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Creating a therapeutic environment: a non-randomised controlled trial of a quiet time intervention for patients in acute care

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Abstract

Background: Noise is a significant barrier to sleep for acute care hospital patients, and sleep has been shown to be therapeutic for health, healing and recovery. Scheduled quiet time interventions to promote inpatient rest and sleep have been successfully trialled in critical care but not in acute care settings.

Objectives: The study aim was to evaluate a scheduled quiet time intervention in an acute care setting. The study measured the effect of a scheduled quiet time on noise levels, inpatients' rest and sleep behaviour, and wellbeing. The study also examined the impact of the intervention on patients', visitors' and health professionals' satisfaction, and organisational functioning.

Design: The study was a multi-centred non-randomised parallel group trial.

Settings: The research was conducted in the acute orthopaedic wards of two major urban public hospitals in Brisbane, Australia.

Participants: All patients admitted to the two wards in the five-month period of the study were invited to participate, with a final sample of 299 participants recruited. This sample produced an effect size of 0.89 for an increase in the number of patients asleep during the quiet time.

Methods: Demographic data were collected to enable comparison between groups. Data for noise level, sleep status, sleepiness and wellbeing were collected using previously validated instruments: a Castle Model© 824 digital sound level indicator; a three point sleep status scale; the Epworth Sleepiness Scale; and the SF12 V2 questionnaire. The staff, patient and visitor surveys on the experimental ward were adapted from published instruments.

Results: Significant differences were found between the two groups in mean decibel level and numbers of patients awake and asleep. The difference in mean measured noise levels between the two environments corresponded to a 'perceived' difference of 2 to1. There were significant

correlations between average decibel level and number of patients awake and asleep in the experimental group, and between average decibel level and number of patients awake in the control group. Overall, patients, visitors and health professionals were satisfied with the quiet time intervention.

Conclusions: The findings show that a quiet time intervention on an acute care hospital ward can affect noise level and patient sleep/wake patterns during the intervention period. The overall strongly positive response from surveys suggests that scheduled quiet time would be a positively perceived intervention with therapeutic benefit.

Keywords: Acute care nursing, Non-randomised controlled trial, Nursing intervention, Quiet time.

What is already known about the topic?

- Noise is a significant barrier to sleep for acute care hospital patients.
- Sleep is of vital importance to health, healing and recovery, particularly in patients who have undergone major surgery.

What this paper adds

- The introduction of a scheduled quiet time intervention can reduce the noise level by an average of than more than 10 decibels (dB) on an acute care hospital ward.
- This reduction in noise level is significantly correlated with an increase in the number of patients asleep during the quiet time period.
- This paper demonstrates that a scheduled quiet time period can be used as a therapeutic evidence-based nursing practice intervention in the acute hospital environment.

1. Introduction

The modern acute care hospital environment is typically busy and noisy. The sick patient in this environment is surrounded by a constant ebb and flow of voices and movement, and the assorted noises of equipment, alarms and diversions; and is subjected, directly and indirectly, to visits, consultations and treatments from numerous health care professionals, students, friends and family. Hospital policy on rest periods for in-patients has changed over time, both in Australia and internationally, with many wards adopting unrestricted visiting. However, there is little research that compares the benefits and therapeutic implications of restricted versus unrestricted visiting and treatment activities for patients. With the study reported here we sought to address that gap and to provide evidence for hospital nurses seeking to develop and maintain a therapeutic environment for their patients within the clinical context of the acute care ward.

Nurse clinicians are increasingly reporting the need to have a structured quiet period in the patient's day. This represents a move away from a 20 year trend that saw unrestricted visiting and treatment access to hospital patients. The fast pace of the contemporary acute care hospital ward creates an environment of noise, turbulence and busyness which raises questions about the potential for this environment to compromise patient health recovery and wellbeing. However, implementing a scheduled quiet time in acute care wards does not have universal support, and arguments on the benefits are largely anecdotal. Robust research was therefore required to investigate the therapeutic and operational outcomes of implementing a quiet time intervention in an acute care ward.

1.1. Literature review

There is an extensive international literature on the therapeutic effect of sleep on healing and health recovery (Southwell and Wistow, 1995; Bowman, 1997; Edell-Gustafsson et al., 2003). Several studies have shown that illness, trauma and surgery significantly increase sleep

requirements for hospital inpatients (Bowman, 1997; Ersser et al., 1999; Haigh, 2001). Adequate sleep has been shown to positively influence blood pressure (Holand et al., 1999; Kato et al., 2000; Fogari et al., 2001), pain experience (Onen et al., 2001) and emotional wellbeing (Redeker et al., 2004). There are also indications that surgical patients (Beydon et al., 1994), particularly those undergoing orthopaedic surgery (Bowman 1997), have both increased need for sleep and prolonged sleep disruption persisting after discharge from hospital. Recent studies have shown that the hospital environment paradoxically presents unique challenges for patients in gaining the quality of sleep and rest needed to aid healing, recovery and emotional wellbeing (Tullmann and Dracup, 2000; Topf and Thompson, 2001). These environmental challenges relate to noise, rest disruption and visitors.

