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Dorothy de la Cruz-Schmedel

University of the Pacific, dorthandlil@gmail.com

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Neonate Psychophysiological Responses to Ambient Features of the Neonatal Intensive Care Unit

A Thesis
Submitted to The Psychology Department and and the Committee on Graduate Studies University of the Pacific In Partial Fulfillment of the Requirements for the Degree Master of Arts

by Dorothy de la Cruz-Schmedel August 1989
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Projects of any size are the result of teamwork.

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Dorothy de la Cruz-Schmedel

is approved for recommendation to the Committee on Graduate Studies, University of the Pacific.

Department Chairman or Dean:

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Chairman

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Abstract

Hospital treatment environments have become a major concern in recent years. Noise and illumination are potential stress sources in hospitals. The purpose of this study was to examine the effects of hospital noise levels and ambient illumination on newborn infants (neonates). Noise levels and lighting were varied and their effects upon neonatal heart rate, respiration rate, blood pressure, and oxygen consumption was measured. These measures are sensitive to sympathetic nervous system reactivity such as that brought about by stressful environments. In addition, noise and lighting levels were measured to determine if differences existed across conditions. Psychophysiological responses to various noise and lighting levels varied within and across neonates with some changes in the expected direction. Some unexpected results of Quiet Time were noted among neonatal intensive care staff and hospital personnel.
Neonate Psychophysiological Responses to Ambient Features of the Neonatal Intensive Care Unit

The hospital treatment environment has become a major concern over the last 15 years (Falk & Woods, 1973; Hargest, 1978; Haslam, 1970; Seidlitz, 1981; Woods & Falk, 1974). The purpose of this study was to examine the effects of hospital noise levels and ambient illumination on newborn infants. There have been numerous studies examining noise as a source of stress for adult humans in various settings. However, research dealing with the effects of lighting has been primarily restricted to animals. General findings of the noise and lighting research will be summarized briefly.

Noise Research

Noise has been defined as any unwanted sound, as "a sound or a collection of sounds which is unpleasant to the listener and annoying, either because the noise is physiologically intolerable or because it interferes with other auditory perceptions which are more pleasant or more important" (Levy-Leboyer, 1982). Sites in which noise pollution has been studied
include hospitals as well as urban areas, airports, and occupational settings. The majority of noise research has focused on subjective reactions of human subjects, but noise effects have also been studied extensively on sleep, speech, and work (Cantrell, 1979).

It has been recognized for more than 100 years that workers in noisy occupational settings develop a greater likelihood of hearing loss than workers in quieter jobs (Seidlitz, 1981). The maximal sound intensity which does not produce sensorineural hearing loss regardless of duration is 80 dB (A) in adults, and Occupational Safety and Health Administration standards specify a 90 dB (A) noise exposure limit for an 8 hour day (Seidlitz, 1981).

Hearing loss is just one result of a noisy environment on people. In recent studies, the effect of noise on the body's biochemistry, cardiovascular system, and the organs controlled by the autonomic nervous system are more serious than previously suspected (Cantrell, 1979). Constriction of blood vessels, tense muscles, pupil dilation, decreased salivary and gastric secretions, decreased
peristalsis, increased adrenalin secretion, permanent ear damage, disturbed sleep, and disturbed relaxation are a few of the results associated with adult exposure to excessive noise (Borsky, 1979; Cantrell, 1979; Roth, Kramer, & Trinder, 1972; Seidlitz, 1981; Woodward, 1981). In addition, noise produces increases in arousal level (McLean & Tarnopolsky, 1977).

Little research has been done on the effects of excessive noise levels on children. There is little data available on noise-induced hearing loss in children. In a study by Cohen, Evans, Krantz, and Stokols (1980), children from noisy schools (74 dB) had higher blood pressure than those in quiet schools (56 dB). There is speculation that excessive levels of noise may interfere significantly with children's perception of speech and its acquisition, language, and language-related skills. There are no firm conclusions regarding the effects of noise on sleeping patterns of children; however, it may disturb or arouse children (Mills, 1975). No guidelines or standards have been made regarding noise levels and children.
Several deleterious effects of ambient lighting have been documented. Bright lighting can result in eyestrain (Taylor, 1977) and the suppression of human melatonin secretion (Okudaira, Kripke, & Webster, 1983). There is mostly speculation as to the function of melatonin, however, there is evidence that lowered amounts of it are associated with depression syndromes, manic depression, and infertility (Carlton-Foss, Beral, & Evans, 1982; Lewy, 1983; Lewy, Wehr, Goodwin, Newsome, & Marke, 1980; Okudaira, et al. 1983). Fluorescent lighting has been linked with hyperactivity in children (Mayron, 1978). Irwin (1941) studied the effects of strong non-fluorescent light on the body activity of newborns. Body activity increased as the infant subjects went through dark adaptation while increased illumination caused a decrease in body activity.

The Interaction of Noise Levels and Lighting

Hargest (1978) suggested that lowering lighting in hospital patient areas is instrumental in decreasing high noise levels, and Sanders, Gustanski, and Lawton (1974) found that noise levels produced by
people were varied by altering the level of ambient illumination. In a low illumination condition, the mean noise level was 50.3 dB, whereas in a high illumination condition, the mean noise level was 61.1 dB.

Hospital Design Issues

Hospital environments are not free from noise, and studies indicate that there is no less hazard for hospitalized patients than other humans (Haslam, 1970). Several studies have identified hospital environments where noise levels are excessive and what the noise producers are. Falk and Woods (1973) evaluated noise levels every 5 min over 24 hours in a recovery room and acute care unit, which were considered the noisiest patient areas in the hospital. The range of noise in the recovery room was 45 to 84 dB and 50 to 76 dB in the acute care unit. Noise levels were somewhat higher in the day than at night.

Sources contributing to elevated hospital noise levels include mechanical and vocal sources. Mechanical sources include: Telephones (59 dB), the suctioning of patients (67 dB), and cardiac monitors.
(61 dB) (Seidlitz, 1981). Noise levels produced by staff communications ranged from 56 to 84 dB. Some investigators feel that it is staff communications which contribute most heavily to the noise problems in hospitals (Haslam, 1970; Noble, 1979; Woods & Falk, 1974).

The documented physiological effects of noise are of special concern to hospitalized patients due to possible impacts upon patients' already lowered resistance and immunity. In addition, noise levels are often incompatible with normal sleep which is needed by recovering patients.

Hospital environments also have lighting problems. For example, hospital lighting usually consists of fluorescent lighting, and further, patients in recovery rooms and other hospital areas such as intensive care units are often exposed to lighting 24 hours per day (Woodward, 1978).

Intensive Care Unit Design

Several years ago, health personnel began to focus on the potentially stressful environment created by the intensive care unit, studying whether or not
the environment was conducive to patient recovery. Numerous findings were made of adverse somatic/physiological responses to environmental stressors, including increased blood pressure and disturbed sleep and relaxation (Gowan, 1979; Hansell, 1984; Hilton, 1976; Lindenmuth, Breu, & Malooley, 1980; Noble, 1979; Redding, Hargest, & Minsky, 1977).

Alarms, pumps, suction apparatus, ventilators, fans, telephones, conversations, digital displays, flashing monitors, and 24 hour lighting contribute to the excessive noise levels and lighting of intensive care units. As previously mentioned, Noble (1979) found staff communications to be the most disturbing stimuli in the intensive care unit. Several investigators have measured the noise levels in intensive care units and found them to be at or above 70 dB (Bentley, Murphy, & Dudley, 1977; Redding, et al. 1977; Seidlitz, 1981; Woodward, 1981).

Some investigators feel the physical environment of the intensive care unit may have deleterious effects on patients' perceptual experiences. According to Hansell (1984), noise, continuous lighting, and unfamiliarity with the intensive care
unit environment all contribute to alterations in the sensory perceptions of patients. These factors combined with acute illness, painful tests, and the close proximity of patients have been cited as contributory to what is known as the ICU syndrome/psychosis-behavior aberrations and disorientation (Noble, 1979).

**Neonatal Intensive Care Unit Design**

Recently, attention has been given to neonatal intensive care unit (NICU) environments. There are high levels of noise in the NICU as in other hospital areas. According to Vidyasagar, Joseph, and Hamilton (1976), noise levels in the neonatal intensive care unit range from 60 to 70 dB, but at present the significance of this is not known. Other investigators have found sound levels in NICU to be excessively high and potentially hazardous to health (Anagnostakis, Petmezakis, Messaritakis, & Matsaniotis, 1980; Gottfried, Wallace-Lande, Sherman-Brown, King, & Cohen, 1981). The effects of continuous lighting on neonates is also unknown.
Life threatening illnesses cause about 3% of all live-born infants to require special care in the NICU. Admissions to such units include those who have one or more handicaps, respiratory distress syndrome, generalized infections, hyperbilirubin (jaundice), and prematurity (Blackburn, 1982; Evans & Glass, 1978).

Since its development in the early 1960's, the NICU has been instrumental in decreasing the morbidity and mortality rates of critically ill neonates as well as improving the long term prognosis of the sick neonate (Thompson & Reynolds, 1977). Despite the 44% decrease of neonatal mortality rate in the United States, 17.9 in 1964 to 12.1 per 1,000 live births in 1974, investigators have suggested that the neonate may survive only to develop long term complications causing physical and mental limitations as a result of iatrogenic problems, that is, problems associated with the hospital environment and with the common therapeutics applied to the premature neonate (Jonsen & Lister, 1978; Pierog & Ferrera, 1971). At present, there are no criteria established for damage or risk involved regarding excessive noise levels and lighting
environment even though deleterious effects in adults and children have been shown as a result of these ambient environmental features (Falk & Woods, 1973; Lucey, 1973).

**Neonates**

The neonatal period is defined as the first 28 days of life. Not only does the highest incidence of mortality occur during this period, but damage of a physical and intellectual nature may occur as well. Neonates are classified as full term (37 to 42 weeks), post-term (42 weeks or more), pre-term or premature (less than 37 weeks after the first day of the mother's last menstrual period), and low birthweight (infants less than 5.5 lb or 2.5 kg at birth).

Premature and low birthweight infants are especially at risk within the neonatal period and often require special or intensive care (McIntosh, 1983; Pierog & Ferrera, 1971).

Most studies of premature neonates do not take into account what the premature infant is able or likely to respond to. Most infants, even those born prematurely, can sleep in the presence of stimulation adults find unpleasant (Goldberg & DiVitto, 1983). It
has been suggested that constant high levels of noise and illumination actually induce full-term infants to sleep, (Goldberg & DiVitto, 1983). One pediatrician suggests that until 35 weeks from conception, the neurological system is so immature that the environment has little impact on it—however, this view is controversial (Goldberg & DiVitto, 1983). Presently, we can only conjecture what the capabilities of the premature infant are.

**Noise sources.** Contributors to the amount of noise stimulation in the NICU have been studied by several investigators, yet the safe sound levels for full-term and pre-term neonates are still unknown (Bess, Peek, & Chapman, 1979; Committee on Environmental Hazards, 1974). The American Academy of Pediatrics' Committee on Environmental Hazards (1974) recommends that sound levels in incubators and NICU environments not exceed 58 dBA, and that it is preferable that sound levels be below this value. Investigators have addressed two major areas of noise sources: Respiratory therapy devices and incubators.

Hursey (1978) measured sound levels of various respiratory therapy equipment used in patient care.
Nebulizers produced a noise level of 85 dB (A) as did oxygen hoods, and respirators produced 58 to 59 dB. Beckham and Cominsky-Mishoe (1982) evaluated various types of respiratory therapy equipment regarding which of them meet the appropriate noise standard set by the American Academy of Pediatrics. Their results indicated that humidifiers produce lower sound levels than do nebulizers, below 58 dB. It was also suggested that water levels should be maintained at least at the half way mark in both humidifiers and nebulizers to reduce noise levels. They also determined that the use of oxygen hoods with various respiratory therapy devices increased the sound levels. League, Parker, Robertson, Valentine, and Powell (1972) found oxygen hood noise levels of up to 80 dB.

Incubators are another major NICU noise source. Researchers have found a range of sound level values; including 55 dB (Hursey, 1978), 60 dB (Bess, et al. 1979), and 72 to 74 dB (League, et al. 1972). Blennow, Svenningsen, and Almquist (1974) found noise levels inside infant incubators to be between 70 and
80 dB. Seleny and Streczyn (1969) found that the sound pressure level inside infant incubators was higher than 74 dB 50% of the time and 20% of the time measured 86 dB or greater. High environmental noise in the intensive care unit had an additive effect on the sound levels existing in the baby compartment of the incubators. At that time, though there were no established guidelines for neonates, they concluded that neonates were in danger due to their exposure to excessive noise levels.

Sanders, Friedman, and Weintraub (1970) conducted a spectral analysis of noise generated by hospital incubators. A microphone was placed in a position approximating a neonate's head and recordings were made. The noise levels generated by the incubators were found to be a function of the motor operating the air conditioning unit and were about 77 dB. Neonates in open cribs were exposed to 54 dB of noise. Bess et al. (1979) found that overall noise levels were increased by as much as 15 to 20 dB by life support equipment used in the NICU.

Effects of noise on neonates. The noise in NICU has been viewed as a potential health hazard by some
investigators (Anagnostakis et al. 1980). However, Weiss, Pickering, and Mooros (1977) state that adult and animal research dealing with effects of noise pollution cannot be directly related to neonates.

