was stopped two weeks prior to relocation to ACH. The study sampled a different group of parents at ACH six months later. This time period also allowed staff to adjust to the new unit. Another aspect that enhanced the internal validity of the study was while the physical design of the two NICUs changed, the overall service itself remained unchanged with little to no alteration in clinical management of infants, policies or personnel.

Measures to control and identify other known variables (infants transferred from another NICU, parents who received a preadmission tour, time of completion of questionnaire and previous infant in NICU/SCBU) were instituted within the research design and procedures (Chapter Three, p.50). However, having an infant in NICU is an emotional time and as Spencer and Edwards (2001) suggest, other factors could influence parental responses. While critically ill infants were excluded, it was still possible that the infant's diagnosis and health progress may have prejudiced how parents felt about the NICU rooms. Likewise, relationships with staff may also have influenced parental responses.

A possible limitation was that even though parents were asked on the questionnaire to complete the survey from their own point of view and not consult each other, it is possible that on occasion this may have occurred. In order to keep the questionnaire concise and not tire parents, no socio-economic data was collected. Consequently there could have been pre-existing differences according to parental situational and social factors that could have impacted on the responses.

As previously discussed (Chapter Three, p. 47) the quality of the questionnaire can also affect research results. In particular missing data and an abundance of middle or neutral

scores can lead to difficult interpretation, inaccurate and inconclusive results (Oppenheim, 1992). In this regard, there were positive signs from the newly developed questionnaire, as non-responses to individual items (missing data) within the questionnaire were minimal (1.6% overall) and there were few middle values within the results.

5.6.3 External Validity

Establishing the generalisability (external validity) of the study was limited by the small sample size, particularly the number of parents within the subgroups. Unfortunately fathers made up only one third of the sample and therefore paternal perceptions of the physical environment remain under represented within research. Additionally as the majority of the parental sample were married or partnered the results may not represent views of single parents. The ethnicity of the sample was predominately New Zealand European reflecting the population of parents whose infants are admitted to the ACH and NWH NICUs. The study was also limited to those with a comprehension in written English.

An important strength of the study was the high response rate (83% at ACH & 73% at NWH) to the questionnaire, exceeding recommendations of 60% to 75% (Murphy-Black, 2006; Polit & Beck, 2004). A high response rate lessens the chance of non-response bias, and therefore, it is more reasonable to assume that the results are typical for the population (in this case NICU parents) as a whole (Polit & Beck, 2004).

The overall degree of external validity within the context of NICU design will always be affected by the multiplicity of designs and layouts existing of NICUs. Research consumers need to interpret and apply findings that are relevant for their setting and culture of individual NICUs.

5.7 Summary

In this chapter the results of the rating scale and parental responses to the open-ended questions have been discussed in detail. There were four significant differences between the physical environments of the ACH and NWH infant rooms. Space at the cot-side was more adequate, lighting levels more comfortable, the cot side quieter and technology less intrusive at ACH. The largest difference between the two sites was the amount of space around the infant's cot.

Analysis of the levels of care between and within hospitals revealed a number of significant findings. ACH Level 3 rooms were quieter than NWH Level 3 rooms. The perception of family space at ACH was greater in Level 3 rooms than in Level 2 rooms. Also ACH parents preferred to socialise outside the Level 3 rooms compared to parents in Level 2. Parental responses to the open-ended questions revealed four themes (*More space, Feeling good about the space, Privacy and Protective space*) that apart from *privacy* generally supported the findings from the rating scale.

The final chapter (Chapter Six) provides conclusions of the research findings, with recommendations and implications for nursing practice. In addition, future directions in the design of NICUs are offered in light of the findings from this study.

6.0 Chapter Six: Conclusion

Chapter Six concludes the thesis by reviewing the aims of the research and summarising the key findings. Recommendations are made regarding the future design of NICUs and conclusions drawn on the concept of 'healing by design'. Implications for nursing practice are discussed and areas for further research highlighted.

This thesis has presented a study of parental perceptions of the physical environment of two different NICUs; one a more traditionally styled NICU and the other a new custom built facility. The new NICU incorporated changes to aspects of the physical environment such as space allocation at the cot-side, number of infants in rooms, lighting, sound and aesthetics.

The thesis began with the understanding that the physical environment of many present day NICUs is challenging for parents. As a family-centred approach should be the fundamental care philosophy in NICU, it is now the responsibility of providers of neonatal care to consider the environmental concerns of parents. It is known from the literature (Chapter Two) that parents are affected by the NICU physical environment with frequent reports of low to moderate levels of stress largely from visual and auditory sources. However, more important for parents was attainment of their parenting role by interaction with their infants.

The literature from medical, nursing and architectural disciplines (Chapter Two) proposed that the physical environment can be adapted as a healing tool for patients and families. New directions for NICU design now highlight the potential to lessen parental stress and optimise parenting. One key suggestion for the current design of NICU rooms is that parents have added space at the cot-side for increased privacy, confidentiality and sense of belonging. This non-experimental comparative descriptive study 'Changing Rooms in NICU' is the result of an opportunity to investigate added space at the infant cot-side, along with other current design notions.

6.1 Review of the Research Aim and Objectives

The overall **aim** of the study was to describe and compare parental perceptions of the physical environment of the infant rooms of two NICUs. Additionally insights into the effectiveness of changes in room design in the new facility were sought.

The specific **objectives** of the study were to:

1. Describe parental perceptions of the physical environment within the infant rooms at NWH and ACH NICUs. This was addressed with information from the rating scale and open-ended questions providing descriptions that were either unique, or that supported or were contrary to existing research.
2. Compare differences in parental perceptions between the physical environment of the original NICU at NWH and the redesigned NICU at ACH. Contrasts between the two NICUs were made and in this case both the significant and non- significant results led to reflections on the effectiveness of the design changes.

6.2 Overview of Results

This study found a number of significant differences between the old facility (NWH) and the newly designed NICU (ACH). It was evident from the findings that significant differences were related to more tangible aspects of the physical environment. Hence adequacy of space, a quieter cot-side, more comfortable lighting and less intrusive equipment were confirmed positive changes in the new NICU.

Clearly parents noted the increase in space at the cot-side in the new unit. It would be important to explore whether this added space enhances family interaction as suggested by parents. Furthermore, there were encouraging signs that additional space was crucial in influencing other positive changes. For instance, the reduction in sound levels, an inclination of more defined family space, and equipment being less noticeable. Therefore, arising from this study, space allocation is a key caveat to supportive design for parents in

NICU clinical rooms. These findings may also support justifying the cost of added space in infant rooms.

The amount of space per cot-side at the new NICU was within current recommended standards, with the exception of the Level 2 rooms which were only marginally smaller than the suggested sizing. The positive findings related to additional cot-side space were, therefore, in agreement with the American Standards for Newborn Design (White, 2006) on space allocation.

Parents were not directly asked about their preference regarding the number of infants in the clinical rooms. However, there were some indications that the two bedded rooms at ACH were quieter, family space was considered to be greater with increased opportunity for uninterrupted moments with infants. It was difficult to distinguish whether these results were due to the extra space or the reduced number of infants in rooms. Currently it is unclear how best to configure rooms for all the participants in NICU (White, 2003). However, this study has shown that fewer infants in clinical rooms did contribute to the positive benefits for parents.