The health effects (other than hearing loss) of environmental noise have been recognised by the EnHealth Council (Australia) as a significant public and community health issue. Recent recommendations identified the need for health-related noise research in the areas of sleep disturbances, cardiovascular effects and wellbeing (EnHealth Council, 2004). The recommendations further stated that this research was needed particularly for those at-risk individuals such as, among others, the elderly and those suffering from physical and mental conditions. The noise level recommended by the US Environmental Protection Agency (EPA) for safe indoor activity is 45 decibels (dB) (EPA, 1974). Recent research in the US has found hospital sound levels of 72dB during daytime hours and 60dB at night (Busch-Vishniac et al., 2005).

Whilst unrestricted access to patients is standard practice in many hospitals, there is scant research to indicate whether this practice has any effect on client or family outcomes, or whether it improves nursing care (Tullmann and Dracup, 2000). It has been argued that the unlimited intrusion of hospital staff and visitors into the inpatient's milieu contributes to significant disruption to their rest and sleep at a time when a tranquil environment is required (Haigh, 2001). Such disruption is a frequent complaint of inpatients, resulting in more sustained

physical, cognitive and emotional dysfunctions that are known to impair the healing process (Tullmann and Dracup, 2000). Patient outcomes have been shown to be more positive when the inpatient has control over visiting hours, with biophysiological measures such as heart rate and blood pressure improving in the absence of visitors and deteriorating when visitors are present (Lazure and Baun, 1995).

Proponents of scheduled or structured quiet time in the UK and US (Olson et al., 2001; Lower et al., 2002; Lower et al., 2003) cite the greatest benefit of the practice as the promotion of rest and relaxation, and the concomitant reduction of stress levels. This is achieved by controlling the noise and disruption of the external environment by, for example, decreasing the volume of telephone ringers and equipment alarms, closing inpatient doors, turning off lights, discouraging staff interaction in hallways and at nurses' stations, offering ear plugs, silencing pagers and mobile phones, administering prophylactic pain medication prior to quiet time, strategically sign placement, and providing information brochures for patients and visitors detailing the periods of quiet time (Edwards and Schuring 1993; Olson et al., 2001; Lower et al., 2003). These environmental controls are instituted in concert with the natural fall in circadian rhythms (between 1400 and 1600 hours) when the body is most vulnerable to external stimulation and therefore requires more protection (Lower et al., 2002; Plowright, 1998). A designated quiet time also reduces anxiety by affording inpatients a measure of control over the situation. It is known, for example, that the unpredictability of visitor entry can cause significant stress and feelings of helplessness in patients (Lazure and Baun, 1995). Patients who are elderly and/or have cognitive impairment are particularly vulnerable in that the sensory overload they encounter in the general acute hospital environment can cause or contribute to confusion (Tullmann and Dracup, 2000).

There exist several barriers to the introduction of quiet time. These include resistance from nurses and family members who are reluctant to change established practices in units where open visitation has been available (Lower et al., 2002). There is also evidence of a belief

that the benefits of open visiting hours, in terms of decreasing patient and family levels of anxiety and increasing perceptions of support, would be lost (Plowright, 1998; Roland et al., 2001). Moreover, there is an argument that an 'enforced' quiet time would interrupt clinical staff work schedules and reports that allied health personnel and physicians resent restrictions on their ability to plan treatments at times convenient to them (Lower et al., 2002).

The limited available body of literature specifically relating to quiet time reports on research in critical care environments that studied the impact on patients of sleep and sleep disturbance and the effectiveness of restricted visiting, noise and treatment disturbance (Olson et al., 2001; Roland et al., 2001; Lower et al., 2002). There is no research reported that tests the therapeutic outcomes of a quiet time intervention in the acute care environment. Though many studies have assessed the general role of sleep on patient wellbeing (Southwell and Wistow, 1995; Bowman, 1997; Ersser et al., 1999), there is no research to support a relationship between potential wellbeing and rest and sleep during a quiet time period.

2. Method

2.1. Study aims and research questions

The study had two aims, each with specific research questions and/or hypotheses. The first aim was to explore the relationship between specific patient and environmental outcomes and the use of a quiet time intervention in an acute orthopaedic ward. The research questions for this aim were:

Does a quiet time intervention achieve improved sleep and rest conditions for patients in acute orthopaedic wards?

Does a quiet time intervention contribute to improved health outcomes for patients in acute orthopaedic wards?

The following hypotheses were tested:

1. An acute orthopaedic ward that has a quiet time intervention will record lower levels of noise between 1400 and 1530 hours than a ward without a quiet time intervention.

2. Patients in an acute care orthopaedic ward that has a quiet time intervention will be more likely to have an afternoon sleep than patients in a ward without a quiet time intervention.

3. Patients in an acute care orthopaedic ward that has a quiet time intervention will be more likely to report improved overall sleep status than patients in a ward without a quiet time intervention.

4. Patients in an acute care orthopaedic ward that has a quiet time intervention will have more improvement to their health care outcomes following discharge from hospital, as measured on the Shorter SF12 scale, than patients in a ward without a quiet time intervention.

The second aim of the study was to describe the impact of a quiet time intervention on a) patient and family satisfaction, and b) organisational and clinical work issues. The research questions for this aim were:

What is the impact of a quiet time intervention on patient and family satisfaction?

What is the impact of a quiet time intervention on ward operational issues and nursing, medical and allied health work patterns?