The majority of research has focused on possible hearing loss or deafness as a result of NICU noise levels (Barnes, Baum, & Rolfe, 1977; Blennow et al. 1974; Douek, Dodson, Bannister, Ashcroft, & Humphries, 1976; Falk & Farmer, 1973; Peltzman, Kitterman, Ostwald, Manchester, & Heath, 1970; Schulte & Stennert, 1978). Douek et al. (1976) used 1 week old and adult guinea pigs and placed them in incubators for 7 days with 80 dB noise intensity. Adult guinea pigs subjected to incubator noise had no significant loss of outer hair cells, but neonatal guinea pigs subjected to similar sound intensities had considerable loss of outer hair cells. The investigators concluded that incubator noise can damage the young cochlea. An earlier study, Falk, Cook, Haseman, and Sanders (1974), exposed 2-day, 8-day, and 8-month old guinea pigs to 30 continuous hours of white noise at 119 to 120 dB, and the newborn guinea pigs were more susceptible to high intensity
noise exposure in terms of pathological changes in the Organ of Corti.

Three recent studies examined the hearing loss in low birthweight infants treated in NICU (Abramovich, Gregory, Slemick, & Stewart, 1979; Galambos, Hicks, & Wilson, 1982; Jacobsen & Mencher, 1981) and results were inconsistent. Abramovich et al. and Galambos et al. suggested that there was no conclusive evidence that hearing loss was the result of incubator exposure. Jacobson and Mencher (1981) indicated that babies leave the hospital with reduced sensitivity in one or both ears, but they did not specifically state to what level of sound (dB) the neonates were exposed.

**Noise and ototoxic drugs.** Neonates are often given ototoxic antibiotic drugs (drugs affecting hearing or causing ear damage) when in NICU to aid in combating infections. Several investigators have studied possible complications of noise and ototoxic drugs. In a study by Dayal, Korkshanian, and Mitchell (1971), animals given kanamycin (100 mgm/kgm body weight) for 3 weeks and exposed to incubator noise showed hair cell loss in the Organ of Corti. None of the animals given kanamycin alone had any significant
hair cell loss. Only when low frequency and low intensity noise was added did damage appear. Dayal et al.'s (1971) findings were supported by Jauhiainen, Kohonen, and Jauhiainen (1972). These investigators studied the combined effects of noise and neomycin on the cochlea of guinea pigs through electrophysiological and histological methods. They found that each of the two factors increased the effects of the other. This suggested that sensory cells sensitized by a chemical noxious agent, such as neomycin, are more susceptible to mechanical trauma such as intensive care unit noise.

Other effects of noise on neonates. Heart rate and peripheral vasoconstriction changes were observed when neonates were exposed to noise at levels of 70 dB (Weiss et al. 1978).

Gadeke, Doring, Keller, and Vogel (1969) studied the noise level in a children's hospital and its effects on the wake-up threshold in infants. Sound levels of 70-75 dB for more than 12 min disturbed infants's sleep, waking up 2/3 of the children. Altering the sleep state of infants also occurred with excessive noise.
During the active sleep state of neonates, apnea (cessation of breathing) may often occur. Apnea is known to be associated with hypoxemia (reduction of oxygen supply to tissue below physiological levels). Long, Lucey, and Philip (1980) speculated that since noise alters sleep state, it should be considered as a potential cause of hypoxemia. In addition, they hypothesized that environmental noise may cause neonates to cry. Crying in turn causes hypoxemia and elevations in intracranial pressure.

Some investigators hypothesize that excess noise not only disturbs neonate sleep, but also it has the potential of impairing speech and language development. League et al. (1972) suggested that incubator noise masks, attenuates, and distorts sounds, thus impeding language stimulation.

**NICU Lighting and Effects on Neonates**

Investigators have evaluated NICU lighting environments as adequate in terms of allowing maximum visibility (Lawson, Daum, & Turkewitz, 1977) since the lights are on 24 hours per day. However, according to Lucey (1973), "virtually no attention has been paid to the infant's light environment." It has been assumed
that if adequate lighting existed for health personnel to carry out their duties, that this would also be a satisfactory environment for neonates. However, Gottfried et al. (1981) questioned whether or not prolonged exposure to continuous fluorescent lighting has adverse consequences on premature neonates. And, as previously mentioned, studies with animals and adults indicate some lighting conditions have negative biochemical and physiological effects.

Health personnel have noticed infants keep their eyes closed more often when under overhead room lights (Jones, 1982). Animal experiments suggest a potential hazard to retinal structures and also damage from the lack of change in illumination for several days (Brown & Glass, 1979).

Early work demonstrated that after a 30 min dark-adaptation period, the level of illumination had a significant effect upon the activity of the neonate (Irwin, 1941). The majority of subjects in this study showed more activity under minimal than under moderate light conditions. It was also shown that the longer the preceding dark adaptation period, the less crying and activity occurred upon subsequent exposure to a
standard level of illumination. Light would therefore, appear to have an inhibiting or soothing effect upon the newborn. However, as in the case of the effects of ambient noise upon activity, it is more likely that changes in the level of illumination cause the effect rather than absolute illumination level.

Ashton (1971) assessed the effects of different levels of ambient noise and illumination upon the ongoing state of the neonates and upon the state-related heart and respiration rates. He found that a dim light condition had no effect upon heart rate, but it reduced respiratory rate during active sleep or alertness. In addition, ambient noise had no physiological or systemic effects on the neonates. The subjects were full term healthy neonates, thus these results cannot necessarily be generalized to premature or ill neonates.

Fluorescent lighting is not the only source of light which may affect neonates in NICU's. Phototherapy lamps are often used in the treatment of elevated bilirubin levels. These light sources are very bright and often the infant's eyes are covered to prevent any eye damage (Brown & Glass,
The issue of possible effects from phototherapy treatment is controversial; some investigators have found no harmful effects, but others have found various effects—alteration of luteinizing hormone in the neonate, less weight gain, water imbalance, and damage to the neonate's eyes. Phototherapy is discussed in detail by many other investigators (Cohen & Ostrow, 1980; Romagnoli & Polidori, 1977; Vogl, Hegyi, Hiatt, Polin, & Indyk, 1978).

**Summary and Conclusions**

Much research has been done investigating noise sources and their effects in adults. In addition, studies regarding the effects of lighting have also been done with animals, adults, and children. Both noise and lighting and their potential effects are of concern in a hospital environment.

Sources of noise in hospitals range from equipment to staff communications. Noise levels range from 45 to 84 dB. Vasoconstriction, increased ACTH, disturbed sleep and relaxation, tense muscles, and decreased salivary and gastric secretions are a few of the symptoms associated with excessive noise levels.
in adults. It is uncertain as to what degree these effects are also true for children, and, at present, there are no guidelines or standards regarding noise levels and children.

Most hospital lighting is bright and continuous. Eyestrain is often caused by bright lighting and melatonin secretion is also suppressed. Regarding children, there is controversy as to the effects of fluorescent lighting on their activity level.

A few researchers have found that decreased light levels lead to reduced noise levels. Intensive care units are special areas of excess noise and continuous lighting. The environment has been described as over-stimulating and possibly contributory to ICU psychosis. Noise levels have been found to be around or above 70 dB. However, there are no firm conclusions as to the significance of these levels. The neonates in NICU are often at high-risk due to their prematurity, low birthweight, or disease, and yet the immediate effects or implications of a NICU environment are not known.

In the present study, noise levels and levels of illumination in an NICU were varied, and their effects
upon neonatal psychophysiological responses: heart rate, respiration rate, oxygen consumption, and blood pressure, were measured. These measures are sensitive to sympathetic nervous system reactivity such as that brought about by stressful environments.

Method

Setting

The setting for this study was the eight bed neonatal intensive care unit at San Joaquin General Hospital in French Camp, California. The neonatal intensive care nursery (NICU) consists of one large room, and infants are placed either in incubators or on open warm tables. Illumination consists of groups of overhead fluorescent lights arranged in three parallel rows. There are also nine large windows on three sides permitting natural lighting. Light can be decreased on individual infants by placing a blanket over the top of a particular incubator.

Infants receiving phototherapy have eyepatches on approximately 85% of the time. Most devices in the NICU, including ventilators, cardiac, respiratory, and transcutaneous oxygen monitoring devices, heaters on
warming tables, and incubators, have auditory alarms which are set to be triggered most of the time in the event of a machine malfunction or change in neonate health status. Neonates' temperatures, heart rate, blood oxygenation, blood pressure, and respiration rate are monitored. The specific functions monitored depend upon neonate health status.

To measure heart rate and respiration rate, pre-lubricated infant monitoring electrodes manufactured by Medtronic are placed on the neonates' left and right upper chest area and a ground electrode is attached to the right/left lower abdomen/leg. The electrode leads hook to a cable corresponding to the right/left upper arm or leg and the cable inserts into the neonatal monitors. Leads are only changed when they fall off. Heart rate and respiration rate are monitored on almost all neonates in the NICU.

Transcutaneous oxygen monitoring (TCM) values are measured through the use of a heat producing probe which is applied to any neonate skin surface except bony areas. The probe dilates blood vessels at the skin site and a sensor measures blood oxygenation
(pO₂). The probes are changed by respiratory therapists every 2 to 3 hours with more frequent changes for smaller neonates. Generally, TCM is monitored in neonates in serious or critical condition.

Blood pressure values are measured by an indwelling pressure catheter into the umbilical artery and then connected to a transducer and the blood pressure readout appears on the neonatal monitor. As with TCM, neonate blood pressure is monitored if neonate condition is serious.

Participants.

Neonates with various medical diagnoses and physical conditions are admitted to the NICU: Common conditions requiring admission include respiratory distress syndrome, infection, low birth weight, less than 36 weeks gestation, difficult delivery, low Apgar score, life threatening diseases, and hyperbilirubinemia (high bilirubin count). Primary reasons for admission to the NICU for participants in this study were prematurity and respiratory distress (Table 1).
Upon admission to the unit, nurses completed a neonate information sheet (Appendix A) on each neonate. The following information was obtained: gender, present age, estimated gestational age, date of admission to NICU, reason for admission, medications, comments, name of person filling out the form, and date the form was completed. Unique subject numbers were assigned to each neonate at this time and used in place of neonate names in data collection. Neonates were randomly assigned at this time to a light control or standard light condition. The light control condition consisted of reduced overhead/ambient lighting during certain time intervals during the study.

Measures were originally recorded on 40 neonates, 27 males and 13 females. However, only neonates who were monitored for 3 shifts, day shift, pm shift, and night shift, over 3 consecutive days were eventually included in the study, leaving a total of 8 participants, 7 males and 1 female, in this study. Mean estimated gestational age of the 8 neonates was 223 days.
Design, Intervention, and Measures

Treatment consisted of three 30 min periods each day of reduced noise and light, so that each participant neonate was exposed to repeated baseline and treatment periods. The intervention, "Quiet Time" was instituted at 1:00 p.m., 8:00 p.m., and 3:00 a.m. During Quiet Time, the following conditions were in effect: (a) Traffic was limited in and out of the unit; (b) Walking was kept to a minimum; (c) Auditory beeps of monitors were turned off, alarms remained on; (d) Visitors were restricted; (e) No feedings occurred; (f) Lab work and x-rays were postponed unless absolutely necessary; (g) Talking was kept to a minimum, and a radio on the unit was turned off; (h) Incoming telephone calls were limited when possible; and (i) Blankets were placed over isolettes randomly assigned to a light control condition. A letter (Appendix B) was given summarizing Quiet Time conditions and clarifying staff responsibilities during quiet time intervention.

Psychophysiological measures of heart rate, respiration rate, transcutaneous oxygen monitoring (TCM), and blood pressure, were recorded on data
sheets (Appendix C) from Hewlett Packard 78801 B Neonatal monitors. Heart rate and respiration rates were recorded for all participants, whereas TCM and blood pressure were recorded for short durations on some neonates only upon admission when in serious health status. Therefore fewer TCM and blood pressure measures were recorded. Data was not recorded for participant neonates while undergoing phototherapy or being aided by a ventilator due to excessive light and noise, respectively, from these therapies. It was also noted (Appendix D) whether or not neonates were in incubators or on warming tables.

To measure the lighting, a Sargent-Welch footcandle meter was used. It was held a few inches over neonate's eyes and held steadily and evenly until needle swung to a numerical value. The meter ranged from 0 to 75 footcandles (0-850.34 lx). The numerical value was recorded on the data sheet (Appendix D) and then the sound measurement was taken. Sound levels in the neonates immediate surroundings were measured by a hand-held digital Type I Bruel & Kjaer (B & K) 2232 sound level meter capable of measuring sound levels only in decibels.
Noise has frequency and intensity dimensions. Frequency is measured in Hertz and intensity is measured in decibels (dB). High frequency sounds are not only more damaging than low frequency sounds, the human ear is more sensitive to them. When decibels (linear scale) are measured on the A scale, (filtered, sound level) low frequency sounds are filtered out (Committee on Environmental Hazards, 1974).

I held the sound level meter over the neonate with the microphone near the neonate's ears. A button was pushed to clear or reset the meter and then a digital readout appeared with the dB sound measurement. The number which appeared was noted and the number was recorded on the data sheet (Appendix D).

All measures were recorded every 10 min beginning at 12:30 p.m., 7:30 p.m., and 2:30 a.m., for 30 min prior to each intervention period. This time period was labeled Pre-Quiet Time. Physiological measures were once again recorded every 10 min throughout the 30 min Quiet Time which were labeled: 10 min Quiet Time reading, 20 min Quiet Time reading, and 30 min
Quiet Time reading, respectively. Then normal NICU conditions were reinstituted and physiological measures were recorded at 10 min intervals for 30 min beginning at 1:30 p.m., 8:30 p.m., and 3:30 a.m.