Significant changes between the two NICUs were mainly related to auditory or visual components of the environment. For example, in the ACH rooms sound and lighting levels were more comfortable for parents. Despite these findings, results suggest that further improvements in sights and sounds of NICU are required. Although monitors were seen as reassuring, no changes were shown in the frequency and stressfulness of monitors alarming within the two different designs. Equipment was less noticeable in the new NICU but still appears to be a dominating physical feature as noted by parents.

Familiarisation with intensive care environments may be occurring with parents reportedly not shocked at the first sight of NICU. There was indication that some parents, in particular mothers, may have been disturbed by initial impressions in the early part of their NICU experience. As a result, preparing parents for the first visit to NICU still

remains necessary. Preadmission tours were found to be beneficial, but notably for many parents the tour was not possible due to the unexpected nature of preterm deliveries.

Impacts of design changes on intangible and more complex psychosocial aspects such as privacy, confidentiality and sense of belonging were harder to establish statistically. However, analysis of subgroups and parental comments imply that a complete picture of these concepts was not evident. It is possible that different research methodologies and methods could reveal a fuller account. A phenomenological approach with interviews, useful for in-depth understanding of the complexities of human experience (Carpenter, 2003; Polit & Beck, 2004) may well reveal further information. Moreover the discussion around these concepts within NICU rooms has only just begun.

Social interaction between parents within the infant rooms was helpful and made the NICU experience less lonely. This needs to be balanced against parents being strongly affected by seeing other sick infants in the NICU rooms. Parents also clearly desired moments alone with their infants. How this can be achieved in over crowded multi-bedded NICU rooms seems challenging and further supports NICU design suggestions of reducing numbers of infants in clinical rooms (White, 2003). There was no overall significant evidence that pointed to isolation from social contact for parents at the new ACH NICU. However, it cannot be completely discounted as a small group of parents in the two bedded ACH rooms, did prefer to socialise outside the infant rooms and may have needed more opportunity to mix with other parents.

6.2.1 Hypothesis

Given the significant differences in parental perceptions between the physical environments of ACH and NWH NICUs the null hypothesis was rejected. The alternative hypothesis that there was a significant relationship between changes in the physical environment and parental perceptions was accepted.

6.2.2 Healing by Design

Rebuilding or remodelling a NICU is an opportunity to enhance healing within a known challenging physical environment. Elements of healing by design were evident within the findings of the current research with some encouraging signs of a movement towards a healing environment in the new ACH NICU. For example, quieter clinical rooms with supportive lighting. Added to this there were positive comments from parents on the aesthetics or the 'feel' of the new NICU. Further investigations should focus on directly measuring outcomes of patients or as in this case parental outcomes, from healing environments. This could be achieved by utilising the existing parental stress tool, the Parental Stress Scale: NICU (Miles et al., 1991) or a newly developed instrument for measuring maternal-infant interaction in NICU (Furman & O'Riordan, 2006). Such research may add further evidence that indeed 'healing by design' can positively affect parenting outcomes.

6.3 Recommendations:

Regarding future NICU design and modifications to the physical environment of NICU infant rooms, it is recommended that:

- Neonatal services adopt the current recommended standards (White, 2006) on allocation of space at the infant's cot-side.
- Design projects give careful consideration to the benefits of reduced numbers of infants in clinical rooms.
- Ambient lighting design in NICUs includes multiple options (wall lights, examination lights, cot lights) that are individualised for the cot-space and can be adjusted to provide a range of light intensity from soft to bright lighting where clinically necessary.
- Infant rooms are designed to reduce noise levels by decreasing the number of infants in rooms, with greater space around each cot-side and the use of acoustic ceiling tiles.
- Clinical staff and manufacturers work collaboratively with parents in future development of monitoring systems that are technologically safe and environmentally supportive.
- Neonatal services with single or two bedded room configurations consider further ways of providing parent-to-parent contact.

6.4 Future Research

While this study has made a contribution to evidence based design of NICUs, a number of additional questions arose from the findings that provide guidance for further research.

Recommendations for future research include:

- Examining and comparing parental health outcomes (for example parental stress and parent–infant interactions) from different NICU environments.
- A focus on the impact of room configuration (number of infants in clinical rooms) on infants, parents and staff.
- Utilisation of other research methodologies to extract information on the role of privacy, confidentiality, and sense of belonging for parents within NICU clinical rooms.
- Enrolment of greater numbers of fathers, single parents and parents with extremely premature infants (< 26 weeks gestation).
- Further utilisation and testing of the research questionnaire employed in this study to enhance its validity and reliability.

6.5 Nursing Implications

Nurses, as the most consistent caregiver of parents within the NICU rooms, are in an ideal position to maximise the physical environment for parents. As one mother said *"The nurses make me feel good about the environment"*. This study has revealed aspects of care that can assist the nurse further in this endeavour. It is suggested that nurses:

- Protect uninterrupted times between parents and infants within the safe clinical environment. Skin-to skin contact seems an ideal time for these moments.
- Attend promptly to monitor alarm messages till alternative signalling systems are more widely available.
- Offer and make privacy screens easily accessible especially for breastfeeding, the expression of milk and when infants are critically ill.
- Develop a computerised 'virtual' tour of NICU that could be shown to parents unable to tour NICU prior to the birth of their infant.
- Scrutinise children visiting the NICU rooms with regards to infection.

It is evident that nurses have been active partners with other disciplines in advancing more nurturing environments for infants and families in NICU. Yet some nurses still feel powerless to make change to the macro environment (Williams, 2001). One answer to this is for nurses themselves to research impacts and changes to the physical environment, such as this project. It needs to be acknowledged that the current study could only address parents in NICU; infants and nurses have their own environmental needs. Given that NICU is a stressful place to work (Gibbons et al., 1997) and concern over staff isolation in single room designs, a study of nurses' perceptions of the physical environment of NICU seems most appropriate.

6.6 Concluding Statement

This thesis illustrated that some modifications to the physical environment of a NICU based on new design directions, were viewed positively by parents and therefore were supportive to their needs. Nurses with a background interest in the environment and working within a family-centred care model have much to offer infants and parents in the provision of such environments. Parents' special and irreplaceable role in NICU requires support. This study has shown that the physical environment has an important role to play in providing quality healthcare and improve outcomes for parents in NICU.

Appendices

Appendix A: Questionnaire

Appendix B: Massey University Human Ethics Committee Approval

Appendix C: Auckland Ethics Committees Approval

Appendix D: Auckland District Health Board Approval

Appendix E: Maori Research Review Committee Approval

Appendix F: Information Sheet

Appendix G: Auckland Ethics Committees Amendment

Appendix A: Questionnaire

The Surroundings of NICU A Parental Questionnaire.

- ✦ The questions in this survey are designed to measure how you feel as a parent about the physical surroundings of your baby's cot space and within the NICU infant rooms.
- ✦ Your help would be really appreciated but you do not have to take part. Completion of this questionnaire means you have consented and are willing to be included. You have the right to not answer any particular question that you feel uncomfortable with.
- ✦ Please answer all questions as honestly as possible **Answer the questions from your own point of view**- mothers and fathers may feel differently about these questions.
- ✦ If you are unsure of an answer, please circle or tick what best describes your response rather than leaving the question unanswered.
- ✦ When complete please place this questionnaire in the box provided in the NICU room, or if you prefer, use the stamped addressed envelope to return it by post.

Please do not write your name on this questionnaire

Before we begin....

In what part of NICU was your baby cared for?