2.2. Research design

The study was designed as a multi-centred non-randomised parallel group trial of the effects of a quiet time intervention on selected patient and environmental outcomes, and descriptive outcomes related to the impact of a quiet time intervention on patients, family and health professionals. The research was conducted in the acute orthopaedic wards of the Royal Brisbane and Women's Hospital (experimental site) and the Princess Alexandra Hospital (control site) in Brisbane, Australia. The orthopaedic wards in each facility were matched in terms of size (both 50-bed wards) and clinical service (both have orthopaedic elective and

trauma admissions). Both wards had a mix of multiple-bed bays and single rooms, and were comparable in terms of clinical space, corridors, and other nursing work areas.

The quiet time intervention included:

1. Designated quiet time between 1400 and 1530 hours
2. Restriction of visitors to patients during quiet time
3. Restriction of staff movement and treatment activities during quiet time
4. Promotion of patient rest and comfort through positioning and pain relief prior to quiet time
5. Reduction of environmental stressors through reduced lighting and ward noise (eg. reduced telephone volume, corridor conversations, television and radio) during quiet time.

The selection of the daily time period for the intervention was informed by literature reporting that between 2pm and 4pm is the low point in the circadium rhythm and a time that the body is naturally at rest (Plowright 1998, Lower et al 2002). This time period was also nominated by the Nurse Unit Manager on the intervention ward as the optimal time from an organisational perspective.

2.3. Population and sampling

The research population was patients in orthopaedic wards in two tertiary care hospitals. Given the geographical imperatives of public hospital admissions, random subject assignment was not a methodological option for this study. Hence a non-randomised sampling method was used for the matched group study (Pagano and Gauvreau, 2000). The experimental group (Group A) was at the Royal Brisbane and Women's Hospital (RBWH), and the control group (Group B) was at Princess Alexandra Hospital (PAH).

This study replicated aspects of a quasi-experimental study conducted in a neurocritical care unit (Olson et al., 2001) in a different context (ie. acute rather than critical care). Power analysis was conducted based on calculation of effect size from the neurocritical care study. Sample size was calculated at patient level giving an estimate of 233 patients required in each of

the experimental and control groups to detect an effect size of 0.13 increase in the number of patients having an afternoon sleep (power = 0.80, significance = 0.05). There was insufficient data from the previous study to calculate sample size accounting for cluster effect. Additionally, we expected a larger effect size in our study because the intervention was stronger with less environmental technology and less disturbance of patients during the quiet time than that reported in the neurocritical care study.

All patients admitted to the two wards in the five-month period of the study were invited to participate, and data were collected from all consenting patients. The study received ethical clearance from the RBWH, PAH, and Queensland University of Technology Human Research Ethics Committees.

2.4. Data collection

All participating patients had demographic data collected to enable comparison between groups. Data were collected between January and May of 2007, a period determined by available grant funding.

The four main variables of interest were noise levels, afternoon sleep, overall sleepiness, and health status during the first week following discharge. Therefore data collection involved the use of the following previously validated instruments:

1. A digital sound level meter to measure noise levels in all patient rooms and in the corridor outside each room. Sound levels were measured using a Castle Model© 824 digital sound level indicator set at an A frequency weighting. Measurements were made using the 'slow' time weighting and averaged to produce a single daily score.
2. Patients' sleep status was observed and recorded on a three point scale. All patients were observed for a minimum of 15 seconds for each measurement (Olson et al., 2001; Edwards and Schuring, 1993).

3. On admission and discharge each patient completed the Epworth Sleepiness Scale for an overall sleep pattern score (Johns, 1991; Johns, 1992).

4. On admission, discharge, and one week after discharge each patient completed the SF12 V2 questionnaire (Sanderson and Andrews, 2002).

In addition to the comparative data collected from both Group A and Group B, surveys were conducted in the Group A ward with patients and family members on satisfaction with the quiet time intervention. Additionally, health professionals in the Group A ward were surveyed to measure the organisational impact of the quiet time intervention. These questionnaires were adapted from published instruments (Tuller et al., 1997; Ramsey et al., 1999).

3. Results

Two hundred and ninety-nine participants (*N*=299) were recruited into the study over the five-month data collection period. Of 138 subjects in the experimental group, one withdrew consent for inclusion during the course of the study (*n*=137). Of 161 subjects in the control group, five withdrew consent for inclusion during the course of the study (*n*=156).

3.1. Demographic and inpatient admission data

A summary of demographic and inpatient admission data for the experimental and control groups can be seen in Table 1. The groups were well-matched for mean length of stay (t=1.8, p=0.08), living arrangements (χ^2=8.0, p=0.20), vision impairment (χ^2=1.1, p=0.29), and mean number of comorbid conditions (t=1.2, p=0.25). They were unmatched for mean age (t=2.8, p<0.01), sex (χ^2=5.7, p<0.05), occupation (χ^2=41.9, p<0.01), admission type (χ^2=12.3, p<0.01), reason for admission (Lambda=0.091, p<0.01), and hearing impairment (χ^2=4.7, p<0.05).