**Procedure**

**Baseline.** Physiological measures as well as lighting and sound measures were recorded for 11 days prior to the intervention. In addition, this time was used to meet the NICU nursing staff to inform them of the study and get feedback regarding the institution of quiet time during pre-designated time periods. Staff were shown how to fill out data sheets, the neonate information form, and phototherapy and isolette forms (Appendices A & F). A letter was sent to NICU staff regarding baseline period (Appendix F).

**Data collection.** The study began February 16, 1985. I collected data for the first 2 weeks every 10 min throughout Pre-Quiet Times: 12:30 p.m., 7:30 p.m., 2:30 a.m., Quiet Times: 1:00 p.m., 8:00 p.m., and 3:00 a.m., and Post-Quiet Times: 1:30 p.m., 8:30 p.m., and 3:30 a.m., to ensure proper implementation of Quiet Time as well as to obtain light and sound measurements.
During the remainder of the study, I was present approximately 60% of the Quiet Times during each of the three hospital shifts (days, pm's, and nights) as determined by quasi-random sequence tables.

Two data sheets were used for each recording period: Pre-Quiet Time, Quiet Time, and Post-Quiet Time. One sheet was used to record psychophysiological measures from the neonatal monitors and the second sheet to record NICU light and sound measurements from a light and sound meter respectively, as well as to record neonate environmental condition—in isolette, in isolette with blanket to cover isolette during quiet time (thus reducing light) on warming table, or other neonate interventions such as oxygen, ventilator, and phototherapy application. Data sheets were kept in the top compartment of a letter file tray at the nursing station desk or were attached to an orange University of the Pacific clipboard when recording data.

When I was present, all recordings were done by me. When not present, nurses took turns recording data, or the task was given to the nurse least busy
during that time period. Nurses used a wall clock in the NICU to determine the 10 min recording intervals during Pre-Quiet Time, Quiet Time, and Post-Quiet Time. When it was time to record the measurements from the monitors, the data recorder walked around the nursery with the clipboard to record measures from the monitors by the appropriate participant numbers attached to the neonate's warming table or isolette. Participant numbers were written in orange ink on yellow Scotch Post-It notes for easy removal when a neonate was discharged and another neonate was admitted. When a neonate was randomly assigned to the light control condition (placing a blanket over isolette during Quiet Time), this was indicated on the neonate's isolette by writing a "B" in orange pen on a Scotch Post-It note placed next to the neonate's number on the isolette.

**Light and Sound Measurement**

Light and sound measurements were only taken when I was present. Immediately after recording psychophysiological measures from the monitors, light and sound measurements were recorded for each neonate. Measurements were taken throughout the study so as to
assess possible variations in light and sound measures throughout the study.

**Pre-Quiet Time**

Near the close of Pre-Quiet Time (12:30 p.m., 7:30 p.m., and 2:30 a.m.) and 5 min prior to the implementation of Quiet Time, a verbal statement was given to the nursing staff by either myself, when present, or by the nurse in charge: "Five minutes to Quiet Time." Prior to the implementation of Quiet Time (1:00 p.m., 8:00 p.m., and 3:00 a.m.) a Quiet Time poster made by me was placed in the entryway of the NICU. The neonatal monitors were turned down and the unit radio was turned off. Blankets were placed over designated isolettes, and Quiet Time went into effect. After several days, data collection and initiation of Quiet Time measures seemed to become routine for the staff.

**Quiet Time**

During Quiet Time, heart rate, blood pressure, oxygenation (TCM), and respiration rate measurements were recorded every 10 min as during Pre-Quiet Time. Sound and light measures were also taken every 30 min as previously described. Physiological measure
recordings were taken only when the neonates were not being handled by staff or other health personnel in order to eliminate the effect of staff handling on the measurements. Handling could increase or decrease neonate arousal and thus result in apparent psychophysiological changes. A "no handling" instruction was given to personnel during the recording times, however, in some cases it was not possible for unit staff to adhere to it.

Nurses generally spent Quiet Time sitting down in the unit doing a variety of things—they read, worked on hobbies, charted, or put heads down, among other things. A few nurses took a break in the nearby lounge. Other than an occasional unexpected phone call, a crying baby in the adjacent nursery, or a neonatal emergency, the NICU was successfully able to implement Quiet Time according to the prescribed criteria. Occasionally a nurse would do something noisely and another nurse would signal her and remind her of Quiet Time. There were several times when it was not possible to implement Quiet Time during the prescribed time period due to an emergency in the unit or a neonatal death. However, data was recorded during these periods.
Post Quiet Time

At the conclusion of Quiet Time, normal working and environmental conditions resumed. The poster was removed from the entryway as a signal to other nursery personnel that Quiet Time had ended.

Again psychophysiological measures were recorded during Post-Quiet Time every 10 min and sound and light measures were recorded during the first Post-Quiet Time recording as well as the last Post-Quiet Time recording (2:00 p.m., 9:00 p.m., and 4:00 a.m.) to get readings of light and sound measures 30 min Post-Quiet Time.

Staff Feedback and Perks

In order to keep staff informed on the progress of the study, a weekly newsletter (Appendices G-J) was posted as to the events of the previous week, including concerns about lack of compliance with Quiet Time implementation, and so forth. Newsletters were also sent to staff neonatologists and head nursing personnel for the NICU. A large tallyboard was posted in the NICU indicating the total number of recordings each shift (Day, P.M., and Night) took during the week. The shift having the most recordings were
recognized weekly via colorful and prominent signs posted in the unit. Examples included:
(a) "Fantastic Quiet Time P.M. shift! Thank you.",
(b) "Good work P.M. shift for a perfect record two weeks in a row.",
(c) "Superb Quiet Time night shift.",
(d) "I did not know the sound meter could go so low--excellent Quiet Time P.M. shift! Thanks.",
(e) "Congratulations day shift for recording data seven out of eight Quiet Times! Thank you."
On an intermittent basis, cakes and other goodies were brought in for the staff in appreciation for their cooperation with the study. Also, signs would be posted intermittently in regard to appreciation for overall cooperation throughout the study. Signs were also posted in the newborn nursery since the newborn nursery compliance was an important factor due to their close proximity to the NICU. Examples included
(a) "Happy St. Patrick's Day newborn nursery staff! Thank you for your help and cooperation with the NICU study,
(b) "Thank you newborn nursery staff for your cooperation with NICU Quiet Time." Signs in the NICU included:
(a) "Thanks to all of you this study has been a success! You have been great!",
(b) "Thank you
everyone--no recordings missed so far this week. Good work!", (c) "Thank you everyone for helping to make Quiet Time a success!", (d) "Thank you for your consistent data recording." At the completion of the study, the shift having the least missed recordings was given a pizza party.

**Quiet Time Questionnaires**

The week of March 22, 1985, about 1 week prior to the end of the study on March 31, a 15-item questionnaire (Appendix K) was distributed to 75 nursery and NICU staff. Included were physicians, nurses, respiratory therapists, ward clerks, and house cleaning personnel who were directly or indirectly involved with neonates in the NICU throughout the study. The questionnaires were designed to assess thoughts or feelings about the study. In addition, space was provided for comments. They were asked not to write their names on the completed questionnaires and upon completion were to put them in a tray at the nurses' station in the NICU.

**Results**

Neonate demographic information is summarized in Table 1. As indicated in Table 1, Neonates 8, 9, 14,
and 15 were in NICU throughout most of the study. Neonates 17, 18, 32, and 35 were in the unit for shorter durations. Neonates 9, 14, and 17 were in the light control condition throughout the study.

The premise of this study was that neonates would experience psychophysiological changes in response to changes in their ambient environment. Heart rate and blood pressure were expected to be higher during normal light and sound conditions, while respiration rate would be more rapid and transcutaneous oxygenation (TCM) would be lowered. During Quiet Time periods, these measures would change in the opposite directions: Heart rate and blood pressure were expected to be lowered, while respiration rate would be more regular and TCM would be higher.

Mean psychophysiological values across all neonates during Quiet and Non-Quiet times are presented in Table 2. Across all neonates, no difference was seen in heart rate during different NICU conditions. Respiration rate slightly decreased from Pre Quiet Time to Quiet Time but decreased even more during Post Quiet Time. TCM continually decreased across conditions. Systolic and diastolic
blood pressure decreased from Pre Quiet Time to Quiet Time but increased from Quiet Time to Post Quiet Time. Mean psychophysiological values during Quiet and Non-Quiet Time conditions are presented in Tables 3-10 for each neonate and results will be summarized in the text to follow.

**Heart rate**

Mean measurements were obtained from all neonates and no change occurred during different NICU conditions (Table 2). From Pre Quiet Time to Quiet Time, Neonates 8, 9, 18, and 32 had decreases in heart rate as was expected (Tables 3, 4, 8, & 9). Neonates 15 and 17 (Tables 6 & 7) experienced no overall change in heart rate whereas Neonates 14 and 35 (Tables 5 & 10) had slight increases in heart rate. From Quiet Time to Post Quiet Time no overall change in heart rate for Neonates 9 and 18. For Neonates 8, 14, 15, 17, and 35 heart rate increased from Quiet Time to Post Quiet Time whereas in Neonate 32, heart rate decreased.

Table 11 summarizes mean psychophysiological measures within Quiet Time. Neonates 8, 14, 15, and 35 had declines in heart rate progressively throughout
Quiet Time. Heart rate remained relatively the same throughout Quiet Time in Neonate 9. Neonates 17, 18, and 32 showed decreases from 10 min to 20 min recording then heart rate increased by one beat during the last Quiet Time reading. Across all neonates, there was a progressive decrease in heart rate within the 30 min Quiet Time period.

Graphs of heart rate for each participant over the course of the study with corresponding light and sound values are presented in Figures 1 to 8, pp. 86-114. From examining these graphs that there are no sharp changes in physiological measures as a function of Quiet Time. As seen on pp. 86-91, Neonate 8's heart rate remained relatively unchanged throughout each environmental condition. This was also the case with Neonate 9 (pp. 92-97), Neonate 17's (pp. 108-110) and Neonate 32's (p. 113). Heart rate increased in response to Quiet Time. Neonate 14's heart rate also had a small increase between Pre Quiet Time and Post Quiet Time which is not concurrent with the expected results (pp. 98-101). Only one infant, Neonate 18 (pp. 111-112) demonstrated decrease in heart rate between Pre Quiet Time and Quiet Time as well as
between Quiet Time and immediately after Quiet Time, and also between Pre Quiet Time and Post Quiet Time.

In summary, decreases noted in computed heart rate means of Neonates 8, 9, 18, and 32 were all slight decreases. In fact, the heart rate differences between Pre Quiet Time, Quiet Time, and Post Quiet Time were also very slight. Within Quiet Time mean measures showed decreases in heart rate the longer the non-stressful environment was in effect.

Respiration rate

Measurements were obtained from all participants and mean respiration rate decreased slightly from Pre Quiet Time to Quiet Time (Table 2). Increases were noted for 14, 32 and 35 (Tables 5, 9, & 10) from Pre Quiet Time to Quiet Time. From Quiet Time to Post Quiet Time, decreases occurred for all neonates except Neonate 17 (Table 7).

Successive respiration rate decreases from Pre Quiet Time to Post Quiet Time were seen in Neonates 8, 9, 15 and 18 (Tables 3, 4, 6, & 8). Neonates 32 and 35 (Tables 9 & 10) experienced slight increases in respiration rate during Quiet Time and then returned to Pre Quiet Time level during Post Quiet Time.
recording. However, Neonate 14's (Table 5) respiration rate decreased from Quiet Time to Post Quiet Time but the Post Quiet Time reading was higher than Pre Quiet Time reading. Neonate 17 (Table 7) decreased from Pre Quiet Time to Quiet Time but increased from Quiet Time to Post Quiet Time.

Within Quiet Time respiration rates (Table 12) indicated a decrease from the 10 min Quiet Time reading to the 20 min Quiet Time reading for Neonates 8, 9, 17, and 18 and increased from the 10 min Quiet Time reading to the 20 min Quiet Time reading in Neonates 14, 15, 32, and 35. Continual decreases in respiration rate throughout Quiet Time were seen in Neonates 9 and 18. Neonates 15, 32, and 35 showed increases in respiration rate throughout Quiet Time.

Graphs representing respiration rates and accompanying sound and light levels for all neonates are presented in Figures 9-16 (pp. 115-140). Examination of these graphs reveals no noticeable changes across conditions in respiration rate or regularity in Neonate 14 (pp. 127-128), Neonate 15 (pp. 129-134), Neonate 32 (p. 139), and Neonate 35 (p. 140). In Neonate 17, respiration rate increased
in response to Quiet Time (pp. 135-136). Three participants exhibited changes in the expected direction, a decrease in respiration rate as Quiet Time progressed. Neonate 8's (pp. 115-120) respiration rate decreased between Quiet Time and Post Quiet Time which is consistent with the hypothesis of decreased respiration rate during non-stress environmental conditions. There was a relative decrease in respiration rate between Quiet Time and immediately after Quiet Time in Neonate 9 (pp. 121-126). And in Neonate 18 (pp. 137-138), respiration rate showed a relative decrease between Pre Quiet Time as well as between Quiet Time and immediately after Quiet Time and also between Pre Quiet Time and Post Quiet Time.

In summary, respiration rate generally decreased from Pre Quiet Time to Quiet Time and from Quiet Time to Post Quiet Time as exhibited by both the computed mean values and graphical presentations. Although the computed means are consistent with the graphical trends, which also supports the hypothesis, the general decrease in respiration rate is slight. There does not appear to be a consistent trend within Quiet Time readings for respiration rate.
Transcutaneous blood oxygenation measures were obtained for all neonates. However, results are based on fewer recordings than heart rate and respiration rate. These are usually monitored throughout the infants stay in NICU whereas TCM is monitored usually upon admittance to the unit and is discontinued when a neonate's condition has stabilized.