If your baby was in level 3 and level 2 - **choose the one where you spent the most time and fill out the questionnaire from that point of view.**

(please tick one box)

- ☐ Level 3 (rooms 1-9)
- ☐ Level 2 (rooms 10- 15)

A. First Impressions...

1. Were you shown around NICU before the birth of your baby?

(Please tick one box)

☐

Yes



Continue to the next question

☐

No



Go straight to question 4

Please circle the number that comes closest to the way you think about the statement.

2. The tour of NICU prepared me for the appearance of the NICU infant rooms.

Strongly
Disagree

1 2 3 4 5 6 7

Strongly
Agree

3. Nothing, even a tour, could have prepared me for the first visit to the NICU infant rooms.

Strongly
Disagree

1 2 3 4 5 6 7

Strongly
Agree

4. My first sight of the NICU rooms was pretty much as I expected.

Strongly
Disagree

1 2 3 4 5 6 7

Strongly
Agree

5. At first, the appearance of the infant rooms in NICU is shocking for parents.

Strongly
Disagree

1 2 3 4 5 6 7

Strongly
Agree

B. You and your baby...

Please circle the number that comes closest to the way you think about the statement.

1. The amount of space around my baby's incubator (or cot) is adequate for me and my family.

Strongly
Disagree

1 2 3 4 5 6 7

Strongly
Agree

2. I try to make the area around my baby's incubator (or cot) sort of like his/her room at home.

Strongly
Disagree

1 2 3 4 5 6 7

Strongly
Agree

3. The area around my baby's incubator (or cot) has become 'our family space' within the NICU room.

Strongly
Disagree

1 2 3 4 5 6 7

Strongly
Agree

4. It's hard for me, as a parent, to feel a sense of belonging in NICU.

Strongly
Disagree

1 2 3 4 5 6 7

Strongly
Agree

5. Even though my baby is in NICU and needs care, I still can have private moments with my baby.

Strongly
Disagree

1 2 3 4 5 6 7

Strongly
Agree

6. Uninterrupted times with my baby help us to feel close.

Strongly
Disagree

1 2 3 4 5 6 7

Strongly
Agree

C. Sights and Sounds of the NICU...

Please circle the number that comes closest to the way you think about the statement.

- | | | | | | | | | | |
|--|-------------------|---|---|---|---|---|---|---|----------------|
| 1. The lighting levels in the NICU rooms are comfortable for me. | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Strongly Agree |
| 2. The area around the incubator (or cot) is a quiet place for me to be with my baby. | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Strongly Agree |
| 3. Overall, the sound levels in the NICU rooms are higher than I would like. | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Strongly Agree |
| 4. The monitors are comforting and reassure me that my baby is doing ok. | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Strongly Agree |
| 5. The monitors constantly alarm in the infant rooms. | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Strongly Agree |
| 6. I hardly notice the machinery and equipment around my baby's cot. | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Strongly Agree |
| 7. The sound of the monitors alarming in the infant room is stressful for me. | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Strongly Agree |
-

D. Other Families...

Please circle the number that comes closest to the way you think about the statement.

- | | | | | | | | | | |
|---|-------------------|---|---|---|---|---|---|---|----------------|
| 1. It's helpful for me to have other babies and their families in the rooms. | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Strongly Agree |
| 2. I worry that other parents and families will overhear personal information about me or my baby. | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Strongly Agree |
| 3. Sharing a room with other babies and their families makes me feel less alone in NICU. | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Strongly Agree |
| 4. I prefer to mix with parents in other parts of NICU (parent lounge/ mothers lounge) rather than within the infant rooms. | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Strongly Agree |
| 5. It can affect you when other babies in your room are really sick. | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Strongly Agree |
| 6. I prefer to focus on my own baby, not other infants and families in the rooms. | Strongly Disagree | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Strongly Agree |
-

E. Final thoughts...

Is there anything you feel you would like to add about this questionnaire or the infant rooms in NICU?

Have you any suggestions for improvements on how NICU rooms and cot-spaces are designed?

F. Now about you ...

Lastly we would like to know a little bit about you and your baby so that we can see how different families feel about the surroundings in NICU. (Please tick one box only).

1. Are you?

- ☐ Male ☐ Female

2. Which age group do you belong in?

- ☐ 18- 29 years
☐ 30 – 36 years
☐ 37 – 45 years
☐ > 45 years

3. How would you describe your current status?

- ☐ Non-partnered
☐ Partnered
☐ Married

4. Which race you mostly identify with?

- ☐ NZ European. ☐ Niuean
☐ NZ Maori ☐ Other Pacific
☐ Samoan ☐ S E Asian
☐ Cook Island ☐ Chinese
☐ Tongan ☐ Indian
☐ Other

5. Have you had a previous baby in a NICU or a special baby care nursery?

- ☐ Yes
☐ No

Please continue →

6. Have you other children?

☐ Yes ☐ No

If Yes please state number of children.

9. How old is your baby now (at time of filling out questionnaire)?

Days

7. What gestation was your baby at birth?

- ☐ < 26 weeks
- ☐ 27 - 32 weeks
- ☐ 33 - 37 weeks
- ☐ > 38 weeks

10. Is or was your baby on a ventilator? (breathing machine).

- ☐ Yes
- ☐ No

8. What birth weight range was your baby in?

- ☐ < 999 grams
- ☐ 1000 – 1499 grams
- ☐ 1500 – 1999 grams
- ☐ 2000 – 2499 grams
- ☐ > 2500 grams

11. Is or was your baby on CPAP?

- ☐ Yes
- ☐ No

Your participation is greatly appreciated



Appendix B: Massey University Human Ethics Approval



Massey University
AUCKLAND

OFFICE OF THE
DEPUTY VICE-CHANCELLOR
Private Bag 102 904
North Shore MSC
Auckland
New Zealand
T: Deputy Vice-Chancellor
64 9 414 0800 extn 9517
Regional Registrar
64 9 414 0800 extn 9516
F: 64 9 414 0814
www.massey.ac.nz

04 March 2004

Robyn Wilkinson
C/o Dr Denise Dignam
School of Health Sciences
Massey University
Albany

Dear Robyn

HUMAN ETHICS APPROVAL APPLICATION – MUAHEC 04/008
"Changing Rooms: parental perceptions of reconfigurations in neonatal intensive care rooms"

Thank you for your application. It has been fully considered, and approved by the Massey University, Albany Campus, Human Ethics Committee to proceed to the Health and Disability Ethics Committee, Auckland.

Could you please forward to us a copy of the letter of response from HDEC, once that committee has considered your application?

If you make any significant departure from the Application as approved then you should return this project to the Human Ethics Committee, Albany Campus, for further consideration and approval.

Yours sincerely

Associate-Professor Kerry Chamberlain
Chairperson,
Human Ethics Committee
Albany Campus

cc: Dr Denise Dignam
School of Health Sciences



Appendix C: Auckland Ethics Committees Approval

Please include the reference no. and study title in all correspondence/telephone calls.

16 April 2004

Ms Robyn C. Wilkinson
C/o School of Health Sciences
Albany Campus
Massey University
PB 102 904
North Shore Mail Centre
Auckland.

Auckland Ethics Committees

Private Bag 92522
Wellington Street
Auckland
Delivery Address:
C/O Ministry of Health
3rd Floor, Unisys Building
650 Great South Road, Penrose
Phone (09) 580 9105
Fax (09) 580 9001
Committee X Email: pat_chaine@mh.govt.nz
~~Committee Y Email: yvonne_erixon@mh.govt.nz~~

Dear Robyn,

AKX/04/03/059 Changing rooms - parental perceptions of reconfigurations in neonatal intensive care rooms: a descriptive comparison study: IS V#2, 01/04/04

Thank you for your amendments, received 8 April 2004.