Table 1: Demographic and inpatient admission data

	Experimental group (*n*=137)	Control group (*n*=156)
Mean age (SD, mode)	56.4 (19.1, 76)	50.5 (19.4, 56)
Sex: male (%) / female (%)	67 (48.9) / 70 (51.1)	98 (62.8) / 58 (37.2)
Mean length of stay in days (SD)	13.7 (15.1)	10.9 (10.2)
Occupation (%)		
Employed	50 (36.5)	45 (28.8)
Self-employed	20 (14.6)	64 (41.0)
Retired	46 (33.6)	14 (9.0)
Other	21 (15.3)	33 (21.2)
Accommodation (%)		
Own home independent	112 (81.8)	133 (85.3)
Own home dependent	10 (7.3)	10 (6.4)
Residential facility low level care	4 (2.9)	0 (0)
Residential facility high level care	0 (0)	0 (0)
Residential facility villa	2 (1.5)	2 (1.3)
Hostel	2 (1.5)	0 (0)
Boarding house	2 (1.5)	5 (3.2)
Other	5 (3.6)	6 (3.8)
Type of admission (%)		
Trauma	82 (59.9)	110 (70.5)
Elective	43 (31.4)	45 (28.8)
Non-orthopaedic	12 (8.8)	1 (0.6)
Reason for admission (%)		
Fractured ≤2 bones	37 (27.0)	63 (40.4)
Joint replacement inc revision	14 (10.2)	3 (1.9)
Infection/inflammation	23 (16.8)	21 (13.5)
Multi-trauma (fractured >2 bones)	8 (5.8)	13 (8.3)
Elective orthopaedic (not inc joint replacement)	15 (10.9)	26 (16.7)
Excision/drainage/biopsy	6 (4.4)	10 (6.4)
Removal of metalwork	3 (2.2)	1 (0.6)
Repair of tendon/ligament/muscle/skin	8 (5.8)	4 (2.6)
Amputation	2 (1.5)	5 (3.2)
Other	21 (15.3)	10 (6.4)
Hearing impaired (%)	14 (10.2)	6 (3.8)
Vision impaired (%)	1 (0.7)	0 (0)
Mean comorbid conditions (SD)	0.9 (1.4)	0.7 (1.3)

3.2. Sound level and sleep status

Sixty-one (*n*=61) matched separate daily measurements were taken of decibel (dB) level and sleep status for each group (see Table 2). Significant differences were found between the two groups in dB level and number of patients asleep and awake.

The difference in mean measured sound (ie. noise) levels between the two environments was 10.3dB, which corresponds to a 'perceived' difference of 2 to1, meaning that the experimental group would have experienced only half the sound (ie. noise) level of the control group.

Table 2: Sound level and sleep status

Mean (SD)	Experimental group (*n*=61)	Control group (*n*=61)	
dB level	51.3 (3.2)	61.6 (3.2)	t=-18.060, p=.000
Patients asleep	25.7 (4.9)	9.5 (3.5)	t=20.722, p=.000
Patients awake	21.8 (5.6)	28.3 (4.1)	t=-7.911, p=.000

There were strongly significant correlations between average dB level and number of patients awake (r=0.627, p<0.01) and asleep (r=-0.704, p<0.01) in the experimental group (see Figure 1). In the control group, there was a significant, though weaker, correlation between average dB level and number of patients awake (r=0.243, p<0.05) (see Figure 2).

Figure 1: Experimental group: number of patients awake and asleep by mean dB level