Increases in TCM are expected as an environment becomes less stressful. Mean TCM values for all neonates decreased from Pre Quiet Time to Post Quiet Time (Table 2). Mean values are summarized in Tables 3-10 for individual neonates. Neonates 14, 32, and 35 (Tables 5, 9, & 10) showed increases from pre Quiet Time to Quiet Time then decreases from Quiet Time to Post Quiet Time. Neonates 8, 9, and 15 TCM measures (Tables 3, 4, & 6) decreased from Pre Quiet Time to Quiet Time, and continued to decrease from Quiet Time to Post Quiet Time. Neonate 17 (Table 7) had a decrease from Pre Quiet Time to Quiet Time but showed an increase from Quiet Time to Post Quiet Time.

Within Quiet Time mean readings for TCM indicate only Neonate 32 exhibited (Table 13) steady increases
in TCM throughout Quiet Time. Neonates 8, 15, and 32 had increases from the 10 min Quiet Time reading but decreases from the 20 min Quiet Time reading to the 30 min Quiet Time reading. However, Neonates 9, 14, 17, and 35 had TCM values that decreased by the 20 min Quiet Time reading. Of these Neonates, 9, 32, and 35 showed increased TCM during the 30 min Quiet Time reading. Neonate 17 had continual TCM decreases throughout the entire Quiet Time period resulting in an overall lower TCM value at the conclusion of Quiet Time.

TCM values are graphically displayed in Figures 17-23 (pp. 141-150). Review of these graphs shows TCM did not exhibit any changes/trends in Neonate 9 (pp. 143-144). There was overall decrease in TCM in Neonate 14 (pp. 145-146) in which TCM appears to decrease between Pre Quiet Time and overall Post Quiet Time.

Increased TCM occurred in Neonates 8, 17, 32, and 35. Neonate 8 (pp. 141-142) had an increase between Quiet Time and overall Post Quiet Time as well as between Pre Quiet Time and Post Quiet Time. TCM values compared from Quiet Time to overall Post Quiet
Time notably increased in Neonate 17 (p. 148) as well. In Neonate 35 (p. 150), TCM values showed a relative increase between Quiet Time and immediately after Quiet Time. In Neonate 32 (p. 149) TCM values exhibited an increase from Quiet Time to overall Post Quiet Time as well as from Pre Quiet Time to Post Quiet Time.

In summary, TCM values found through computed means and through graphical examination were relatively consistent. The changes noted, however, were usually minimal. Generally, the computed mean values of TCM and the graphical analysis of TCM both showed a decrease from Pre Quiet Time to Quiet Time and from Quiet Time to Post Quiet Time.

**Blood Pressure**

Only Neonates 14, 32, and 35 were monitored for blood pressure readings. This measure, like TCM, is usually monitored for a brief period of time while neonates are critically ill.

Mean systolic blood pressure for all three neonates decreased from Pre Quiet Time to Quiet Time then increased from Quiet Time to Post Quiet Time, as would be expected. Thus, lowest systolic blood
pressure occurred during Quiet Time. Systolic blood pressure is the only psychophysiological measure of those recorded throughout the study that showed the expected changes consistently as Quiet Time periods were instituted and removed. Mean diastolic blood pressure measures reflected the same pattern for all neonates as did mean systolic blood pressure (Tables 2, 5, 9, & 10).

Mean within Quiet Time evaluation of systolic blood pressure values for (Table 14) Neonate 14, increased throughout Quiet Time. For Neonate 32, systolic blood pressure decreased slightly during the 10 min Quiet Time reading and continued to decrease throughout Quiet Time. A decrease during the 10 min to 20 min Quiet Time reading occurred for Neonate 35 but from the 20 min to 30 min reading an increase occurred. However, overall blood pressure values at the conclusion of Quiet Time were lower than at the 10 min Quiet Time reading.

Mean within Quiet Time diastolic blood pressure slightly increased for Neonate 14 during the 20 min Quiet Time reading then slightly decreased at the 30 min Quiet Time reading. In Neonate 35, decreases
occurred throughout Quiet Time and in Neonate 32 there was a slight increase in diastolic blood pressure in the 20 min Quiet Time reading but did decrease in the 30 min Quiet Time reading resulting in an overall slightly lower diastolic blood pressure than at start of Quiet Time.

Graphical representation of blood pressure values are presented in Figures 24-26. Examination of these graphs shows relatively no changes in blood pressure values in Neonates 32 and 35 (pp. 152-154). However, in Neonate 14 (p. 151), systolic blood pressure appeared to decrease between Pre Quiet Time and Quiet Time which is consistent with expected results. Systolic blood pressure between Quiet Time and Post Quiet Time exhibited an increase which is not consistent with the expected. Diastolic blood pressure was similar to systolic pressure in following similar and relative trends, but at a smaller magnitude.

In summary, blood pressure generally decreased from Neonates 14, 32, and 35 from Pre Quiet Time to Post Quiet Time. Specifically, all 3 neonates exhibited a slight systolic blood pressure decrease
and a slight decrease in diastolic blood pressure from Pre Quiet Time to Post Quiet Time. This was supported by both computed mean values and graphical examination which is consistent with the expected results.

Psychophysiological Quiet Time measures across hospital shifts

Analysis was performed to see if there were differences in Quiet Time psychophysiological measures across hospital shifts/time periods to ascertain if this would be a factor in possible psychophysiological changes. Hospital shifts were divided into day (7am-3pm), pm (3pm-11pm), and night (11pm-7am) shifts. Results are summarized in Table 15 and based on these results, changes were seen in heart rate for 7 out of 8 neonates.

Heart rate values were lowest during day shift for Neonates 9, 14, 15, 17, 32, and 35. There did not seem to be a distinct pattern that indicated when lowest respiration rate occurred. In Neonates 8, 14, 32, and 35 TCM values were highest during day shift. There did not seem to be any distinct pattern for blood pressure values. Neonate 14 was the only neonate who had a consistent pattern of when lowest
or greatest psychophysiological rates occurred; during day shift, measures were at their lowest or highest accordingly.

An analysis of overall sound levels (Table 17) was performed to ascertain whether or not the independent variable was effectively manipulated as a result of implementing Quiet Time measures. The sound level ANOVA indicated a significant reduction in sound level across Quiet Time periods throughout the study, \( F(2,14) = 16.08, p < .01 \).

Visual inspection of light values indicated there was no need to do an analysis of the light conditions. Overall, light values for neonates during Quiet Time were lower than during other environmental conditions. Neonates 9, 14, and 17 were randomly assigned to light control condition, using blankets over the isolettes during Quiet Time and, as shown in Table 18, this method of reducing ambient lighting was effective.

A comparison of light and sound values across hospital shifts to examine any possible differences is summarized in Table 19. There appeared to be very small differences across shift or times of day in regard to sound measurement during Quiet Time. It
is interesting to note that night shift was the quietest time period for 1 neonate and p.m. shift was the quietest time period for 5 neonates. Day shift was the loudest time period for 4 neonates as would be expected with greater numbers of staff and visitors moving around.

Light values were highest for 4 neonates during day shift as would be expected because of outside natural lighting coming through the large windows. However, for 4 of the neonates, day shift was the least brightly lighted environment. Night shift light values were at their brightest for 3 neonates.

**Quiet Time Questionnaire Results**

Forty questionnaires were returned, approximately 40% of the questionnaires given to neonatal staff and personnel. A breakdown of the questionnaires returned according to shifts found 19% were from the day shift, 14% from the pm shift, and 7% from the night shift.

There were fewer personnel working night shift and they had the poorest record of Quiet Time recordings.

Questionnaire results are summarized in Table 20. The highest mean (8.7) score on a 9 point scale (where a high score was a positive reaction) was Item 4.
(Appendix K). This indicated visual feedback was not only noticed, but served as a staff reminder. Other items that scored high in staff satisfaction with Quiet Time (a score of 7 or better) included Items 1 (8.1), 5 (8.6), 6 (8.2), 7 (7.1), 10 (8.1), 12 (7.5), 13 (8.5), 14 (7.9), and 15 (8.5). These indicated that the Quite Time intervention was: (a) viewed positively by the staff, (b) not difficult to implement, (c) a valuable time for neonates. Item 11, the lowest mean value, "Recording vital sign measures was (1) a pain, (5) not a bother, (9) a pleasure." This may have been due in part to the fact that NICU nurses have so many tasks in the care of critically ill neonates, recording vital signs was just one more thing to do.

Generally speaking, NICU staff viewed the study positively, overall their role was clear, feedback was helpful, interactions with the experimenter were positive, and they believed Quiet Time was an important time for the neonates to have in the NICU environment.
Discussion

The expected decrease of heart rate, respiration rate, and blood pressure, and increase of TCM did not occur across neonates from a stressful NICU environment (Non-Quiet Time condition) to a less stressful NICU environment (Quiet Time condition). There were some individual results in the expected direction due to the Quiet Time intervention, however, there were numerous inconsistencies. For instance, in a particular neonate, heart rate may have been relatively unaffected by treatment intervention whereas respiration rate changed in the appropriate direction. Consistency of any kind across measures and across neonates was not evident. However, with the small number of neonate (n = 8) participants in the study, strong conclusive remarks cannot be made regarding the effect of Quiet Time conditions. Also, unavoidable and random circumstances in NICU such as nursing staff shortages, rapidly changing patient health status and patient census, and numerous other conditions may have impaired the reliability of treatment implementation throughout the study. In these situations, priorities are established
and implementation of Quiet Time conditions was not a high priority. I took steps to improve overall validity such as pre-training sessions with nursing personnel, hanging posters in the unit outlining Quiet Time conditions, use of feedback posters and perks, and being present in the unit at various times, however, too many other factors lowered the reliability of treatment implementation.

Due to the numerous recordings and large amount of data, mean values (Tables 2-10) were not representative of changes in individual neonates between Pre Quiet Time, Quiet Time, and Post Quiet Time.

Infant State

A variety of factors can influence neonate psychophysiological functioning, including handling by staff, or whether or not neonates are in a particular sleep state. In active sleep, respiration rate is more irregular in amplitude and faster. This may account for large fluctuations as demonstrated by graphical data.

Crying can cause irregular patterns in heart rate and respiration rate and it was not noted whether or not particular neonates were crying at a given time.
during data recordings. TCM may be affected by crying as well.

If a neonate was recently fed, as was often the case, prior to Quiet Time (since no feedings occurred during Quiet Time), psychophysiological readings may have been irregular from time to time within the same individual. Feeding may affect TCM and heart rate may increase or decrease as a result of feeding and thus blood pressure is also invariably affected.

Due to the critical nature of the neonates they were often given medication that directly affected psychophysiological measures. Neonate 18, for example, was given theophylline (sympathomimetic and thus a bronchodilator) for apnea problems and this causes side effects of increased heart rate.

Various medical conditions can also affect measures. Neonate 14 had a pneumothorax (collapsed lung) requiring insertion of a chest tube. Heart rate usually increases as a compensatory mechanism (heart rate values are in the 160's even during Quiet Time for this sick premature infant). Neonates 14 and 35 suffered from respiratory distress syndrome which affects respiration rate, TCM, and possibly heart rate.
Another possible condition due to prematurity of the neonates was deafness or impaired hearing, thus making them unresponsive to changes in the sound environment. However, hearing was not evaluated in any of the neonates included in this study.

Preterm and sick infants may react less to variation in such environment stimuli as light and sound and, males may respond to light and sound variables differently than females, only one female was monitored throughout the study. Respiration patterns become more regular with increased age. Age was expected to be a factor in influencing respiration patterns, but it did not prove to be so in this study. Neonates 32, 17, 18, and 35 had EGA of 43 weeks, 32 weeks, and 31.5 weeks, respectively. The infants' respiration rates were not regular, which they should have been in comparison to younger neonates.

Instrumentation

Artifacts in all measures may be caused by neonatal movements and problems with electrode contact. For instance, respiration rate was measured through an apnea monitor that detects variable motion between two electrodes. The motion of an arm or the
kick of a leg may be recorded by the apnea monitor as a breath, when in actuality there was only motion between the electrodes. Variations in TCM readings can occur if TCM sensors are not changed regularly, and if they have recently been attached, the first few readings may not be accurate.

**Sound and Light**

The American Academy of Pediatrics Committee on fetus and newborn recommended 75 dB (A) as the maximum sound level permitted in the nursery and incubators. Even at highest recording 63 dB (A), San Joaquin NICU sound levels were well below recommended criteria. However, the lower the sound level of continuous noise the better. It is possible that despite the difference in sound levels from Pre-Quiet Time, Quiet Time, and Post-Quiet Time, the physical differences were not great enough to create significantly different physiologically stressful environments for the neonates.

Continued staff awareness of noise levels in the NICU was the major factor in reducing sound levels during the study. Overall, the NICU nursery sound levels were within the range of other NICU's previously studied.
Throughout the study, even though not formally recorded, it was observed that neonates' eyes were open the majority of the time unlike reports in previous studies. This may have been because measured light levels (footcandles) were lower than in other studies. Mean light levels in NICU in one study was 350.7 fc; values in the present study were considerably lower (Pre-Quiet Time = 328.5 fc, Quiet Time = 279.3 fc, Post-Quiet Time = 326.3 fc). Thus, though the neonates in this study were exposed to almost constant lighting, it was not as bright as in other NICU's.