The above study has been given ethical approval by Auckland Ethics Committee X.

Certification

It is certified as not being conducted principally for the benefit of the manufacturer and may be considered for coverage under ACC.

Accreditation

This Committee is accredited by the Health Research Council and is constituted and operates in accordance with the Operational Standard for Ethics Committees, March 2002.

Documents Approved:

- Information Sheet/Consent Form V#2, 1 April 2004.
- Questionnaire

It should be noted that Ethics Committee approval does not imply any resource commitment or administrative facilitation by any healthcare provider, within whose facility the research is to be carried out. Where applicable, authority for this must be obtained separately from the appropriate manager within the organisation.

Progress Reports

The study is approved until 31 March 2005. Should you require an extension of time, please contact the Ethics Committee.

Please advise the Committee when the study is completed and a final report is also required at the conclusion of the study.

.../2

Accredited by Health Research Council

Requirements for SAE Reporting

Please advise the Committee as soon as possible if there are any serious adverse events which relate to this study.

Amendments

All amendments to the study must be advised to the Committee prior to their implementation, except in the case where immediate implementation is required for reasons of safety. In such cases the Committee must be notified as soon as possible of the change.

Yours sincerely,

A handwritten signature in blue ink, appearing to read 'Pat Chainey', with a stylized flourish at the end.

Pat Chainey
Administrator, Committee X.

Cc: Auckland Research Office

Appendix D: Auckland District Health Board Approval

EA 05/02
Page 18

PART V: DECLARATIONS

Full Project Title: Changing Rooms – parental perceptions of reconfigurations in neonatal intensive care rooms: a descriptive comparison study

1. Declaration by Principal Investigator

The information supplied in this application is, to the best of my knowledge and belief, accurate. I have considered the ethical issues involved in this research and believe that I have adequately addressed them in this application. I understand that if the protocol for this research changes in any way I must inform the Ethics Committee.

NAME OF PRINCIPAL INVESTIGATOR (PLEASE PRINT): ROBYN WILKINSON

DATE:

10/02/04

Robyn Wilkinson

A separate declaration will be required for each multi-centre site, signed by the principal investigator for that site.

2. Declaration by Head of Department in which the Principal Investigator is located or appropriate Dean or other Senior Manager

I have read the application and it is appropriate for this research to be conducted in this department. I give my consent for the application to be forwarded to the Ethics Committee.

NAME AND DESIGNATION (PLEASE PRINT): CARL KUSCHER, CLINICAL DIRECTOR

SIGNATURE:

INSTITUTION: NATIONAL WOMEN'S HOSPITAL

DATE:

4/2/04

DESIGNATION: CLINICAL DIRECTOR, NICU.

- Where the head of department is also one of the investigators, the head of department declaration must be signed by the appropriate Dean, or other senior manager.
- If the application is for a student project, the supervisor should sign here.

3. Declaration by the ADHB Research Manager (if applicable)

This research project will be reviewed for management approval according to the policies of Auckland District Health Board.

Name of Research Manager (Please Print): Dr Candy Pettus

SIGNATURE:

Candace Pettus

INSTITUTION: AUCKLAND DISTRICT HEALTH BOARD

DATE: 4 FEBRUARY 2004

Appendix E: Maori Research Review Committee Approval



27 February 2004

Ms Robyn Clare Wilkinson
Course Co-ordinator
Postgraduate Neonatal Certificate in Nursing
c/o NICU
National Women's

Auckland District Health Board
Greenlane Clinical Centre, Green Lane West
Auckland 3, New Zealand
Telephone: 09 638 9909
Website: www.adhb.govt.nz

Service: Research Development Office
Office: Level 2, Bldg 14, GLH
Postal: PB 92189 Auckland
Phone: 630-9943
Ext: 4085, 4077 and 3122
Fax: 630 - 9796 or 4996
Email: CandyP@adhb.govt.nz
Website: www.adhb.govt.nz/RDO

*Note: This approval is issued by the Maori Research Review Committee and **does not** represent the E this approval or the ADHB management approval. Investigators are advised to seek other approvals separately.*

Dear Ms Wilkinson

RE: Research project 2893 (A+2893)- Changing Rooms - Parental Perceptions Of Reconfigurations In Neonatal Intensive Care Rooms: A Descriptive Comparison Study

The Maori Research Review Committee for the Auckland District Health Board reviewed your research ethics application on 26 February 2004.

The study is approved.

You and your research team are encouraged to consult Maori Health Services for follow-up liaison and support for any Maori participants you may recruit. Please call Mata Forbes, Maori Health Services Co-ordinator/Advisor, GM Suite 5th Level, Auckland City Hospital. Mobile [REDACTED] or [REDACTED]

Please send a copy of the final report to Maori Health Services at the conclusion of the study.

We wish you the very best in your research.

Sincerely,

Candy Pettus, MBA, PhD
Manager of Research
On behalf of the Maori Research Review Committee
AUCKLAND DISTRICT HEALTH BOARD

cc: Dr Jonathan Koea, Maori Research Review Committee, ADHB
Mata Forbes, Maori Research Review Committee, ADHB

Appendix F: Information Sheet



SCHOOL OF HEALTH SCIENCES
ALBANY
Private Bag 102 904
North Shore Mail Centre
Auckland
New Zealand
T: 64 9 414 0800
F: 64 9 441 9165
www.massey.ac.nz

Physical Surroundings in NICU :Parental Questionnaire.

Information Sheet

Dear parent,

As a parent of an infant in a neonatal intensive care unit (NICU) you are invited to enter a study on how you feel about the physical environment or surroundings. At the moment there is a lot of discussion around ways to design the infant rooms. In particular how to provide surroundings that best support your needs as a parent during your time in NICU. While your feedback will not help parents in NICU right now, it may help in the future.

This research is being conducted by Robyn Wilkinson a part-time staff nurse in NICU for requirements for a Masters in Philosophy (Nursing), supervised by Associate Professor Denise Dignam. Our contact details are listed on the following page.

The aim of the study is to learn directly from you, your impressions of the physical surroundings around the cot (incubator) and within the infant rooms. It is hoped to survey 60 parents. Information will be gathered from your responses to statements on a questionnaire. The questions focus on key issues that have been voiced by parents in other studies. For example first impressions of NICU and how the cot spaces support your developing relationship with your baby. Also questions on the sights and sounds of NICU and how you feel about having other infants and families in the rooms.

Your help would be really appreciated **but you do not have to take part**. Completing the questionnaire means you have consented and are willing to be included in the study. Take 2-3 days to decide if you want to participate. If you choose not to take part it will not affect how your baby is cared for in NICU. In order to protect your identity the questionnaire is anonymous –do not write your name on the questionnaire. You also have the right not to answer any question you are uncomfortable with. The questionnaire should take 15 minutes to complete.

As the questionnaire centres on the physical surroundings of NICU it is not expected to cause you any emotional discomfort. However, in the unlikely event that you feel upset please contact your Family Liaison Nurse. If there is a specific Maori concern/issue, please contact Mata Forbes RGON; Coordinator /Advisor, Auckland City Hospital-Mobile [REDACTED]

If you have any queries or concerns regarding your rights as a participant in this study, you may wish to contact a Health and Disability Advocate, phone 0800 555 050 Northland to Franklin.