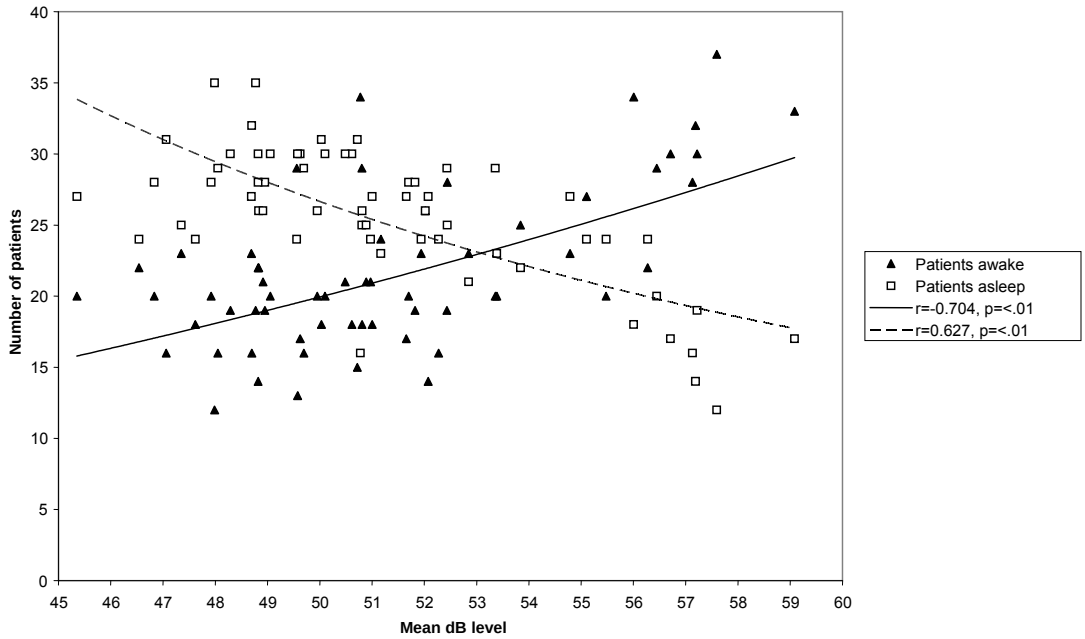
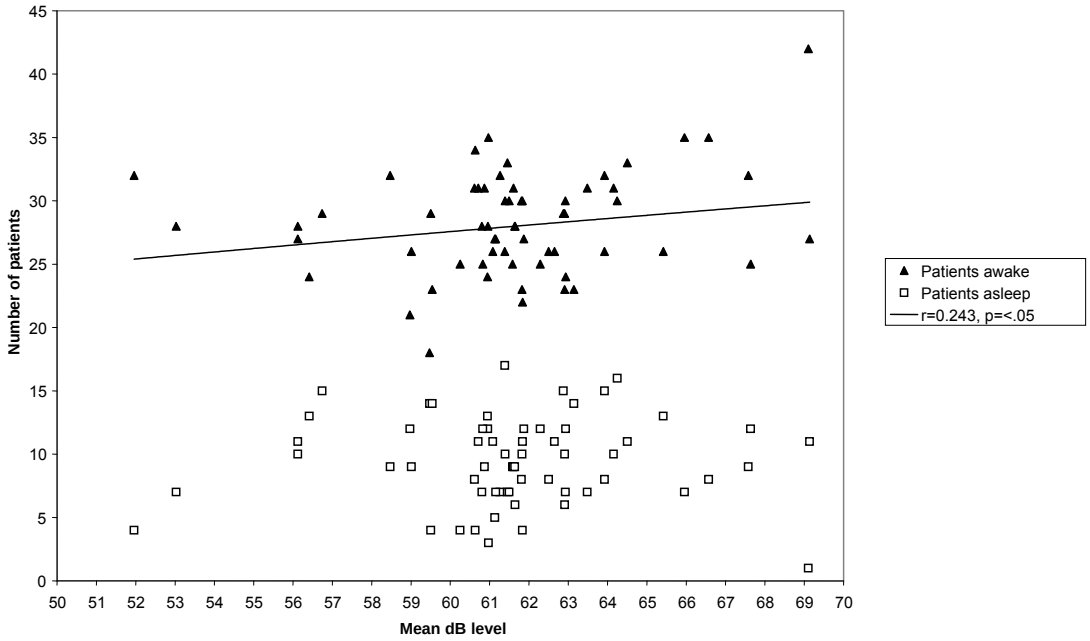


Figure 2: Control group: number of patients awake and asleep by mean dB level



Results from the Epworth Sleepiness Scale showed no significant difference in reported level of sleepiness between the experimental and control groups on admission and on discharge. However, there were missing data for 22 participants in the experimental group (16.1%) and 32 participants in the control group (20.5%) for the discharge measure, so this absence of significance cannot be taken as definitive.

3.3. Health status on SF12 V2

All consented subjects in both groups completed the SF12 V2 survey on admission. Twenty-two participants (16%) in the experimental group and 28 (17.9%) in the control group did not complete the SF12 V2 on discharge. Sixty subjects (43.8%) in the experimental group and 57 (36.5%) in the control group did not complete the SF12 V2 at one week follow-up. Significant differences were found between groups on the SF12 V2 Physical Role sub-scale ($t=-2.257$, $p<0.05$) and Vitality sub-scale ($t=-2.107$, $p<0.05$) on admission only.

3.4. Patient, visitor, and health professional satisfaction

Overall, patients from the experimental group who completed a satisfaction survey (n=112) reported that they felt they had enough scheduled time with visitors (94%), that other patients' visitors were not annoying to them (54%), and that they liked the quiet time intervention (87%).

Of the 34 visitors who completed satisfaction surveys, the majority agreed that they had enough time with the patient (74%), that scheduled visiting hours were convenient (74%), that they were happy to wait while the ward was closed (74%), and that they did not need more time for visiting (64%). However, more than half of visitors (55.9%) agreed or strongly agreed that visiting should be open throughout the day.

Of the 80 health professionals who completed a satisfaction survey, 53 (66.3%) identified themselves as nurses and 27 (33.7%) identified themselves as allied health or other. As shown in Table 3, the majority of nurse respondents agreed that the scheduled quiet time neither adversely affected their clinical work nor unduly constrained visitors' access to patients, and that they strongly supported the quiet time intervention. Allied health and other professionals, however, were less consistently positive, with roughly half the sub-group indicating that the quiet time intervention adversely affected their clinical work and their access to patients.

Table 3: Health professional satisfaction by sub-group

Health professional satisfaction survey statements	Agree (%)	Disagree (%)	No opinion (%)
I have enough time to do patient care activities outside the scheduled quiet time			
Nurses	51 (96.2)	2 (3.8)	0
Allied health/other	11 (40.7)	12 (44.4)	4 (14.8)
I think that visitors have enough access to patients outside the scheduled quiet time			
Nurses	52 (98.1)	0	1 (1.9)
Allied health/other	20 (74.1)	4 (14.8)	3 (11.1)
I am annoyed when I cannot access the patients between 1400 and 1530 hours			
Nurses	2 (3.8)	49 (92.5)	2 (3.8)
Allied health/other	14 (51.9)	10 (37.0)	3 (11.1)
The scheduled quiet time interferes with the time I need to provide patient care			
Nurses	5 (9.4)	47 (88.7)	1 (1.9)
Allied health/other	13 (48.1)	12 (44.4)	2 (7.4)
The scheduled quiet time has enough flexibility to meet my clinical work needs			
Nurses	51 (96.2)	2 (3.8)	0
Allied health/other	12 (44.4)	13 (48.1)	2 (7.4)
I support the quiet time intervention for this ward			
Nurses	51 (96.2)	0	2 (3.8)
Allied health/other	15 (55.6)	9 (33.3)	3 (11.1)