In summary, a variety of conditions can influence the psychophysiological status of neonates over and above the level of lighting and sound, and the effects of these other conditions could obscure or override effects of sound and light variations in any individual instance. One can speculate that noise and lighting are just two of the many stressors neonates are exposed to during their NICU stay. Since neonates at times close their eyes throughout a 24 hr period, noise is probably a greater stressor to the neonates in the unit than overhead lighting. In addition,
adverse effects of noise on various populations as previously discussed are more clearly defined than the possible adverse effects of lighting.

**Duration of Quiet Time**

If Quiet Time had been longer than 30 min, there might have been a greater consistency in observed psychophysiological measures. In examining the graphical trends of the data, a slight trend toward a more relaxed psychophysiological state appears within the Quiet Time data, however, cessation of Quiet Time occurs so early that these trends are never established and possible new physiological equilibria under these conditions could not develop. It is also possible that given the prematurity of the infants less developed nervous systems, Quiet Time was long enough but the possible beneficial physiological effects to the neonates may not have been evident in the 30 min recording period following Quiet Time.

That is, the beneficial effects may have showed up quite a while after being exposed to the non-stressful condition.
NICU Staff

Based on questionnaire comments, results, and informal conversations with NICU staff, Quiet Time was a positive experience for them. An important indicator of this was that 6 months post-study, the staff was continuing to execute Quiet Time at least one time during each shift. They even continued to use the Quiet Time posters they requested to keep after the study had come to an end.

Nurses commented on how they enjoyed having a quieter and not so bright unit. As an additional benefit of Quiet Time, staff conveyed to me that they enjoyed having NOT to handle neonates. Most staff felt babies are handled too much and excessive handling has been shown to bring about adverse changes in psychophysiological states, sometimes inducing hypoxemia. The study seemed to develop a greater awareness on the part of the staff, particularly nursing personnel of various effects as a result of conditions in the NICU.

In previous studies, it has been demonstrated that NICU staff experience high rates of psychophysiological symptomatology, depression,
anxiety, and mood disorders often in part due to the stressful nature of their job. The positive staff response to Quiet Time was not anticipated. It seemed to serve as a brief stress break for them during their shift and this was supported both anecdotally by nursing staff and their supervisors. Many nurses used Quiet Time to read, knit, close their eyes momentarily, or chart progress notes, a task they often have to make time to do. Quiet Time periods may have inadvertently provided staff with a method to reduce job stress and thus, possibly improved the quality of their physical and mental health. This in turn could have served as an indirect means to improve the quality of their job performance.

Future Concerns

The present study was an initial step in the examination of environmental conditions effects on neonates in NICU. Given the individual difference and other factors, in retrospect it is not surprising that there were no large mean variations in psychophysiological measures between baseline and Quiet Times. If this study were to be replicated, several things might be changed to control for
some factors previously discussed. For instance, in regard to neonate characteristics, one thing to consider is infant age in order to better control for age-related factors. In addition, evaluating physical disorder and medications more carefully may also be helpful.

As far as instrumentation changes are concerned, respiration rate should be measured by air exchange rather than using an apnea monitor, thereby including measures of air volume, rate, and relative content of gases during expiration. Installing an automatic data collection system would allow for 24 hour recording of physiological measures and environmental conditions and facilitate a better understanding of neonate responses to their environments on a more continual basis throughout their stay in NICU.

Taking these steps and others may allow the possible beneficial effects of Quiet Time on neonate psychophysiology to become more apparent in future studies.
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<th>Physical Disorder</th>
<th>Duration of data collected</th>
<th>Psycho-physiological condition</th>
<th>Light control (blanket over isolette during QT)</th>
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*ECA = estimated gestational age
1° = primary diagnosis
QT = Quiet Time

HR = heart rate
RR = respiration rate
TCM = transcutaneous oxygen monitoring
BP = blood pressure
Table 2

Mean Psychophysiological Values During Different NICU Environment Conditions For All Neonates (n = 8)

<table>
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<tr>
<th>Measure</th>
<th>Pre QT</th>
<th>QT</th>
<th>Post QT</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR</td>
<td>148.0</td>
<td>148.0</td>
<td>148.0</td>
</tr>
<tr>
<td>RR</td>
<td>55.4</td>
<td>55.2</td>
<td>54.5</td>
</tr>
<tr>
<td>TCM</td>
<td>66.0</td>
<td>63.5</td>
<td>57.4</td>
</tr>
<tr>
<td>SBP (n = 3)</td>
<td>62.9</td>
<td>60.7</td>
<td>63.0</td>
</tr>
<tr>
<td>DBP (n = 3)</td>
<td>37.0</td>
<td>35.1</td>
<td>37.3</td>
</tr>
</tbody>
</table>

QT = Quiet Time
HR = heart rate
RR = respiration rate
TCM = transcutaneous oxygen monitoring
SBP = systolic blood pressure
DBP = diastolic blood pressure
Table 3

Mean Psychophysiological Values During Different NICU Environmental Conditions For Neonate #8

<table>
<thead>
<tr>
<th>Measure</th>
<th>Pre QT</th>
<th>QT</th>
<th>Post QT</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR</td>
<td>158.2</td>
<td>157.9</td>
<td>158.4</td>
</tr>
<tr>
<td>RR</td>
<td>52.9</td>
<td>52.6</td>
<td>52.2</td>
</tr>
<tr>
<td>TCM</td>
<td>54.5</td>
<td>56.8</td>
<td>61.9</td>
</tr>
</tbody>
</table>

QT = Quiet Time
HR = heart rate
RR = respiration rate
TCM = transcutaneous oxygen monitoring
Table 4

Mean Psychophysiological Values During Different NICU Environment Conditions For Neonate #9*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Pre QT</th>
<th>QT</th>
<th>Post QT</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR</td>
<td>148.7</td>
<td>147.2</td>
<td>147.8</td>
</tr>
<tr>
<td>RR</td>
<td>54.1</td>
<td>53.2</td>
<td>52.9</td>
</tr>
<tr>
<td>TCM</td>
<td>55.3</td>
<td>58.5</td>
<td>54.5</td>
</tr>
</tbody>
</table>

QT = Quiet Time  
HR = heart rate  
RR = respiration rate  
TCM = transcutaneous oxygen monitoring  

*In light control condition
Table 5

Mean Psychophysiological Values During Different NICU Environment Conditions For Neonate #14*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Pre QT</th>
<th>QT</th>
<th>Post QT</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR</td>
<td>161.6</td>
<td>162.8</td>
<td>164.4</td>
</tr>
<tr>
<td>RR</td>
<td>56.9</td>
<td>60.7</td>
<td>59.9</td>
</tr>
<tr>
<td>TCM</td>
<td>61.1</td>
<td>66.0</td>
<td>70.5</td>
</tr>
<tr>
<td>SBP</td>
<td>62.9</td>
<td>59.8</td>
<td>61.3</td>
</tr>
<tr>
<td>DBP</td>
<td>32.1</td>
<td>30.0</td>
<td>31.0</td>
</tr>
</tbody>
</table>

QT = Quiet Time
HR = heart rate
RR = respiration rate
TCM = transcutaneous oxygen monitoring
SBP = systolic blood pressure
DBP = diastolic blood pressure

*In light control condition
Table 6

Mean Psychophysiological Values During Different NICU Environment Conditions For Neonate #15

<table>
<thead>
<tr>
<th>Measure</th>
<th>Pre QT</th>
<th>QT</th>
<th>Post QT</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR</td>
<td>151.3</td>
<td>151.4</td>
<td>152.6</td>
</tr>
<tr>
<td>RR</td>
<td>53.2</td>
<td>50.2</td>
<td>50.1</td>
</tr>
<tr>
<td>TCM</td>
<td>75.4</td>
<td>67.5</td>
<td>-</td>
</tr>
</tbody>
</table>

QT = Quiet Time
HR = heart rate
RR = respiration rate
TCM = transcutaneous oxygen monitoring
Table 7

Mean Psychophysiological Values During Different NICU Environment Conditions For Neonate #17*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Pre QT</th>
<th>QT</th>
<th>Post QT</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR</td>
<td>146.0</td>
<td>146.0</td>
<td>148.4</td>
</tr>
<tr>
<td>RR</td>
<td>47.5</td>
<td>46.0</td>
<td>47.8</td>
</tr>
<tr>
<td>TCM</td>
<td>79.2</td>
<td>74.5</td>
<td>84.3</td>
</tr>
</tbody>
</table>

QT = Quiet Time  
HR = heart rate  
RR = respiration rate  
TCM = transcutaneous oxygen monitoring

*In light control condition
Table 8

Mean Psychophysiological Values During Different NICU Environment Conditions For Neonate #18

<table>
<thead>
<tr>
<th>Measure</th>
<th>Pre QT</th>
<th>QT</th>
<th>Post QT</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR</td>
<td>157.5</td>
<td>155.8</td>
<td>155.3</td>
</tr>
<tr>
<td>RR</td>
<td>56.1</td>
<td>54.0</td>
<td>50.3</td>
</tr>
</tbody>
</table>

QT = Quiet Time
HR = heart rate
RR = respiration rate
### Table 9

<table>
<thead>
<tr>
<th>Measure</th>
<th>Pre QT</th>
<th>QT</th>
<th>Post QT</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR</td>
<td>134.7</td>
<td>132.7</td>
<td>130.5</td>
</tr>
<tr>
<td>RR</td>
<td>82.3</td>
<td>84.4</td>
<td>82.2</td>
</tr>
<tr>
<td>TCM</td>
<td>57.8</td>
<td>57.0</td>
<td>64.1</td>
</tr>
<tr>
<td>SBP</td>
<td>72.1</td>
<td>70.0</td>
<td>71.5</td>
</tr>
<tr>
<td>DBP</td>
<td>48.4</td>
<td>46.3</td>
<td>47.4</td>
</tr>
</tbody>
</table>

QT = Quiet Time  
HR = heart rate  
RR = respiration rate  
TCM = transcutaneous oxygen monitoring  
SBP = systolic blood pressure  
DBP = diastolic blood pressure
Table 10

Mean Psychophysiological Values During Different NICU Environment Conditions For Neonate #35

<table>
<thead>
<tr>
<th>Measure</th>
<th>Pre QT</th>
<th>QT</th>
<th>Post QT</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR</td>
<td>126.0</td>
<td>129.9</td>
<td>130.0</td>
</tr>
<tr>
<td>RR</td>
<td>40.5</td>
<td>41.0</td>
<td>40.5</td>
</tr>
<tr>
<td>TCM</td>
<td>61.7</td>
<td>56.6</td>
<td>76.1</td>
</tr>
<tr>
<td>SBP</td>
<td>53.8</td>
<td>52.4</td>
<td>55.8</td>
</tr>
<tr>
<td>DBP</td>
<td>30.5</td>
<td>29.0</td>
<td>33.5</td>
</tr>
</tbody>
</table>

QT = Quiet Time
HR = heart rate
RR = respiration rate
TCM = transcutaneous oxygen monitoring
SBP = systolic blood pressure
DBP = diastolic blood pressure
Table 11

Mean Heart Rate Values During Quiet Time (QT)

<table>
<thead>
<tr>
<th>Neonate</th>
<th>10 min QT</th>
<th>20 min QT</th>
<th>30 min QT</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>159.0</td>
<td>158.0</td>
<td>157.0</td>
</tr>
<tr>
<td>9*</td>
<td>147.6</td>
<td>147.0</td>
<td>147.2</td>
</tr>
<tr>
<td>14*</td>
<td>164.0</td>
<td>163.2</td>
<td>161.6</td>
</tr>
<tr>
<td>15</td>
<td>152.4</td>
<td>152.1</td>
<td>150.0</td>
</tr>
<tr>
<td>17*</td>
<td>146.2</td>
<td>145.4</td>
<td>146.4</td>
</tr>
<tr>
<td>18</td>
<td>157.7</td>
<td>154.5</td>
<td>155.3</td>
</tr>
<tr>
<td>32</td>
<td>136.0</td>
<td>130.1</td>
<td>131.7</td>
</tr>
<tr>
<td>35</td>
<td>132.9</td>
<td>129.8</td>
<td>127.0</td>
</tr>
<tr>
<td>ALL</td>
<td>149.5</td>
<td>147.5</td>
<td>147.0</td>
</tr>
</tbody>
</table>

*In light control condition
Table 12

Mean Respiration Rate Values During Quiet Time (QT)

<table>
<thead>
<tr>
<th>Neonate</th>
<th>10 min QT</th>
<th>20 min QT</th>
<th>30 min QT</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>52.1</td>
<td>51.3</td>
<td>54.5</td>
</tr>
<tr>
<td>9*</td>
<td>53.5</td>
<td>53.2</td>
<td>53.0</td>
</tr>
<tr>
<td>14*</td>
<td>59.5</td>
<td>63.4</td>
<td>59.2</td>
</tr>
<tr>
<td>15</td>
<td>48.6</td>
<td>50.0</td>
<td>52.4</td>
</tr>
<tr>
<td>17*</td>
<td>48.4</td>
<td>42.8</td>
<td>46.8</td>
</tr>
<tr>
<td>18</td>
<td>59.3</td>
<td>51.3</td>
<td>50.5</td>
</tr>
<tr>
<td>32</td>
<td>72.3</td>
<td>85.7</td>
<td>96.0</td>
</tr>
<tr>
<td>35</td>
<td>39.5</td>
<td>40.7</td>
<td>43.0</td>
</tr>
<tr>
<td>ALL</td>
<td>54.2</td>
<td>54.8</td>
<td>56.9</td>
</tr>
</tbody>
</table>

*In light control condition
### Table 13

Mean TCM Values During Quiet Time (QT)