V # 2, 1/4/04



Information gained from this study will only be used for this project and electronically stored for ten years. No material can personally identify you. The project will be reported in a Masters thesis and may be published in a medical/nursing journal. A summary of results will be available after December 2005 and you are welcome to contact Robyn for a summary.

This study has received ethical approval from the Auckland Ethics Committee. Thank you for your consideration of this project. Please feel free to contact Robyn or Denise if you have any further questions or comments regarding this project.

Robyn Wilkinson
c/- School of Health Sciences
Albany Campus
Telephone-09 414 0800 ext 9066
Private Bag 102 904
North Shore Mail Centre
Auckland.
[REDACTED]

Dr Denise Dignam
Associate Professor, Massey University
Telephone 09 414 0800 ext 9176
D.M.Dignam@massey.ac.nz

[REDACTED] 1/4/04

Appendix G: Auckland Ethics Committee Amendment

Please include the reference no. and study title in all correspondence/telephone calls.

15 July 2004

Auckland Ethics Committees

Private Bag 92522
Wellesley Street
Auckland
Delivery Address:
C/O Ministry of Health
3rd Floor, Unisys Building
650 Great South Road, Penrose
Phone (09) 580 9105
Fax (09) 580 9001
Email: pat_chainey@moh.govt.nz

Ms Robyn C. Wilkinson
C/o School of Health Sciences
Albany Campus
Massey University
PB 102 904
North Shore Mail Centre
Auckland.

Dear Robyn,

AKX/04/03/059 Changing rooms - parental perceptions of reconfigurations in neonatal intensive care rooms: a descriptive comparison study: IS V#2, 01/04/04: Prot/amend 1/7/04

Further to my email on 15 July 2004 regarding your protocol amendments.

The chairperson of Ethics Committee X considered the following amendment and has given ethical approval for :

- Protocol amendment 1 July 2004 – change in recruitment method.

Yours sincerely,



Pat Chainey
Administrator, Committee X

Accredited by Health Research Council

References

- Affonso, D. D., Hurst, I., Mayberry, L. J., Haller, L., Yost, K., Lynch, M. E. (1992). Stressors reported by mothers of hospitalized premature infants. *Neonatal Network*, 11 (6), 63-70.
- Als, H. (1986). A synactive model of neonatal behavioural development: A framework for assessment of neurobehavioral development in the premature infant and for support of infants and parents in the neonatal intensive care environment. *Physical and Occupational Therapy in Pediatrics*, 6 (3), 3-53.
- Als, H., Lawhon, G., Duffy, F., McAulty, G., Giles-Grossman, R., & Blickman, J. (1996). 'Individualised behavioural and environmental care for the very low birth weight infant at risk for bronchopulmonary dysplasia: neonatal intensive care unit and developmental outcomes'. *Pediatrics*, 78 (2), 1123-1132.
- Altimier, L. B. (2000). Changing units for changing times: The evolution of a NICU. *Neonatal Intensive Care*, 13 (6), 23-27.
- Altimer, L. B. (2004). Healing environments: for patients and providers. *Newborn and Infant Nursing Reviews*, 4 (2), 89-92.
- Anisman, H., & Merali, Z. (1999). Understanding stress: Characteristics and caveats. *Alcohol Research & Health*, 23 (4), 241-249.
- Appleton, J., & King L. (2002). Journeying from the philosophical contemplation of constructivism to the methodological pragmatics of health science research. *Journal of Advanced Nursing*, 49 (6), 641-648.
- Back, E., & Wikblad, K. (1998). Privacy in hospital. *Journal of Advanced Nursing*, 27 (5), 940-949.
- Bell, C., Graven, S., Shepley, M., Rubin, H., & Ulrich, R. (1997). Pre-symposium workshop: Panel discussion. *Journal of Healthcare Design*, 9, 21-24.
- Beresford, D. (1997a). Family centred care: Fact or fiction? *Journal of Neonatal Nursing*, 3 (6), 8-11.
- Beresford, D. (1997b). Effective planning and commissioning of a neonatal unit: from inception to reality. *Journal of Neonatal Nursing*, 3 (5), 10-15.
- Bialoskurski, M. M., Cox, C. L., & Wiggins, R. D. (2002). The relationship between maternal needs and priorities in a neonatal intensive care environment. *Journal of Advanced Nursing*, 37 (1), 62-69.

- Birrell, J., Thomas, D., & Jones, C. A. (2006). Promoting privacy and dignity for older patients. *Nursing Standard*, 20 (18), 41-46.
- Bowie, B. H., Hall, R. B., Faulkner, J., & Anderson, B. (2003). Single-room infant care: Future trends in special care nursery planning and design. *Neonatal Network*, 22 (4), 27-34.
- Brady-Fryer, B. (1994). Becoming the mother of a preterm baby. In P. A. Field & P. B. Marck (Eds.), *Uncertain Motherhood* (pp.195-225). Thousand Oaks, CA: Sage.
- Bramwell, R., & Weindling, M. (2005). Families' views on ward rounds in neonatal units. *Archives of Diseases in Childhood Fetal and Neonatal Edition*, 90 (5), 429-31.
- Brazy, J. E., Anderson, B .T., Becker, P. T., & Becker, M. (2001). How parents of premature infants gather information and obtain support. *Neonatal Network*, 20 (2), 41- 48.
- Brown, K. W. (1984). How intensive is newborn intensive care? An environmental analysis. *Pediatrics*, 74 (2), 292-294.
- Brown, P., & Taquino, L. T. (2001). Designing and delivering neonatal care in single rooms. *Journal of Perinatal and Neonatal Nursing*, 15 (1), 68-83.
- Carpenter, D. R. (2003). Phenomenology as a method. In H. J. Speziale & D. R. Carpenter (Eds.), *Qualitative Research in Nursing. Advancing the Humanistic Perspective* (pp. 51-71). Philadelphia: Lippincott, Williams & Wilkins.
- Coffey, A., & Atkinson, P. (1996). *Making Sense of Qualitative Data: Complementary research strategies*. Thousand Oaks, CA: Sage Publications.
- Consensus Committee. (2002). *Recommended standards for the newborn ICU*. Retrieved April 11, 2003, from <http://www.nd.edu/~kkolberg/frmain.htm>
- Cox, C. L., & Bialoskurski, M. (2001). Neonatal intensive care: communication and attachment. *British Journal of Nursing*, 10 (10), 668-676.
- Cuba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. In N. K. Denzin & Y. Lincoln (Eds.), *Handbook of Qualitative Research* (pp.105-117). Thousand Oaks, CA: Sage.
- Curtin, L. L. (1992). Privacy: belonging to one's self. *Nursing Management*, 23 (4), 7-8.
- de Vaus, D. (1999). Structured questionnaires and interviews. In V. Minichiello, G. Sullivan, K. Greenwood & R. Axford (Eds.), *Handbook for Research Methods in Health Sciences* (pp. 317-341). Sydney, Australia: Addison-Wesley.