4. Discussion

Since the time of Florence Nightingale the hospital has been recognised as an environment for healing and health recovery and the literature supports the therapeutic benefit of rest and sleep on health recovery. Also since that time, nurses have been the health care workers principally accountable for creating and managing a therapeutic environment in hospitals. The purpose of this study was to test a nursing initiative to better manage the environment for patients on an acute surgical ward.

Attitudes and policy related to hospital care have changed over time: one of the various nursing practices subject to this flux is regulation of visiting hours. Over 20 years ago, in response to emerging patients' rights issues, there was a move away from regulated visiting hours towards unrestricted visiting for general wards. Literature supporting unrestricted visiting was generated at that time and was largely based on opinion rather than research evidence. However, since that time the environment and rhythms of the hospital have changed: patients are more acute, treatments are more invasive, and technology is integral to care in all settings. The acutely ill patient in this environment has increased physiological demands for recovery from illness and maintenance of wellbeing. A period of quiet time with restrictions to visitors and treatments may therefore be considered a therapeutic nursing intervention in that it is a nurse-initiated strategy that seeks to develop and maintain a therapeutic clinical environment.

4.1. Demographics

The contextual realities of conducting a multi-centred non-randomised parallel group trial in two major urban hospitals dictated that strict matching of experimental and control groups was essentially impossible. The groups were well-matched for four of the nine demographic variables. The differences between the groups in terms of age, sex, occupation, admission type, reason for admission, and hearing impairment may most likely be due to different population demographics in the two hospitals' suburban catchment areas.

4.2. Noise level, sleep status and patient wellbeing

The study findings supported hypotheses 1 and 2 in that a scheduled quiet time intervention on an acute care hospital ward made a significant difference to noise level and patient sleep status during the quiet time period. Furthermore, these two variables were significantly positively correlated in the intervention environment in that as noise levels decreased more patients were sleeping.

Noise is a significant characteristic of the contemporary hospital environment: the average decibel (dB) level in the control environment of the present study was 16.64dB higher than the 45dB level recommended by the US Environmental Protection Agency (EPA) (1974) for safe indoor activity. Furthermore, in the experimental group, even the lowest recorded average dB reading was still 0.35dB above the EPA recommended level. Recent research has found hospital sound levels have risen to 72dB during daytime hours and to 60dB at night (Busch-Vishniac et al., 2005), giving emphasis to the necessity for a period in the patient's hospital stay when this noise level is actively managed. In addition to influencing patient comfort and health outcomes, staff can also benefit from a quieter environment. One study (Morrison et al., 2003) found that higher than recommended sound levels were predictive of increases in heart rate, subjective stress and annoyance in hospital nurses.

The study findings also showed that patients in the intervention ward were more than twice as likely to be asleep during the quiet time period as the patients in the control ward. This supports the hypothesis that a quiet time intervention enables patients to have a daytime sleep. There is extensive commentary in the literature on the importance of sleep to health, healing and recovery (Edwards and Schuring, 1993; Southwell and Wistow, 1995; Edell-Gustafsson et al., 2003; Tochikubo et al., 1996; Holand et al., 1999; Kato et al., 2000; Fogari et al., 2001; Onen et al., 2001; Redeker et al., 2004), especially following illness, trauma and surgery (Bowman, 1997; Ersser et al., 1999; Haigh, 2001). Nurses have a primary role in patient recovery and rehabilitation: therefore a scheduled quiet time period, introduced as a standard element of local ward management structure to promote sleep in acute care patients, may be validly defined as a therapeutic evidence-based nursing intervention.

The research findings did not support the hypotheses that a quiet time intervention would result in improved overall sleep status, or that a quiet time intervention would result in improved health outcomes for patients in the acute care environment. Data collection fell short of the estimated sample sizes due to funding limitations. Therefore hypotheses 3 and 4 were unable to

be satisfactorily tested because the study was ultimately insufficiently powered, largely due to limited response rates at discharge and follow-up on the Epworth Sleepiness Scale and SF12 V2 questionnaire. Consequently, the first two hypotheses can be accepted based on statistically significant results: that is, 1) an acute orthopaedic ward that had a quiet time intervention recorded significantly lower levels of noise between 1400 and 1530 hours than a ward without a quiet time intervention; and 2) patients in an acute orthopaedic ward that had a quiet time intervention were more likely to have an afternoon sleep than patients in a ward without a quiet time intervention.

4.3. Patient, visitor and health professional satisfaction

The second aim of the study was to investigate the impact of a quiet time intervention on patient and visitor satisfaction and on ward operational issues and nursing, medical and allied health work patterns. Survey responses from patients, visitors and staff gave an overall indication that having a scheduled quiet time period was a satisfying experience and was a well-accepted intervention with positive outcomes.