<table>
<thead>
<tr>
<th>Neonate</th>
<th>10 min QT</th>
<th>20 min QT</th>
<th>30 min QT</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>55.0</td>
<td>59.3</td>
<td>57.0</td>
</tr>
<tr>
<td>9*</td>
<td>64.3</td>
<td>55.0</td>
<td>56.0</td>
</tr>
<tr>
<td>14*</td>
<td>68.0</td>
<td>63.1</td>
<td>68.2</td>
</tr>
<tr>
<td>15</td>
<td>65.0</td>
<td>69.5</td>
<td>68.0</td>
</tr>
<tr>
<td>17*</td>
<td>76.0</td>
<td>74.8</td>
<td>73.0</td>
</tr>
<tr>
<td>32</td>
<td>55.5</td>
<td>56.9</td>
<td>58.8</td>
</tr>
<tr>
<td>35</td>
<td>53.6</td>
<td>52.8</td>
<td>63.3</td>
</tr>
<tr>
<td><strong>ALL</strong></td>
<td><strong>64.7</strong></td>
<td><strong>61.6</strong></td>
<td><strong>62.6</strong></td>
</tr>
</tbody>
</table>

*In light control condition*
Table 14

Mean Systolic and Diastolic Blood Pressure
During Quiet Time (QT)

<table>
<thead>
<tr>
<th>Neonate</th>
<th>10 min QT</th>
<th>20 min QT</th>
<th>30 min QT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic Blood Pressure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14*</td>
<td>57.0</td>
<td>59.0</td>
<td>63.3</td>
</tr>
<tr>
<td>32</td>
<td>70.4</td>
<td>70.3</td>
<td>68.1</td>
</tr>
<tr>
<td>35*</td>
<td>54.3</td>
<td>50.0</td>
<td>53.4</td>
</tr>
<tr>
<td>ALL</td>
<td>60.6</td>
<td>59.8</td>
<td>61.8</td>
</tr>
<tr>
<td>Diastolic Blood Pressure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14*</td>
<td>29.0</td>
<td>31.0</td>
<td>30.5</td>
</tr>
<tr>
<td>32</td>
<td>46.9</td>
<td>47.1</td>
<td>44.8</td>
</tr>
<tr>
<td>35</td>
<td>30.7</td>
<td>28.5</td>
<td>28.4</td>
</tr>
<tr>
<td>ALL</td>
<td>35.5</td>
<td>35.5</td>
<td>34.6</td>
</tr>
</tbody>
</table>

*In light control condition
Table 15
Mean Quiet Time Comparison Of Psychophysiological Measures Across Hospital Shifts

<table>
<thead>
<tr>
<th></th>
<th>1 - Day Shift (12:30-2:00 PM)</th>
<th>2 - PM Shift (7:30-9:00 PM)</th>
<th>3 - Night Shift (2:30-4:00 AM)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3</td>
<td>1 2 3</td>
<td>1 2 3</td>
</tr>
<tr>
<td><strong>HR</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neonate 8</td>
<td>159.0 157.4 158.0</td>
<td>145.8 149.0 150.0</td>
<td>160.0 163.6 165.0</td>
</tr>
<tr>
<td>RR</td>
<td>52.5 53.0 53.0</td>
<td>53.7 52.6 54.2</td>
<td>55.2 60.0 61.1</td>
</tr>
<tr>
<td>TCM</td>
<td>56.7 52.2 55.9</td>
<td>51.2 56.7 58.0</td>
<td>71.0 65.0 60.6</td>
</tr>
<tr>
<td>SBP</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>DBP</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>HR</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neonate 9*</td>
<td>1 2 3</td>
<td>1 2 3</td>
<td>1 2 3</td>
</tr>
<tr>
<td>RR</td>
<td>50.4 51.0 50.5</td>
<td>48.6 47.3 43.6</td>
<td>56.0 51.1 55.0</td>
</tr>
<tr>
<td>TCM</td>
<td>66.8 60.3 72.2</td>
<td>75.2 83.6 -</td>
<td>-</td>
</tr>
<tr>
<td>SBP</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>DBP</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>HR</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neonate 14*</td>
<td>1 2 3</td>
<td>1 2 3</td>
<td>1 2 3</td>
</tr>
<tr>
<td>RR</td>
<td>58.0 55.2 57.4</td>
<td>64.6 70.8 52.0</td>
<td>65.0 62.8 62.5</td>
</tr>
<tr>
<td>TCM</td>
<td>68.4 73.3 70.5</td>
<td>55.1 48.6 58.0</td>
<td>61.4 62.3 63.1</td>
</tr>
<tr>
<td>SBP</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>DBP</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**HR** = heart rate  
**RR** = respiration rate  
**TCM** = transcutaneous oxygen monitoring  
**SBP** = systolic blood pressure  
**DBP** = diastolic blood pressure  

*In light control condition
Table 16

Mean Light and Sound Levels During Different Environmental Conditions

<table>
<thead>
<tr>
<th></th>
<th>1 = Pre QT</th>
<th>2 = QT</th>
<th>3 = Post QT</th>
<th>* Light Control Condition Blanket Over Isolette</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>fc = foot candles QT = Quiet Time dB = decibels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Light (fc)</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Neonate 8</td>
<td>331</td>
<td>331</td>
<td>345</td>
<td>291</td>
</tr>
<tr>
<td>Neonate 9*</td>
<td>61.4</td>
<td>60.0</td>
<td>61.9</td>
<td>62.4</td>
</tr>
<tr>
<td>Neonate 14*</td>
<td>277</td>
<td>294</td>
<td>287</td>
<td>238</td>
</tr>
<tr>
<td>Neonate 15</td>
<td>59.7</td>
<td>57.9</td>
<td>59.0</td>
<td>58.8</td>
</tr>
<tr>
<td>Neonate 17*</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Neonate 18</td>
<td>544</td>
<td>531</td>
<td>527</td>
<td>390</td>
</tr>
<tr>
<td><strong>Sound (dB)</strong></td>
<td>63.1</td>
<td>57.9</td>
<td>62.9</td>
<td>59.1</td>
</tr>
</tbody>
</table>
Table 17

Mean Sound Levels (dB) Across Environmental Conditions

<table>
<thead>
<tr>
<th>Neonate</th>
<th>Pre QT (dB)</th>
<th>QT (dB)</th>
<th>Post QT (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>61.4</td>
<td>60.0</td>
<td>61.9</td>
</tr>
<tr>
<td>9*</td>
<td>62.4</td>
<td>58.4</td>
<td>60.7</td>
</tr>
<tr>
<td>14*</td>
<td>56.3</td>
<td>53.5</td>
<td>55.4</td>
</tr>
<tr>
<td>15</td>
<td>59.7</td>
<td>57.9</td>
<td>59.0</td>
</tr>
<tr>
<td>17*</td>
<td>58.8</td>
<td>58.7</td>
<td>61.2</td>
</tr>
<tr>
<td>18</td>
<td>59.9</td>
<td>58.3</td>
<td>62.0</td>
</tr>
<tr>
<td>32</td>
<td>63.1</td>
<td>57.9</td>
<td>62.9</td>
</tr>
<tr>
<td>35</td>
<td>59.1</td>
<td>57.3</td>
<td>60.9</td>
</tr>
<tr>
<td>All</td>
<td>60.1</td>
<td>57.8</td>
<td>60.5</td>
</tr>
</tbody>
</table>

*In light control condition

QT = Quiet Time
dB = decibels
Table 18

Comparison of Light Level Changes for Neonates In Light Condition & Not In Light Condition

### Neonates In Light Condition

<table>
<thead>
<tr>
<th>Neonate</th>
<th>*Low (fc)</th>
<th>**High (fc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>170</td>
<td>290</td>
</tr>
<tr>
<td>14</td>
<td>120</td>
<td>280</td>
</tr>
<tr>
<td>17</td>
<td>161</td>
<td>238</td>
</tr>
</tbody>
</table>

### Neonates Not In Light Condition

<table>
<thead>
<tr>
<th>Neonate</th>
<th>*Low (fc)</th>
<th>**High (fc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>331</td>
<td>351</td>
</tr>
<tr>
<td>15</td>
<td>277</td>
<td>294</td>
</tr>
<tr>
<td>18</td>
<td>211</td>
<td>274</td>
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<tr>
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*fc = foot candles
*Low = minimum light value
**High = maximum light value
Table 19

Comparison of Environmental Conditions Across Hospital Shifts

1 = Day Shift  2 = PM Shift  3 = Night Shift

<table>
<thead>
<tr>
<th>Location</th>
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*In light control condition

fc = foot candles
dB = decibels
Table 20

Quiet Time Questionnaire Results

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Figure 1

HEART RATE

KEY
- LIGHT
- SLEEP
- QUIT TIME: 11, 21, 20
- BED, AWAKE
- NOXIOUS CONDITION

HEART RATE (beats per minute)

PH MIGHT DAY NIGHT PH MIGHT DAY NIGHT PH MIGHT DAY
Feb. 16 Feb. 17 Feb. 18 Feb. 19 Feb. 20

LIGHT & SOUND

HEART RATE (beats per minute)

PH MIGHT DAY NIGHT PH MIGHT DAY NIGHT PH MIGHT DAY
Feb. 20 Feb. 21 Feb. 22 Feb. 23 Feb. 24

LIGHT & SOUND
Figure 1 continued

**MIDNIGHT 8 - March 6 to March 10**

HEART RATE

**MIDNIGHT 5 - March 10 to March 13**

HEART RATE

**MIDNIGHT 6 - March 13 to March 16**

HEART RATE

**KEY**

* LIGHT
* SLEEP
* SILENT ROOM
  * 10, 10
* SILENT ROOM
  * 20, 20
  * 30, 30

**Note:** The figure shows the heart rate trend over the specified periods with various conditions indicated. The conditions include light, sound, and silent room settings, with specific data points marked for each day.
Figure 1 continued

HEART RATE

HEART RATE (beats per min.)


March 14

March 15

March 16

March 17

HEART RATE

HEART RATE (beats per min.)


March 17

March 18

March 19

March 20

KEY
- LIGHT
- SOUND
- QUIET TIME
- PH, PH, PH
- MUS, REC, MUS
- MEDICAL
- CONDITIONS

LIGHT & SOUND

LIGHT (footcandle) AND SOUND (decibels)


March 17

March 18

March 19

March 20
Figure 1 continued

NEONATE 8 - March 21 to March 24
HEART RATE

LIGHT & SOUND

March 21 to March 24

LIGHT (exercise, vocal, and sound (decibels))

NEONATE 8 - March 24 to March 29
HEART RATE

LIGHT & SOUND

March 24 to March 29
Figure 1 continued

Table 1

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HEART RATE (beats per minute)

KEY
- LIGHT
- SOUNDS
- QUIET TIMES:
  24, 30, 30
  MLS, RECORD.
- NORMAL CONDITIONS

LIGHT (footcandles) AND SOUND (decibels)
Figure 2

Heart Rate

MIDWEEK 2 - Feb. 16 to Feb. 20

LIGHT & SOUND

MIDWEEK 3 - Feb. 20 to Feb. 23

LIGHT & SOUND
Figure 2 continued
Figure 2 continued

HEART RATE

LIGHT & SOUND

HEART RATE

LIGHT (footcandles) AND SOUND (decibels)
Figure 2 continued

Figure 3

MEASUREMENT 3 - March 12 to March 15

HEART RATE

DAY PH NIGHT PH NIGHT PH NIGHT PH

LIGHT AND SOUND

LIGHT AND SOUND

HEART RATE

HEART RATE

March 12 March 13 March 14 March 15

March 15 March 16 March 17 March 18

LIGHT AND SOUND

LIGHT AND SOUND

March 15 March 16 March 17 March 18
Figure 3

Figure 3 shows the heart rate of two neonates, Neone 14 and Neone 15, from Feb. 19 to March 7. The heart rate measurements are recorded hourly and are represented by symbols indicating light, sound, quiet time, 0.5, 1.0, and 1.5 ml/kg/min. The graph includes a legend that explains the different symbols used for the conditions under which the heart rate was measured.

For Neone 14, the heart rate values are shown for Feb. 19 to March 7. The heart rate varies significantly throughout the period, with some days showing a steady pattern and others showing more fluctuation. The light and sound conditions are indicated by different symbols, with light being represented by a circle and sound by a square.

For Neone 15, the heart rate values are also shown for Feb. 19 to March 7. The heart rate trends are similar to those of Neone 14, with variations in heart rate and indications of light and sound conditions.