- Diaz-Azcuy, O. (1992). Design heals. *Interiors*, 90, 61-65.
- Dobbins, N., Bohlig, C., & Sutphen, J. (1994). Partners in growth: Implementing family-centred changes in the neonatal intensive care unit. *Children's Health Care*, 23 (2), 115-126.
- Doering, L. V., Moser, D. K., & Dracup, K. (2000). Correlates of anxiety, depression and psychosocial adjustment in parents of NICU infants. *Neonatal Network*, 19 (5), 15-23.
- Donchin, Y. (2002). The hostile environment of the intensive care unit. *Current Opinion in Critical Care*, 8 (4), 316-320.
- Dudek-Shriber, L. (2004). Parent stress in the neonatal intensive care unit and the influence of parent and infant characteristics. *American Journal of Occupational Therapy*, 58 (5), 509-520.
- Dyer, I. (1995). Preventing the ITU syndrome or how not to torture an ITU patient! *Intensive and Critical Care Nursing*, 11 (Pt. 1), 130-139.
- European Environmental Information and Observation Network (2005). *Concept Definitions*. Retrieved December 15, 2005, from <http://www.eionet.eu.int/gemet/concept?cp>
- Evans, G. W., Lepore, S. J., & Allen, K. M. (2000). Cross-cultural differences in tolerance for crowding: Fact or fiction? *Journal of Personality and Social Psychology*, 79 (2), 204-210.
- Fenwick, J., Barclay, L., & Schmied, V. (2001). Struggling to mother: Consequences of inhibitive nursing interactions in the neonatal nursery. *Journal of Perinatal and Neonatal Nursing*, 15 (2), 49-64.
- Fontaine, D. K., Briggs, L. P., & Pope-Smith, B. (2001). Designing humanistic critical care environments. *Critical Care Quarterly*, 24 (3), 21-23.
- Forsythe, P. (1995). Changing the ecology of NICU. *Designing for Child Health Institute for Family-Centred Care*, 3 (1), 11-14.
- Forthofer, R. N., & Lee, E. S. (1995). *Introduction to Biostatistics, A guide to design, analysis and discovery*. San Diego, CA: Academic Press.
- Fowler, F. J. (2001). *Survey Research Methods* (3rd ed.). London: Sage Publications.
- Franck, L.S., Cox, S., Allen, A., & Winter, I. (2005). Measuring neonatal intensive care unit-related stress. *Journal of Advanced Nursing*, 49 (6), 608-615.

- Furman, L., & O'Riordan, M. A. (2006). How do mothers feel about their very low birth weight infants? Development of a new measure. *Infant Mental Health*, 27 (2), 152-172.
- Gibbons, C., Geller, S., & Glatz, E. (1998). Biomedical equipment in the neonatal intensive care unit: Is it a stressor? *Journal of Perinatal and Neonatal Nursing*, 12 (3), 67-73.
- Giger, J. N., & Davidhizar, R. (1990). Culture and Space. *Advancing Clinical Care*, Nov/Dec, 8-11.
- Glen, S., & Jownally, S. (1995). Privacy: a key nursing concept. *British Journal of Nursing*, 4, (2), 69-72.
- Gordin, P., & Johnson, B. H. (1999). Technology and family-centred perinatal care: Conflict or synergy. *Journal of Obstetric, Gynecologic & Neonatal Nursing*, 28 (4), 401-408.
- Graven, S. N. (2000). The full term and premature infant. Sound and the developing infant in NICU: Conclusion and recommendations for care. *Journal of Perinatology*, 20, 88-93.
- Greenough, A., & Milner, A. (2005). Chronic Lung Disease. In J. M. Rennie (Ed.), *Robertsons Textbook of Neonatology* (4th ed., pp. 554-572). Edinburgh, Scotland: Elsevier Churchill Livingstone.
- Grbich, C. (1999). *Qualitative Research: An introduction*. London: Sage Publications.
- Griffin, T., Kavanaugh, K., Soto, C. F., & White, M. (1997). Parental evaluation of a tour of the neonatal intensive care unit during a high risk pregnancy. *Journal of Obstetric, Gynecologic & Neonatal Nursing*, 26 (1), 59-65.
- Guidelines for Intensive Care Unit Design. (1995). *Critical Care Medicine*, 23 (3), 582-588.
- Harris, D. D., Shepley, M. M., White, R. D., Kolberg, K. J. S., & Harrell, J.W. (2006). The impact of single room design on patients and caregivers: executive summary. *Journal of Perinatology*, 26, 38-48.
- Harrison, L. L., Lotas, M. J., & Jorgensen, K. M. (2004). Environmental Issues. In C. Kenner & J. McGrath (Eds.), *Developmental Care of Newborns & Infants* (pp. 229- 262). St Louis, MO: Mosby.
- Hek, G. (2006). Asking the right question. In K. Gerrish. & A. Lacey. (Eds.), *The Research Process in Nursing*, (5th ed., pp. 73-79). Oxford, England: Blackwell Publishing.

- Hennessy, K. A. (2000). NICU redesign. A new home for new life. *Nursing Spectrum*, 10 (8), 15.
- Heuer, L., Bengiamin, M., Downey, V. W., & Imler, N. J. (1996). Neonatal intensive care nurse stressors: An American Study. *British Journal of Nursing*, 5 (18), 1126-1130.
- Hill, A. (1997). A paradigm shift: A code for life and the right to heal. In P. B. Kritek (ed.), *Reflections on Healing. A central nursing construct* (pp. 39-42). New York: NLN Press.
- Holaday, B. (2002). Johnson's behavioural system model in nursing practice. In M. R. Alligood & A. Marriner-Tomey, *Nursing Theory* (2nd ed., pp. 149-173). St Louis MO: Mosby.
- Horsburgh, C. R. (1995). Healing by design. *The New England Journal of Medicine*, 333 (11), 735-710.
- Hott, J. R., & Budin, W.C. (1999). *Notter's Essentials of Nursing Research*. (6th ed.). New York: Springer Publishing Company.
- Hughes, M., McCollum, J., Sheftel, D., & George, S. (1994). How parents cope with the experience of neonatal intensive care. *Childrens Health Care*, 23 (1), 1-4.
- Hurst, J. (2001). Mothers strategies to meet their needs in the newborn intensive care nursery. *Journal of Perinatal and Neonatal Nursing*, 15 (2), 65-82.
- Hutchfield, J. (1999). Family-centred care: A concept analysis. *Journal of Advanced Nursing*, 29 (5), 1179-1187.
- Jackson, C. (2004). Healing ourselves, healing others. *Holistic Nursing Practice*, 18 (2), 67-82.
- Jackson, K., Ternestedt, B., & Scollin, J. (2003). From alienation to familiarity: Experiences of mothers and fathers of preterm infants. *Journal of Advanced Nursing*, 43 (2), 120-129.
- Jamsa, K, & Jamsa, T. (1998). Technology in neonatal intensive care- a study of parents' experiences. *Technology and Health Care*, 6, 225-230.
- Jarrett, M. H. (1996). Parent partners: A parent-to-parent support program in the NICU. Program development. *Pediatric Nursing*, 22 (Pt.1), 60-63.
- Jensen, L. (1999). Together let's cope: A model for parent support in the neonatal intensive care unit and special care nursery. *Mother Baby Journal*, 4 (5), 31-38.