There has been almost no recent research in the specific area of visitors' timing preferences, though of the 204 patients' visitors surveyed by Tanner (2005) in the UK, one third did not like to be present at mealtimes, and the majority preferred open visiting with a 'quiet hour'. The majority of visitors surveyed in the present study stated that they felt that had enough time to visit patients during scheduled visiting hours and that they did not feel that they needed more time to visit the patient. However, paradoxically they also felt that they wanted to retain the right to visit at any time which may indicate a tension between general support for patients' and visitors' rights and an understood need for increased patient rest. Other related research in this area has recommended specific staff education related to increased and individualised incorporation of visitors into patient care routines according to the clinical context (eg. neuroscience, oncology) (Farrell et al., 2005; Livesay et al., 2005).

Among the health professionals' surveyed, the overall response was positive. Neither nurses nor allied health or other disciplines felt that the quiet time intervention unduly constrained visitors' access to patients. However, while the majority of nurses agreed that the scheduled quiet time did not adversely affect their clinical work, about half of the allied health or other disciplines indicated that the quiet time intervention adversely affected their clinical work and their access to patients. This interdisciplinary disagreement could not be investigated further due to the small sample size and lack of specific comment from those surveyed. The lack of survey data from medical staff may simply be an indication that the quiet time intervention and timing has more direct impact on nursing and allied health work than on medical rounds, which tend to happen early in the morning or later in the afternoon/evening in the study sites.

There is little research to indicate whether open visiting has any effect on either client and family or nursing care outcomes (Tullmann and Dracup, 2000), and it has been argued that unlimited intrusion of hospital staff and visitors into the inpatient's environment contributes to significant rest and sleep disruption (Haigh, 2001). Therefore, this study provides good evidence for the sustainability of a scheduled quiet time period, and its findings are in accord with research into this issue in critical care environments (Lazure and Baun, 1995; Olson et al., 2001; Lower et al., 2002). As is often the case with this type of applied research, engaging in the research process has empowered the nursing staff to adopt the quiet time intervention as standard practice on the experimental ward beyond the end of the study period, as the study provides good evidence for decreased noise levels and increased patient rest/sleep.

4.4. Limitations of the study

The principal limitations of the study were the reduced sample size and the low response rates for Epworth Sleepiness Scale and SF12 V2 questionnaires at discharge and follow-up. While reduced sample size, combined with the loss of power from the cluster effect, can often lead to a type II error (ie. a false negative, or a failure to detect a difference that is actually

there), this did not eventuate in our study. The relevant results were statistically significant, and the effect size for the increase in the number of patients asleep during the quiet time was 0.89. The low response rates for the discharge and follow-up questionnaires prevented the study from testing hypotheses 3 and 4 concerning improvement to overall sleep status and health outcomes. It would be possible for the effects of both of these limitations to be reduced with sufficiently powered and funded study.

5. Conclusion

This is the first reported research to have tested the therapeutic outcomes of a quiet time intervention in an acute care, as opposed to a critical care, environment.

While the study generally supports previous work in this area, the interpretive limitations imposed by the lack of discharge and follow-up data prevent definitive conclusions being drawn regarding the relationship between rest and sleep and potential wellbeing during a quiet time period. However, we have shown that a quiet time intervention on an acute care hospital ward shows strong effects on noise level and associated patient sleep/wake patterns during the intervention period. The overall strongly positive response from patients, visitors and staff also suggests that scheduled quiet time would be a positively perceived intervention with good outcomes that would be relatively straightforward to introduce on other wards.

We recommend that further research be undertaken in this area in order to build on the positive indications of this study. Larger sample sizes on a variety of different wards would be favourable, as would controlling measures for better response rates for follow-up data collection. A quiet time intervention has significant potential for improved patient outcomes and increased consumer satisfaction with acute care health services, both factors which are of increasing importance in the contemporary health care environment.

References

Beydon, L., Rauss, A., Lofaso, F., Liu, N., Cherqui, D., Goldenberg, F., Bonnet, F., 1994. Survey of the quality of sleep during the perioperative period. Study of factors predisposing to insomnia. Annales Franciases d'Anesthesie et de Reanimation 13 (5), 669–674.

Bowman, A.M., 1997. Sleep satisfaction, perceived pain and acute confusion in elderly clients undergoing orthopaedic procedures. Journal of Advanced Nursing 26 (3), 550–564.

Busch-Vishniac, I.J., West, J.E., Barnhill, C., Hunter, T., Orellana, D., Chivukula, R., 2005. Noise levels in Johns Hopkins hospital. Journal of the Acoustical Society of America 118, 3629–3645.

Edell-Gustafsson, U.M., Gustavsson, G., Yngman Uhlin, P., 2003. Effects of sleep in men and women with insufficient sleep suffering from chronic disease: a model for supportive nursing care. International Journal of Nursing Practice 9 (1), 49–59.

Edwards, G.B., Schuring, L.M., 1993. Pilot study: validating staff nurses' observations of sleep and wake states among critically ill patients, using polysomnography. American Journal of Critical Care 2 (2), 125–131.

EnHealth Council, 2004. The health effects of environmental noise. Publication approval number 3311 (JN 7845). Commonwealth of Australia, Canberra.

Environmental Protection Agency, 1974. Information on levels of environmental noise requisite to protect public health and welfare with an adequate margin of safety. Publication number 550-9-74-004. Government Printing Office, Washington DC.