The graph provides a visual representation of the heart rate changes over time, highlighting the impact of various conditions on the neonates' heart rates.
Figure 3 continued

CHRONAL: 15 - March 15 to March 18
HEART RATE

LIGHT & SOUND

CHRONAL: 16 - March 19 to March 22
HEART RATE

LIGHT & SOUND
Figure 3 continued

**HEART RATE**

- **HEART RATE (beats per minute)**
- **LIGHT & SOUND**

**MIDNIGHT 14 - March 22 to March 26**

**MIDNIGHT 15 - March 26 to March 31**
Figure 4

NEONATE 15 - Feb. 16 to Feb. 22
HEART RATE

NEONATE 15 - Feb. 22 to Feb. 27
HEART RATE
Figure 4 continued

MORPHANT 12 - Feb. 27 to March 4
HEART RATE

MORPHANT 13 - March 4 to March 8
HEART RATE
Figure 4 continued

NEONATE 15 - March 8 to March 11
HEART RATE

NEONATE 15 - March 11 to March 14
HEART RATE

KEY
- LIGHT
- SBI
- QUIET TIME
- S, P, H
- NURSING
- OTHER CONDITIONS

LIGHT & SOUND

LIGHT (footcandles) AND SOUND (decibels)
Figure 4 continued

HEART RATE

NEONATE 15 - March 21 to March 24

HEART RATE

NEONATE 15 - March 25 to March 30

HEART RATE

LIGHT & SOUND

DAY PM DAY PM DAY PM DAY PM DAY PM

March 25 March 26 March 27 March 28 March 29 March 30

LIGHT & SOUND

DAY PM NIGHT DAY PM NIGHT DAY PM

March 23 March 24 March 25 March 26 March 27 March 28

LIGHT & SOUND

DAY PM NIGHT

March 21 March 22 March 23 March 24

LIGHT & SOUND

DAY PM NIGHT

March 21 March 22 March 23 March 24

HEART RATE
Figure 4 continued

NEONATE 15 - March 30 to March 31
HEART RATE

LIGHT & SOUND

LIGHT (footcandles) and SOUND (decibels)
Figure 5

NEONATE 17 - Feb. 20 to Feb. 24
HEART RATE

- LIGHT
- SLEEP
- SLEEP TIME
- 00, 30, 60
- NOT RECORDED
- NORMAL
- OPIATE

Feb. 20 Feb. 21 Feb. 22 Feb. 23 Feb. 24

LIGHT & SOUND

NEONATE 17 - Feb. 25 to March 1
HEART RATE

- LIGHT
- SLEEP
- SLEEP TIME
- 00, 30, 60
- NOT RECORDED
- NORMAL
- OPIATE

Feb. 25 Feb. 26 Feb. 27 Feb. 28 March 1

LIGHT & SOUND
Figure 5 continued

Figure 5 continued

Figure 5 continued

Figure 5 continued
Figure 5 continued

Figure 5 - continued

**NEONATE 17 - March 10 to March 19**

- **HEART RATE**

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**LIGHT & SOUND**

- Light
- Sound
- Quiet time 10, 20, 30
- Normal conditions

**NEONATE 17 - March 13 to March 17**

- **HEART RATE**

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**LIGHT & SOUND**

- Light
- Sound
- Quiet time 10, 20, 30
- Normal conditions
Figure 6 continued

HEART RATE

- NIGHT
- DAY
- QUIET TIMES: 10, 20, 30 MIN BREAKS
- SIGNAL CONDITIONS

LIGHT & SOUND

LIGHT (footcandles) AND SOUND (feathered)

March 9  March 12  March 13  March 14
Figure 8

**HEART RATE**

**MARCH 23 - MARCH 27**

- **LIGHT**
- **SOUND**
- **SUDDEN DEATH**
- **NO RECORD**
- **NORMAL CONDITIONS**

**MARCH 28 - MARCH 30**

- **LIGHT**
- **SOUND**
- **SUDDEN DEATH**
- **NO RECORD**
- **NORMAL CONDITIONS**
Figure 9 continued

**NEOT: NE** - Hurc 6 to Hurc 10

**PH:** Horch 6 Light & Sound

**RESI:** - Horc 10 to March 13

**RESI:** - Horc 10 to March 13

**KEY:**
- Light
- Sound
- Quiet Time: 10, 20, 30
- Normal Conditions
Figure 9 continued

KEY
- LIGHT
- SOUND
- QUIET TIME
- 10, 20, 30
- NOISE, NOISY
- NORMAL CONDITIONS

HEART RATE (beats per minute)

MARCH 21
MARCH 22
MARCH 23
MARCH 24

LIGHT & SOUND

MARCH 24 - March 29

KEY
- LIGHT
- SOUND
- QUIET TIME
- 10, 20, 30
- NOISE, NOISY
- NORMAL CONDITIONS

HEART RATE (beats per minute)

MARCH 24
MARCH 25
MARCH 26
MARCH 27
MARCH 28
MARCH 29

LIGHT & SOUND
Figure 9 continued

KEY
- LIGHT
- SOUND
- QUILT TIME
- 10, 21, 30
- HYP NOISE.
- NORMAL
- CONDITIONS

NEONATE B - March 30 to March 31
RESP. RATE

DAY  PM  NIGHT  DAY  PM  NIGHT

RESPIRATORY RATE (breaths per minute)

March 30  LIGHT & SOUND  March 31

LIGHT (decibels) and sound (decibels)
Figure 10

Figure 10 represents the respiratory rate (breaths per minute) over two periods:

**NEUROLOGIC 1 - Feb. 16 to Feb. 20**
- Resp. Rate
- LIGHT & SOUND

**NEUROLOGIC 2 - Feb. 20 to Feb. 23**
- Resp. Rate
- LIGHT & SOUND

The graphs show fluctuations in respiratory rate and light/sound conditions over the specified dates.
Figure 10 continued

NOTE 2 - Feb. 24 to Feb. 28
Resp. Rate

NOTE 3 - Feb. 28 to March 4
Resp. Rate
Figure 10 continued

MARCH 9 - March 5 to March 8
Resp. Rate

DAY | PM | NIGHT | DAY | PM | NIGHT | DAY | PM | NIGHT | DAY | PM | NIGHT
March 5 | March 6 | March 7 | March 8

LIGHT & SOUND

MARCH 9 - March 8 to March 11
Resp. Rate

SIGHT | DAY | PM | NIGHT | DAY | PM | NIGHT | DAY | PM | NIGHT | DAY | PM | NIGHT
March 8 | March 9 | March 10 | March 11

LIGHT & SOUND

LEGEND - LIGHT | SOUND | SIGHT TIME | 1H, 1D, 2D | PAIRED, REEDED | NORMAL CONDITIONS

LEGEND - LIGHT | SOUND | SIGHT TIME | 1H, 1D, 2D | PAIRED, REEDED | NORMAL CONDITIONS
Figure 10 continued

KEY
- LIGHT
- SOUND
- QUIT TIME: 16, 20, 20
- SUG: 200, 200
- SLEEP: 7-9 HRS.
- NORMAL CONDITIONS

RESP. RATE (breaths per minute)

DAY | PM | NIGHT | DAY | PM | NIGHT | DAY | PM | NIGHT | DAY | PM | NIGHT | DAY | PM | NIGHT | DAY | PM | NIGHT | DAY | PM | NIGHT | DAY | PM | NIGHT |
March 12 | March 13 | March 14 | March 15

LIGHT & SOUND

LIGHT (footcandles) AND SOUND (decibels)

March 15 to March 18

Resp. Rate

March 15 | March 16 | March 17 | March 18

March 15 | March 16 | March 17 | March 18
Figure 11

MORPH 18 - Feb. 19 to March 3
RESP. RATE

LIGHT & SOUND

MORPH 14 - March 4 to March 7
RESP. RATE

LIGHT & SOUND
Figure 11 continued

MODULATE 14 - March 15 to March 19

RESPIRATORY RATE (breaths per minute)

NIGHT | PM | NIGHT | DAY | PM | NIGHT | DAY | PM | NIGHT | DAY
March 15 | March 16 | March 17 | March 18 | March 19

LIGHT & SOUND

MODULATE 14 - March 19 to March 22

RESPIRATORY RATE (breaths per minute)

DAILY | PM | NIGHT | DAY | PM | NIGHT | DAY | PM | NIGHT | DAY
March 19 | March 20 | March 21 | March 22

LIGHT & SOUND
Figure 12 continued

Figure 12 continued

Figure 12 continued
Figure 12 continued

MIDWAXE 11 - March 8 to March 11
RESP. RATE

March 8      March 9      March 10      March 11
LIGHT & SOUND

MIDWAXE 12 - March 11 to March 14
RESP. RATE

March 11      March 12      March 13      March 14
LIGHT & SOUND
NEONATE 15 - March 15 to March 18
RESP. RATE

Figure 12 continued

NEONATE 15 - March 18 to March 21
RESP. RATE

KEY
* LIGHT
* SOUND
* QUIET TIME: 10, 20, 30
NORMAL CONDITIONS
Figure 12 continued

Figure 12 continued - March 21 to March 24

KEY
- LIGHT
- SOUND
- LIGHT INT.
- PH, PH
- PH

RESPIRATORY RATE (breaths per minute)

LIGHT & SOUND

March 21 March 22 March 23 March 24

Figure 12 continued - March 25 to March 30

KEY
- LIGHT
- SOUND
- QUIET INT.
- PH, PH
- PH

RESPIRATORY RATE (breaths per minute)

LIGHT & SOUND

March 25 March 26 March 27 March 28 March 29 March 30
Figure 12 continued

MINNATE 15 - March 30 to March 31

RESP. RATE

RESPIRATORY RATE (breaths per minute)

NIGHT  PM  NIGHT  PM
March 30  March 31

KEY

- LIGHT
- SILENT
- QUIET TIME-
10, 20, 30
night record
- NORMAL
CONDITIONS

LIGHT & SOUND

LIGHT (decibels)  SILENT (decibels)

PM  NIGHT  PM  NIGHT
March 30  March 31
Figure 13

Figure 13 shows the response rates of two different conditions over a period from February 20 to March 2. The top graph illustrates the response rates during light and sound conditions from February 20 to 24. The bottom graph shows the response rates during light and sound conditions from February 25 to March 2. The data points are marked with different symbols to indicate various conditions, including light, sound on, and sound off. The x-axis represents the days of the week, and the y-axis shows the response rates per minute.
Figure 13 continued

**Diagram:**

**NEOSMATE 17 - March 5 to March 9**

**RESP. RATE**

**KEY**
- *LIGHT*
- *SOUND*
- **QUIET TIME**
- 16, 20, 24
- MIN. REO5D.
- EARLIER CONDITIONS

**Graph:**
- Days: March 5 to March 9
- Y-axis: RESP. RATE (breaths per minute)
- X-axis: Days

**Legend:**
- Different markers and line styles for various conditions.
Figure 14

NEONATES 1A - March 4 to March 7
RESP. RATE

March 4  March 5  March 6  March 7
PM    NIGHT    DAY    PM    NIGHT    DAY    PM    NIGHT

LIGHT & SOUND

NEONATES 1B - March 8 to March 11
RESP. RATE

March 8  March 9  March 10  March 11
DAY    NIGHT    DAY    PM    NIGHT    DAY    PM

LIGHT & SOUND
Figure 14 continued

Figure 14 (continued) - March 11 to March 14

RPEF RATE

March 11  March 12  March 13  March 14

KEY
• LIGHT
* SLOW
* SLEEP TIME
10, 20, 30
SEA RECOMM.
• STRONG
• DISRUPTIONS
Figure 15

1. Key:
- Light
- Sound
- Quiet: 10, 20, 30
- No. Record
- Normal Conditions

**DEMONSTRATION 32** - March 19 to March 24

**DEMONSTRATION 33** - March 25 to March 29

**Legend:***
- Light
- Sound
- Quiet: 10, 20, 30
- No. Record
- Normal Conditions
Figure 17

- Light
- Sound
- Quiet Time
- Age, No.
- Bed, Murder
- General Conditions

Transcutaneous Oxygen Monitoring (pO2 \text{mm Hg})

1. Neonate A - Feb. 21 to Feb. 25
2. Neonate B - Feb. 25 to March 2

Light and Sound (Reference: X X X X X X X X)

Duration: Feb 25 - March 2

Legend:
- Light
- Sound
- Quiet Time
- Age, No.
- Bed, Murder
- General Conditions
Figure 17 continued
Figure 18 continued

Figures 18 and 19: Graphs showing the effects of light and sound on transcrustal monitoring responses. The graphs display the data from February 24 to March 4, with various conditions indicated by symbols on the graphs.
Figure 19

NEGATIVE LEAD - Feb. 19 to March 3
TAM

TRANSCRIBABLE GUTTER MONITORING

LIGHT & SOUND

10 20 30 40 50 60 70

DAY PM NIGHT DAY PM NIGHT DAY PM NIGHT
Feb. 19 Feb. 20 Feb. 28 March 2 March 3

LIGHT & SOUND

10 20 30 40 50 60 70

LIGHT & SOUND

10 20 30 40 50 60 70

LIGHT & SOUND
Figure 19 continued

Diagram 14 - March 23 to March 26

TRANSIENTS WITH DURATION

DAY
March 23
March 26

LIGHT (foot-candles) AND SOUND (decibels)
Figure 21
Figure 24

NEONATE 14 - Feb. 19 to Feb. 20

BLOOD PRESSURE

![Graph showing blood pressure data from Feb. 19 to Feb. 20, with various symbols and annotations for different conditions such as blood pressure levels, day, night, and light & sound.]
NEONATE 32 - March 21 to March 26

BLOOD PRESSURE

Light & Sound

Light (footcandles) & Sound (decibels)
Figure 25 continued

NEONATE 32 - March 26 to March 28

BLOOD PRESSURE

- SYSTEMIC BLOOD PRESSURE
- QUIET TIME
- -10.15.20 LMT. RECORD
- NORMAL TENSIONS
- HYPOTONIC BLOOD PRESSURE

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March 26  March 27  March 28

LIGHT & SOUND

- Light (footcandles) & Sound (decibels)
NEONATE 35 - March 23 to March 24

BLOOD PRESSURE

Light & Sound

DAY | PM | NIGHT | DAY

March 23 | March 24
References


Further observations on noise levels in infant incubators. *Pediatrics, 63*, 100-106.


Seidlitz, P. R. (1981). Excessive noise levels detrimental to patients, staff. *Hospital Progress*, 62, 54-64.


Appendix A

SUBJECT # ________

NEONATE INFORMATION SHEET

Sex:   F   M   Apgar score ________

Present age when filling out form ________

Estimated gestational age _______________________

Date of admission to ICN _______________________

Reason for admission __________________________________________

Medications ____________________________________________

Comments ____________________________________________

Name of person filling out form ___________________ Date ________
Appendix B

COLLEGE OF THE PACIFIC
a College of Arts and Sciences

February 4, 1985

ICN Staff & Personnel
San Joaquin General Hospital
French Camp, CA

Dear ICN Staff & Personnel:

This week is the beginning of a baseline recording period in the ICN, as part of the ICN Neonate Study. In other words, nurses will be asked to record vital sign measures of neonates who have subject numbers on their warming tables/incubators (subject number is written in orange on a yellow post-note slip). However, no intervention/quiet time is to be instituted during this baseline period.