- Johnson, A. N. (2003). Adapting the neonatal intensive care environment to decrease noise. *Journal of Perinatal and Neonatal Nursing*, 17 (4), 208-288.
- Johnson, B. H., Abraham, M. R., & Parrish, R. N. (2004). Designing the neonatal intensive care unit for optimal family involvement. *Clinics in Perinatology*, 31 (92), 353-383.
- Johnson, D. (1980). *The Behavioural Systems Model for Nursing: Conceptual Models for Nursing Practice* (2nd ed.). New York: Appleton-Century Crofts.
- Kahn, D. M., Cook, T. E., Carlisle, C. C., Nelson, D. L., Kramer, R. P., & Millman, R. P. (1998). Identification and modification of environmental noise in an ICU. *Chest*, 114 (2), 535-536.
- Keegan, L. (2005). Environment. In B. M. Dossey, L. Keegan, & C. E. Guzzetta (Eds.), *Holistic Nursing. A handbook for practice* (4th ed., pp. 273-303). Sudbury MA: Jones and Bartlett Publishers.
- Kellman, N. (2002). Noise in the intensive care nursery. *Neonatal Network*, 21 (1), 35-41.
- Kowalski, W. J., Lawson, M. L., & Oelberg, M. D. (2003). Parent and nurse perceptions of confidentiality, rounding and visitation policy in a neonatal intensive care unit. *Neonatal Intensive Care*, 16 (3), 46-50.
- Kritek, P. (1997). Healing: A central nursing construct. In P. B. Kritek (Ed.), *Reflections on Healing: A central nursing construct* (pp. 11-27). New York: NLN Press.
- Kuschel, C. A., & Roy, R. N. (2005). Who's got what? A benchmarking exercise for tertiary neonatal units. *Journal Paediatric Child Health*, 41, 635-639.
- Kuzma, J. W., & Bohnenblust, S. E. (2005). *Basic Statistics for the Health Sciences*. (5th ed.). New York: McGraw-Hill.
- Landis, B. J. (1997). Healing and the human Spirit. In P. B. Kritek (Ed.), *Reflections on Healing. A central nursing construct* (pp.72-80). New York: NLN Press.
- Levy, G. D., Woolston, D. J., & Browne, J. V. (2003). Mean noise levels in level II vs level III neonatal intensive care units. *Neonatal Network*, 22 (2), 33-36.
- Lindquist, P., & Jakobsson, L. (2003). Swedish's men's experience of becoming fathers to their preterm infants. *Neonatal Network*, 22 (6), 25-32.
- Lindsay, J. K., Roman, L., DeWys, M., Eager, M., Levick, J., & Quinn, M. (1993). Creative caring in the NICU: Parent-to-parent support. *Neonatal Network*, 12 (4), 37-44.

- Loring, C. F. (1998). New digs for tiny tots. *Association of Women's Health Obstetric & Neonatal Nurses, Lifelines*, 2, (5), 27-30.
- Lotas, M. J. (1992). Effects of light and sound in the neonatal intensive care unit environment on the low-birth-weight infant. *Nurses' Association of the American College of Obstetricians and Gynaecologists, Clinical Issues in Perinatal and Womens' Health Nursing*, 3 (1), 34-44.
- Lovallo, W. R. (2005). *Stress and Health. Biological and Psychological Interactions* (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Lupton, D., & Fenwick, J. (2001). They've forgotten that I'm the mum: Constructing and practising motherhood in special care nurseries. *Social Science and Medicine*, 53, 1011-1021.
- MacFarlane, A., & Mugford, M. (2005). Epidemiology. In J. M. Rennie (Ed.), *Robertons Textbook of Neonatology* (4th ed., pp. 3-41). Edinburgh, Scotland: Elsevier Churchill Livingstone.
- McHaffie, H. E. (1990). Mothers of very low birth weight babies: How do they adjust? *Journal of Advanced Nursing*, 15 (6), 6-11.
- McHaffie, H. E. (1992). Social support in neonatal intensive care. *Journal of Advanced Nursing*, 17, 279-287.
- Meyer, E. C., Kennally, K. F., Zika-Berres, E., Cashmore, W., & Oh, M. D. (1996). Attitudes about sibling visitation in the neonatal intensive care unit. *Archives in Adolescent Medicine*, 150, October, 1023-1026.
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative Data Analysis: An expanded sourcebook* (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Miles, M. S., Funk, S. G., & Kasper, M. A. (1991). The neonatal intensive care unit environment: Sources of stress for parents. *American Association of Critical Care Nurses*, 2, 346-353.
- Miles, M. S., Funk, S. G., & Kasper, M. A. (1992). The stress response of mothers and fathers of preterm infants. *Research in Nursing and Health*, 15, 261-269.
- Miles, M. S., Carlson, J., & Funk, S. G. (1996). Sources of support reported by mothers and fathers of infants hospitalized in a neonatal intensive care unit. *Neonatal Network*, 15 (3), 45-51.
- Miles, M. S., & Funk, S. G. (1998). Parental stressor scale. Neonatal intensive care unit. Retrieved October, 29th, 2005 from <http://www.nursing.unc.edu/crci/instruments/pssnicu/nicuman.pdf>

- Miles, M. S., Holditch-Davis, D., Burchinal, P., & Nelson, D. (1999). Distress and growth outcomes in mothers of medically fragile infants. *Nursing Research*, 48 (3), 129-139.
- Murphy-Black, T. (2006). Using Questionnaires. In K. Gerrish., & A. Lacey (Eds.), *The Research Process in Nursing*, (5th ed., pp. 367-382). Oxford, England: Blackwell Publishing.
- Neil, R. M., & Marriner-Tomey, A. M. (2006). Jean Watson: The philosophy and science of caring. In A. Marriner-Tomey & M. R. Alligood (Eds.), *Nursing Theorists and Their Work* (6th ed., pp. 91-115). St Louis, MO: Mosby Elsevier.
- Neuman, B. (1982). *The Neuman System Model: Application to nursing education and practice*. Norwalk, CT: Appleton-Century-Grofts.
- Nightingale, F. (1924). *Notes on Nursing*. London: J.B. Harrison & Sons.
- Nyqvist, K. H., Sjoden, P., & Ewald, U. (1994). Mothers' advice about facilitating breastfeeding in a neonatal intensive care unit. *Journal of Human Lactation*, 10 (4), 237-239.
- Ohler, J. M., Davidson, M. G., Starr, L. E., & Lee, D. A. (1991). Burnout, job stress, anxiety, and perceived social support in neonatal nurses. *Heart and Lung*, 20 (5), 500-505.
- Oppenheim, A. N. (1992). *Questionnaire Design, Interviewing and Attitude Measurement*. London: Pinter Publishers.
- Padden, T., & Glenn, S. (1997). Maternal experiences of preterm birth and neonatal intensive care. *Journal of Reproductive & Infant Psychology*, 15 (2), 121-140.
- Parsons, C. L. (1999). Obtaining ethical approval for health sciences research. In V. Minichiello, G. Sullivan, K. Greenwood, & R. Axford (Eds.), *Handbook for Research Methods in Health Sciences* (pp.75-96). Sydney, Australia: Addison-Wesley.
- Peat, J. (2001). *Health Science Research. A Handbook of quantitative methods*. Sydney, Australia: Allen & Unwin.
- Perehudoff, B. (1990). Parents' perceptions of the environmental stressors in the special care nursery. *Neonatal Network*, 9 (2), 39-44.
- Pfetscher, S. A. (2006). Florence Nightingale: Modern nursing. In A. Marriner-Tomey & M. R. Alligood (Eds.), *Nursing Theorists and Their Work* (6th ed., pp. 71-90). St Louis, MO: Mosby Elsevier.

- Philbin, M. K. (2004). Planning the acoustic environment of a neonatal intensive care unit. *Clinics in Perinatology*, 31 (92), 331-353.
- Philbin M. K., & Evans, J. B. (2006). Standards for the acoustic environment of the newborn ICU. *Journal of Perinatology*, 26, 27-30.
- Polit, D. F., & Beck, C. T. (2004). *Nursing Research, Principles and Methods* (7th ed.). Philadelphia: Lippincott Williams & Wilkins.
- Raeside, L. (1997). Perceptions of environmental stressors in the neonatal unit. *British Journal of Nursing*, 6 (16), 914-923.
- Rawnsley, M. M. (1980). The concept of privacy. *Advances in Nursing Science*, 2 (2), 25-30.
- Rhea, M. (2004). Lighting for caregivers in the neonatal intensive care unit. *Clinics in Perinatology*, 31 (92), 229-243.
- Roeder, C. (1996). Environmental design technology: using color & light as medicine. *Journal of Healthcare Design*, 8, 133-136.
- Roy, C. (1984). *Introduction to Nursing: An adaptation model* (2nd ed.). Englewood Cliffs, NJ: Prentice Hall.
- Roy, C., & Zhan, L. (2006). Sister Callista Roy's adaptation model and its applications. In M. E. Parker (Ed.), *Nursing Theories and Nursing Practice* (2nd ed., pp.268-280). Philadelphia: F. A. Company.
- Rubin, H. R., & Owens, A J. (1996). Report: An investigation to determine whether the built environment affects patients' medical outcomes. *The Centre for Health Design*, Martinez, CA.
- Rushton, C. (1990). Family-centred care in the critical care setting: Myth or reality? *Child Health Care*, 19, (2), 68-78.
- Rylance, G. (1999). Privacy, dignity, confidentiality: interview study with structured questionnaire. *British Medical Journal*, 318 (7179), 301-303.
- Shelton, L., & Stepanek, J. S. (1995). Excerpts from family-centred care for children needing specialised health and development services. *Pediatric Nursing*, 2 (4), 362-364.
- Shepley, M. M. (2002). Predesign and postoccupancy: Analysis of staff behaviour in a neonatal intensive care unit. *Children's Health Care*, 3 (3), 237-253.

- Shepley, M. M. (2006). The role of positive distraction in neonatal intensive care unit settings. *Journal of Perinatology*, 26, 34-37.
- Shields-Poe, D., & Pinelli, J. (1997). Variables associated with parental stress in neonatal intensive care units. *Neonatal Network*, 16 (1), 29-36.
- Siegal, R., Gardner, S. L., & Merenstein, G. B. (2004). Psychosocial aspects of neonatal care: Families in crisis. In G. B. Merenstein & S. L. Gardner (Eds.), *Handbook of Intensive Care* (5th ed., pp. 725-753). St Louis, MO: Mosby.
- Smith, J. (1994). Issues in designing the NICU. *The Missouri Nurse*, 63 (6), 6.
- Spencer, C., & Edwards, S. (2001). Neonatal intensive care unit environment: A review from the parents' perspective. *Journal of Neonatal Nursing*, 7 (4), 127-131.
- Standards for Intensive Care Units. (1997). Prepared by The Intensive Care Society. Retrieved January 5, 2007, from: <http://www.ics.ac.uk/icmprof/downloads/ICSstandards4302.pdf>
- Stichler, J. (2001). Creating healing environments in critical care units. *Critical Care Nursing Quarterly*, 24 (3), 1-20.
- Strauch, C., Brandt, S., & Edwards-Beckett, J. (1993). Implementing a quiet hour: effect on noise levels and infant sleep states. *Neonatal Network*, 9 (2), 31-35.
- Symington, A., & Pinelli, J. (Updated 2006). Developmental care for promoting development and preventing morbidity in preterm infants. [Cochrane Review]. In *Cochrane Database of Systematic Reviews*, 2006 (4). Retrieved January 10, 2007, from Ovid Evidence Based Medicine Reviews : Cochrane Database of Systematic Reviews.
- Taquino, L., T. & Lockeridge, T. (1999). Caring for critically ill Infants: Strategies to promote physiologic stability and improve developmental outcomes. *Critical Care Nurse*, 19 (6), 64-79.
- Thomas, K. A., & Martin, P. A. (2000). The acoustic environment of hospital nursery. *Journal of Perinatology*, 20, 93-98.
- Ulrich, R. S. (1992). How design impacts on wellness. *Healthcare Forum Journal*, September/October, 20-25.
- Ulrich, R. S. (1997). A theory of supportive design for healthcare facilities. *Journal of Healthcare Design*, 9, 3-7.
- Venolia, C. (1988). *Your Guide to Indoor Well-being*. Berkeley, CA: Celestial Arts.

- Vestal, R. (1999). Building Blocks. *American Women's Health Obstetric & Neonatal Nurses, Lifelines*, 3 (3), 37-39.
- Vinall, P. E. (1997). Design technology: What you need to know about circadian rhythms in healthcare design. *Journal of Healthcare Design*, 9, 141-144.
- Walsh-Suks, M., Reitenbach, A., Hudson-Barr, D., & Depompei. (2001). Reducing light and sound in the neonatal intensive care unit: an evaluation of patient safety, staff satisfaction and costs. *Journal of Perinatology*, 21 (4), 230-235.
- Ward, K. (2001). Perceived needs of parents of critically ill infants in a neonatal intensive care unit. *Pediatric Nursing*, 27 (3), 281-286.
- Watson, J. (1979). *Nursing: The Philosophy and Science of Caring*. Denver, Colorado: University Press.
- Watson, J. (1988). *Nursing: Human Science and Human Care*. New York: National League of Nursing.
- Watson, J. (1999). *Postmodern Nursing and Beyond*. Edinburgh, Scotland: Churchill Livingstone.
- Wereszczak, J., Shandor-Miles, M., & Holditch-Davis, D. (1997). Maternal recall of a neonatal intensive care unit. *Neonatal Network*, 16 (4), 33-40.
- White, R. B. (2003). Individual rooms in the NICU-An evolving concept. *Journal of Perinatology*, 23, 22-24.
- White, R. D. (2004). Lighting design in the neonatal intensive care unit: practical application of scientific principles. *Clinics in Perinatology*, 31 (92), 331-353.
- White, R. D. (2006). Recommended standards for NICU design. *Journal of Perinatology*, 26, 4-9.
- White, R. D., & Newbold, P. A. (1995). Reinventing the newborn ICU. *Healthcare Forum*, 38 (2), 30-34.
- Wigert, H., Johansson, R., Berg, M., & Hellstrom, A. L. (2006). Mothers' experience of having their newborn child in a neonatal intensive care unit. *Scandinavian Journal of Caring*, 20, 35-41.
- Williams, M. (2001). Critical care unit design: A nursing perspective. *Critical Care Quarterly*, 24 (3), 35-42.
- Wood, D. A. (2005). Privacy is a priority. *Nursing Spectrum (Southeast)*, 6 (2), 19-20.

- Woogara, J. (2005). Patients' rights to privacy and dignity in the NHS. *Nursing Standard*, 19 (18), 33-37.
- Wright, D. B. (2002). *First Steps in Statistics*. London: Sage Publications.
- Yeldham, M. (2000). Combining complementary therapies and nursing practice skills to supplement healing. *Australian Journal of Holistic Nurse*, 7 (1), 21-25.
- Zagon, L. (1993). Design technology: selecting appropriate colors for healthcare. *Journal of Healthcare Design* 5, 135-141.
- Zahr, L. (1991). Correlates for mother-infant interaction in premature infants from low socioeconomic backgrounds. *Pediatric Nursing*, 17 (3), 259-264.
- Zwick, M. B. (1993). Decreasing environmental noise in the NICU through staff education. *Neonatal Intensive Care*, 2, 16-19.