Ersser, S., Wiles, A., Taylor, H., Walsh, R., Bentley, T., 1999. The sleep of older people in hospital and nursing homes. Journal of Clinical Nursing 8, 360–368.

Farrell, M.E., Joseph, D.H., Schwartz-Barcott, D., 2005. Visiting hours in the ICU: finding the balance among patient, visitor and staff needs. Nursing Forum 40 (1), 18–28.

Fogari, R., Zoppi, A., Corradi, L., Marasi, G., Vanasia, A., Zanchetti, A., 2001. Transient but not sustained blood pressure increments by occupational noise. An ambulatory blood pressure measurement study. Journal of Hypertension 19 (6), 1021–1027.

Haigh, C., 2001. Quiet please. The Journal for Health Design & Development 32 (4), 29–30.

Holand, S., Girard, A., Laude, D., Meyer-Bisch, C., Elghozi, J., 1999. Effects of auditory startle stimulus on blood pressure and heart rate stimulus. Journal of Hypertension 17 (12), 1893–1897.

Johns, M., 1991. A new method for measuring daytime sleepiness: the Epworth Sleepiness Scale. Sleep 14 (6), 540–545.

Johns, M., 1992. Reliability and factor analysis of the Epworth Sleepiness Scale. Sleep 15 (4), 376–381.

Kato, M., Phillips, B.G., Sigurdsson, G., Narkiewicz, K., Pesek, C.A., Somers, V.K., 2000. Effects of sleep deprivation on neural circulatory control. Hypertension 35 (5), 1173–1175.

Lazure, L.L.A., Baun, M.M., 1995. Increasing patient control of family visiting in the coronary care unit. American Journal of Critical Care 4 (2), 157–164.

Livesay, S., Gilliam, A., Mokracek, M., Sebastian, S., Hickey, J.V., 2005. Nurses' perceptions of open visiting hours in neuroscience intensive care unit. Journal of Nursing Care Quality 20 (2), 182–189.

Lower, J., Bonsack, C., Guion, J., 2002. Combining high tech and high touch. Nursing 32 (8), CC1–CC6.

Lower, J., Bonsack, C., Guion, J., 2003. Peace and quiet. Nursing Management 34 (4), 40A–40B, 40D.

Morrison, W.E., Haas, E.C., Shaffner, D.H., Garrett, E.S., Fackler, J.C., 2003. Noise, stress, and annoyance in a pediatric intensive care unit. Critical Care Medicine 31, 113–119.

Olson, D.M., Borel, C.O., Laskowitz, D.T., Moore, D.T., McConnell, E.S., 2001. Quiet time: a nursing intervention to promote sleep in neurocritical care units. American Journal of Critical Care 10 (2), 74–78.

Onen, S.H., Alloui, A., Gross, A., Eschallier, A., Dubray, C., 2001. The effects of total sleep deprivation, selective sleep interruption and sleep recovery on pain tolerance thresholds in healthy subjects. Journal of Sleep Research 10 (1), 35–42.

Pagano, M., Gauvreau, G., 2000. Principles of biostatistics. Pacific Grove, Duxbury.

Plowright, C.L., 1998. Intensive therapy unit nurses' beliefs about and attitudes towards visiting in three district general hospitals. Intensive & Critical Care Nursing 14 (6), 262–270.

Ramsey, P., Cathelyn, J., Gugllotta, B., Glenn, L., 1999. Visitor and nurse satisfaction with a visitation policy change in critical care units. Dimensions of Critical Care Nursing 18 (5), 42–48.

Redeker, N.S., Ruggiero, J.S., Hedges, C., 2004. Sleep is related to physical function and emotional wellbeing after cardiac surgery. Nursing Research 53 (3), 154–162.

Roland, P., Russell, J., Richards, K.C., Sullivan, S.C., 2001. Visitation in critical care: processes and outcomes of a performance improvement initiative. Journal of Nursing Care Quality 15 (2), 18–26.

Sanderson, K., Andrews, G., 2002. The SF-12 in the Australian population: cross validation of item selection. Australian & New Zealand Journal of Public Health 26 (4), 343–345.

Southwell, M.T., Wistow, G., 1995. Sleep in hospitals at night: are patients' needs being met? Journal of Advanced Nursing 21 (6), 1101–1109.

Tanner, J., 2005. Visiting time preferences of patients, visitors and staff. Nursing Times 101 (27), 38–42.

Tochikubo, O., Ikeda, A., Miyajiama, E., Ishii, M., 1996. Effects of insufficient sleep on blood pressure monitored by a new multibiomedical recorder. Hypertension 27 (6), 1318–1324.

Topf, M., Thompson, S., 2001. Interactive relationships between hospital patients' noise-induced and other stress with sleep. Heart & Lung 30 (4), 237–243.

Tuller, S., McCabe, L., Cronenwett, L., Hastings, D., Shaheen, A., Daley-Faulkner, C., Wheeler, K., 1997. Patient, visitor and nurse evaluations of visitation for adult postanesthesia care unit patients. Journal of PeriAnesthesia Nursing 12 (2), 402–412.

Tullmann, D.F., Dracup, K., 2000. Creating a healing environment for elders. AACN Clinical Issues 11 (1), 34–50.