During baseline, it will give us the opportunity to conduct a pilot study - test out data sheets, methods of recording, sound and light measurements, etc. without actually beginning the intervention. In addition, it will give us information about neonatal response to normal ICN conditions. You will be given three to four days notice before quiet time will be initiated and there will be a poster located in the unit describing the criteria of quiet time. I would appreciate your feedback during this time period so that the study set-up will be efficient for your schedules as well.

Please fill-out a demo sheet for each neonate participating in the study (will have the yellow slip signifying subject #), then when recording vital signs, please record neonate subject # in the appropriate column. Each shift will use three data sheets, one sheet for each of the half-hour recording periods, and the sheets are marked accordingly. When data sheets are completed, return them to bottom compartment of UOP correspondence tray at the nursing desk.

If you have questions/problems please alert Karen Sousa or call me at 466-4316 days/leave a message at 473-0190 evenings. Thank you for your help and participating in the study.

Sincerely,

Dorothy de la Cruz-Schmedel
Behavioral Medicine Graduate Student
Appendix C

### Day/PM/Night Shift Sheet

#### DATA SHEET - UOP NEONATE STUDY

<table>
<thead>
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<th>SUBJECT #</th>
<th>Heart Rate</th>
<th>Respiration</th>
<th>TCM</th>
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Appendix D

<table>
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<tr>
<th>Shift:</th>
<th>TIME PERIOD:</th>
<th>SOUND LEVEL &amp; LIGHT MEASURES</th>
</tr>
</thead>
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<td>TIME</td>
<td>SUBJECT #</td>
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Appendix E

PHOTOTHERAPY LOG

SUBJECT # __________

Please record date & time when therapy begins and ends in the appropriate column:

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<th>OFF</th>
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ISOLETTE LOG

SUBJECT # __________

Please record date and time when neonate is placed in isoclette and record when neonate is transferred to crib/warming table:

IN ISOLETTE FROM __________ TO __________

TRANSFERRED TO CRIB ____________________________

TRANSFERRED BACK TO ISOLETTE ____________________
Appendix F

February 11, 1985

ICN & Nursery Staff
San Joaquin General Hospital

Dear ICN & Nursery Staff:

I appreciated your cooperation and input during the baseline period. All of you made me feel welcome to your unit and were helpful in many ways. Monday, February 11 is the beginning of the neonate study. The study will be conducted during the following time periods:

- 12:30 - 2:00 pm (DAY SHIFT)
- 7:30 - 9:00 pm (PM SHIFT)
- 2:30 - 4:00 am (NIGHT SHIFT)

During pre-quiet times: 12:30-1:00 pm; 7:30-8:00 pm; and 2:30-3:00 am; staff will record vital signs from neonatal monitors every 10 minutes, as was done during baseline period, on designated data sheets. Data sheets are located in the file tray at the desk in the ICN. DURING PRE-QUIET TIME NORMAL ICN CONDITIONS WILL BE IN EFFECT.

Quiet time periods: 1:00-1:30 pm; 8:00-8:30 pm; and 3:00-3:30 am. During this 30 minute period, the following conditions will be in effect: (1) Auditory beeps of monitors turned off, alarms remain on; (2) Blankets placed over designated isolettes; (3) Talking and walking are kept to a minimum (radio is turned off); (4) No feedings; (5) No handling; (6) No visitors; (7) Lab work and x-rays postponed unless necessary; (8) Limit traffic and phone calls in and out of the unit. In addition, a sign will be placed to remind personnel when quiet time is in effect. Vital signs will continue to be recorded every 10 minutes during this period.

During post-quiet time: 1:30-2:00 pm; 8:30-9:00 pm; and 3:30-4:00 am, NORMAL ICN CONDITIONS WILL RESUME and recordings will continue to be made every 10 minutes.

It is THE RESPONSIBILITY OF THE STAFF TO INSTITUTE QUIET TIME CRITERIA AND RECORD VITAL SIGNS. On a random basis, I will be present in the ICN to record noise and lighting levels. In addition, I will also record the vital signs. It is also staff responsibility to completely fill out NEONATE INFORMATION SHEET (orange sheets) for each neonate given a subject # (yellow post-note attached to isolette/crib). There will also be a card attached to each neonate's isolette/crib to track times and dates when neonate undergoes phototherapy. When under bili lights, neonates will be removed from the study, but when therapy is discontinued, they will be reintroduced into the study. There will also be a card to log whether or not neonate stays in isolette while in ICN or is transferred to crib/warming table and then transferred back to isolette.

Thank you for your help and cooperation. I appreciate your feedback and questions. Should you have any problems or further questions, contact Karen Sousa or call me 466-4316 (days) or 473-0190 (evenings).

Sincerely,

Dorothy de la Cruz-Schmedel
Behavioral Medicine Graduate Student
Appendix G

Dear Newborn Nursery Staff:

Your cooperation and concern regarding ICN quiet time is very much appreciated. Some of you have developed a great awareness so when you see the sign posted in front of ICN, talking is reduced, the radio is turned down, and attempts are made to minimize other sources of noise. As I have taken sound measurements this past week I have observed that even when the babies in the newborn nursery are crying, overall noise level can be lessened by minimizing talking and reducing activities which contribute noise.

Quiet time periods in ICN are: 1:00-1:30 pm on day shift; 6:00-8:30 pm on the pm shift; and 3:00-3:30 am on the night shift. During quiet time the following criteria are in effect in ICN:

1. Monitor auditory beeps are turned down, only alarms remain on.
2. Blankets are placed over designated isolettes.
3. Talking and walking are kept to a minimum.
4. No visitors are allowed.
5. No feedings/handling of babies.
6. Lab work, x-ray, and respiratory work is postponed unless absolutely necessary.
7. Traffic and phone calls are limited in and out of the unit.

The above criteria do not apply to the newborn nursery during quiet time, I just wanted you to have an idea of what was occurring in the ICN.

Thank you for your attempts to make quiet time a success in ICN by doing your part to minimize noise whenever possible.

Sincerely,

Dorothy de la Cruz-Schmedel
Behavioral Medicine Graduate Student
UPDATE FOR WEEK 2

February 20, 1985

Dear ICN Staff:

Overall, you have been supportive, cooperative, and helpful in making the first week of the Neonate study a success. Out of 24 quiet time periods, you recorded data for 17-day shift recorded 7 out of 8 periods, pm and night shifts recorded 5 out of 8 periods. For the duration of the study, check the orange poster in ICN for a weekly tally.

Despite the busy state of the unit this past week, your attempts to record data and initiate quiet time are admirable. When it is not possible to have a quiet time period, record data anyway and just mark on the data sheet that no quiet time was instituted. Also, if for some reason a baby needs to be attended to during quiet time, please indicate by her/his subject number that you handled or cared for the baby during that time period. This will indicate to me which baby is not to be included in the quiet time criteria.

You have done a GREAT job filling out neonate information forms and keeping track of phototherapy. An accurate record of phototherapy is essential so as not to include the baby's data when undergoing phototherapy and to reintroduce the baby into the study when phototherapy is complete.

Some of your have taken the responsibility of initiating quiet time even when I am present taking sound and light measurements and it is IMPRESSIVE. It is an indication that quiet time is caringly instituted even when I am not around and it makes a statement about the teamwork necessary to run this study and to make it a success.

Most of you have worked your baby's feedings, lab/respiratory therapy work around quiet time periods and this is WONDERFUL. The less movement and handling during quiet time makes for a successful "quiet" quiet time period. Just a reminder - keep talking and walking down to a minimum. Any movement in the unit, whether it be closing a drawer, running the water, or even opening syringe packages adds considerably to the noise level during quiet time.

Thank you again for your team work. Your feedback and comments are always welcome and appreciated.

With sincere appreciation,

Dorothy de la Cruz-Schmedel
Behavior Medicine Graduate Student
Appendix I

Dear ICN & Nursery Staff:

Data was recorded for 20 out of 21 quiet time periods. Day Shift and PM Shift-7 and Night Shift-6. PM Shift has had a perfect record for data recording two weeks in a row!

Several of you have inquired about the results of this study. At present data is being entered into the computer. This is quite a job since there are approximately 240-400+ numbers recorded on a daily basis. Data analysis will not begin until the completion of the study and will take about one month to complete. When the data analysis is completed, the results will be shared with you. Remember, this is a blind study. Thus, I am not able to share information I have gathered/trends I have observed until the completion of the study.

Please remember to remind parents that no visitors are allowed from 1:00-1:30 during day shift; 8:00-8:30 during pm shift; and 3:00-3:30 during night shift. I appreciate your efforts in this area because I have heard many of you talk to parents about this matter.

Thank you for your continual help, support, and enthusiasm with this project. I am truly enjoying my interactions with all of you and am grateful that I have the privilege to work with such a GREAT group of people.

Thanks,

Dorothy de la Cruz-Schmedel
Behavioral Medicine Graduate Student
DEAR ICN & NEWBORN NURSERY STAFF:

This past week, data was recorded 20 out of 21 quiet time periods. Out of seven periods for each shift, both day and pm shift recorded all periods, and night shift recorded six.

The cooperation and support for this project is evident from both the ICN and Newborn Nursery Staff. ICN nurses have worked feedings, etc. around quiet time as to adhere to the "no handling" of babies during quiet time. In general, newborn nursery staff has turned down the radio and tried to reduce noise levels during quiet time. In addition, both ICN and nursery staff have made parents more aware of quiet time periods, thus the number of visitors has been reduced or in some cases even eliminated during quiet time.

Just a reminder-data sheets are in the orange folder and if you have a greater number of babies than the lines allow (as is the situation now), just draw additional lines on each sheet so that data is kept in the 30 minute interval fashion as indicated on the top of the data sheets.

Everyone seems to have the "quiet time routine" down to a system and you are doing a WONDERFUL JOB at making Quiet Time really a quiet and noise reduced time period.

Thanks a lot for your help and cooperation.

Dorothy de la Cruz-Schmedel
Behavioral Medicine Graduate Student
Appendix K

QUIET TIME QUESTIONNAIRE

For each of the following items, circle a number from one to nine on the accompanying scale to indicate the degree to which the statement applies to you. A sample item is provided below:

EXAMPLE:

It was ________ to stay quiet during quiet time.

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<tbody>
<tr>
<td>impossible</td>
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<td>difficult</td>
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<td>easy</td>
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This response indicated the person found it quite difficult to stay quiet during quiet time. By circling number four, the person indicated feelings as described by the range of available responses.

PLEASE READ EACH ITEM AND ALTERNATIVES CAREFULLY. Accurately evaluate the alternatives on the basis of your thoughts/feelings. There is no time limit in filling out this questionnaire. If some of the items are not relevant to your particular job description (i.e., item about recording vital sign measures and you work in the newborn nursery and do not record vital sign measures), leave them blank.

Complete the questionnaire when it is given to you and hand it back to Dorothy. If this is not possible, put it in the bottom compartment of the UOP filing tray in the ICN. DO NOT WRITE YOUR NAME ON THE QUESTIONNAIRE AND FEEL FREE TO WRITE ANY COMMENTS ON THE LAST PAGE AFTER ITEM 15. Your prompt attention is greatly appreciated.

The intent of the questionnaire is to evaluate your thoughts/feelings about the quiet time period in the ICN. Your responses to this questionnaire are confidential.

* PLEASE CHECK ONE OF THE FOLLOWING:

- I work on day shift
- I work on pm shift
- I work on night shift
- I do not work on a particular shift
1. If I had the opportunity to participate in another quiet time project I would ________.

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2. I ________ the 30 minute quiet time period.

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3. When other people asked me about quiet time I ________ the project.

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4. The quiet time signs and posters in the unit ________.

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5. My interactions with Dorothy were often ________.

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6. I think quiet time is an ________ time for the neonates to have.

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7. When I heard other people in the hospital talk about quiet time I was

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8. Feedback to me about the number of quiet time periods recorded each week was

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9. People around me are ______ quiet time on the basis of what I say.

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<tr>
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<td>about</td>
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<td>in</td>
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10. If I could, I would like to tell my charge person ______

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</thead>
<tbody>
<tr>
<td>&quot;never let&quot;</td>
<td>&quot;I don't mind&quot;</td>
<td></td>
<td>&quot;I like&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dorothy</td>
<td>Dorothy</td>
<td>coming</td>
<td>having</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>come to ICN again&quot;</td>
<td>coming to ICN&quot;</td>
<td>Dorothy</td>
<td>come to ICN&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

11. Recording vital sign measures was ______.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>a pain</td>
<td>not a bother</td>
<td></td>
<td></td>
<td>a pleasure</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

12. During quiet time I was ______.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>bored and</td>
<td>busy</td>
<td>relaxed and</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>could not</td>
<td>doing</td>
<td>it seemed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wait for</td>
<td>my</td>
<td>like 30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>the 30</td>
<td>charting</td>
<td>minutes went</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>minutes</td>
<td>to go by</td>
<td>by quickly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
13. The quiet time data sheets and forms were

difficult to use

useable with some effort

easy to use

14. Placing blankets over isolettes was

a hassle

a bit of a problem

easy to do

15. The slip on the isolette indicating whether the baby was in the blanket or not blanket condition was ________, thus I was whether to place blankets over the isolette prior to quiet time.

confusing, unsure

very clear, certain

COMMENTS: