Surgical Patients' Experiences of Sleep, Night-Time Pain and Analgesic Provision

Susan José Closs

Ph.D
Doctor of Philosophy
Department of Nursing Studies

University of Edinburgh
January 1992

Declaration

Except where specific reference is made to other sources, the work in this thesis is the original work of the author. It has not been submitted in whole or in part for any other degree.

S. José Closs

Abstract

The promotion of sleep and the control of pain for patients in hospital are recognised as important nursing functions, but they have tended not to be considered together. Research evidence suggests that both sleep disruption and pain have adverse effects on the recovery of surgical patients. This thesis examines the interactions between sleep and pain through three studies of patients on surgical wards. The first study investigated 200 patients' experiences of sleep in hospital; the second study took the form of a retrospective examination of analgesic provision for a sub-sample of 36 post-operative patients from the initial survey; and the third study concentrated on 100 surgical patients' experiences of sleep, pain and analgesic provision and the relationships between these factors.

The first study indicated that the majority of patients felt that their sleep was worse in hospital than at home. Pain or discomfort were cited by 90% of patients as disturbing sleep at night. The high frequency with which pain was reported as a cause of disrupted sleep prompted the next study.

This second study was a retrospective examination of analgesic provision for a sub-sample of 36 surgical patients from the first study. It showed that analgesics were given approximately half as frequently during the night as during the day. It was also found that a mean of only 27% of the maximum doses of analgesics prescribed were actually given during the immediate post-operative period.

In the third study closer attention was paid to relationships between post-operative pain, sleep and analgesic provision. Again, pain was the most commonly reported cause of night-time sleep disturbance. Almost three-quarters of the sample reported that pain had interfered with sleep in some way. Approximately half of the patients felt that pain was worse at night than during the day. Many patients held strong beliefs about the relationships between pain and sleep. Over one-third of the patients felt that tiredness affected post-operative pain, for the most part making it worse. One-third felt that sleep reduced the intensity of the pain. Over three-quarters felt that sleep helped them to cope effectively with their pain and almost all believed that sleep had a positive effect on recovery. Patients received fewest doses of opioid analgesics during the night (as in the previous study), while the majority of doses were given in the morning and evening. This circadian pattern of administration was not evident for non-opioid analgesics. Between one-fifth and one-quarter of the maximum possible amount of analgesics prescribed was actually given to patients during the first two post-operative days.

Overall, these studies underline that sleep and pain are closely linked. It is recommended that the interactions between sleep and pain should be recognised by nurse practitioners, educators and researchers. The findings are discussed with particular reference to the development of effective and efficient methods of assessing and controlling pain at night with the objective of promoting sleep and recovery from surgery.

Acknowledgements

First of all I am grateful to SOHHD who funded this research as part of the core programme of the Nursing Research Unit at the University of Edinburgh.

The two key individuals to whom I am extremely grateful are my supervisors, whose inputs have been complementary. Hamish Macleod gave me invaluable methodological and statistical advice and useful criticism, along with constant good humour. Alison Tierney provided excellent all-round support, being consistently scrupulous, constructive and encouraging.

Thanks are due to all the friends who put up with me throughout the time it took to complete the work, and also to my mother, Diane Closs who is ultimately responsible for my being in a position to undertake a PhD.

There are many other people without whom this work would have been much the poorer. I am grateful to Kevin Morgan, whose expertise in the field of sleep research enabled me to move forward with work in the early days. Thanks are also due to Frances Provan who gave essential advice on computing and analysis. Many people have given helpful comments on various drafts, in particular my colleagues in the NRU, including Ian Atkinson, Maureen Macmillan, Hazel McHaffie and Tricia Murphy-Black. In addition, Steve Tilley, Kath Melia and Mike Barfoot all kept the work moving forward in its final stages.

I am also grateful to all the nursing and medical staff who permitted me to interview patients in their wards. The people who deserve the greatest thanks, however, are the patients who participated in this research. Many of them were good enough to give up their time to be interviewed despite being at an uncomfortable stage of post-operative recovery. Their contribution is appreciated enormously.

Contents

List of Figures

List of Tables

INTRODUCTION

> "During the dreadful nights you face the pain, and the horrors brought by fever and half-sleep, alone. It cannot be described."
>
> *(Freed 1975)*

Obviously not everyone has an experience as bad as this following surgery, but the extent to which such distress occurs is not known. Sleeping well and being pain free are two aspects of life which are taken for granted by most people most of the time. There can be few adults, however, who have not suffered pain or disturbed sleep at some point in their lives. These are commonplace experiences, often affecting both physical and mental health and, as such, they are necessarily the concern of health professionals. Sleep and pain are highly subjective phenomena, making any kind of objective quantification of them almost impossible. Furthering knowledge of these phenomena is therefore both challenging and necessary if our understanding is to progress.

The origins of this research lie in personal experience of nursing post-operative patients at night. Developing expertise specific to surgical nursing included a strong emphasis on practical problem-solving skills such as monitoring vital signs, calculating intravenous infusion rates and so on. The less immediately accessible problems of pain and disturbed sleep were relatively neglected. Nursing surgical patients produced a powerful feeling of inadequacy in me; there was little that nurses had to offer patients who suffered at night, either with sleeplessness or pain. Medications were frequently ineffectual, and there seemed little else that nurses could do to help.

For the majority of people, adjustment to being in hospital disrupts normal daily routines, including sleep patterns. Helping patients to sleep while they are in hospital is generally recognised as a predominantly nursing function. The planning of care at night therefore revolves around this fundamental need for sleep. Night-time and day-time nursing care are equally important, but they do differ from one another.

The major reason for differences in nursing care at night is simply that patients need to be allowed to sleep as best they can. This simple fact has considerable implications for how care is organised at night.

The 24-hour contact which nurses have with patients means that at night it is they who have the responsibility of making the ward environment as compatible with sleep as possible, as well as identifying individual problems with sleep and pain. Medical intervention may be sought where it is appropriate, for example when hypnotic, analgesic or antidepressant medication is needed. Since research suggests that lack of sleep is detrimental to the physiological and psychological (and therefore social) state of the individual, it is an area of care relevant to all practising nurses. Nurse researchers have paid little attention to issues which are unique to the care of patients during the night, and it is an area much deserving of attention.

The importance of sleep to the individual is well accepted and is discussed more fully in Chapter 1. The 24-hour sleep-wake cycle is fundamental to the normal functioning of all human beings, although the actual length of time spent asleep and the reported quality of sleep may vary enormously between individuals. The roles of sleep in physiological and psychological functioning have been the subjects of vast amounts of research in many different disciplines. While the precise function of sleep in healing mechanisms is not known, the evidence suggests that recovery from illness or surgery may be improved, perhaps even accelerated, if there is adequate sleep. The postulated role of sleep in tissue restoration suggests that patients undergoing surgery are likely to benefit from nursing interventions designed to enhance sleep. The possibility of improving the rate of recovery by improving sleep quality may have important implications for the reduction of hospital stay and therefore costs to the health service.

There is considerable research (see Chapter 1) which has examined sleep in hospital and those factors which influence sleep. Much of this has concentrated on patients in special units; for example, intensive care units, post-cardiac surgery wards and renal units. The poor sleep quality discovered was probably due to internal (physiological) as well as external (environmental) factors, some of which may have been avoidable. There are many causes of sleep disruption which result from admission to hospital, for example, noise, sleeping in a strange environment, anxiety and pain. While it may be difficult for nurses to tackle all these problems at once, by selecting and dealing with the most prevalent problems specific to particular clinical areas, sleep may well be improved for hospital patients.

Although pain has so far been mentioned in passing as a cause of sleep disturbance, the effective control of post-operative pain is well recognized as a widespread problem in its own right (see Chapter 2). Many researchers have demonstrated the inadequacy of pain relief experienced by surgical patients, but little is known specifically about post-operative pain at night. Allowing surgical patients to endure pain unnecessarily can detrimentally affect their recovery. It can inhibit mobility, stimulate catabolic processes, disrupt sleep and increase the chance of suffering long-term pain. The experience of post-operative pain specifically at night and its effects on sleep, however, have received little attention from researchers or clinicians.

This thesis is based on three consecutive studies (Chapters 3-7). These were undertaken within the core programme of research in the Nursing Research Unit at the University of Edinburgh. The first study prompted the second, and the third addressed and expanded on issues from each of the earlier studies. The area addressed specifically by the first study (see Chapters 3 and 4) was how being in hospital changed patients' normal sleep patterns and which factors most affected sleep. One of the findings was that pain was the most commonly cited cause of disturbance at night. To investigate this further, a small retrospective study of analgesic provision was carried out in order to explore the possibilities of there being day-night differences (Chapter 5). This showed that fewer doses of analgesics were given to patients at night, and the number of doses given was not related to whether pain had disturbed their sleep. This finding prompted the third study which focused on the relationships between night-time pain, analgesic provision and sleep (see Chapters 6 and 7).

It is likely that the sleep of post-operative patients would be improved by better pain control at night. Systematic research-based observations of the phenomena of sleep and pain at night are required in order to promote informed night-time nursing care. The integration of sleep and pain in terms of research, knowledge, assessment and care are discussed in Chapter 8. The work presented in this thesis is a step towards the goal of improving the night-time experiences of post-operative patients.

CHAPTER 1

LITERATURE REVIEW (1)

Sleep

The literature review is presented in two chapters, since the three studies in this thesis were concerned with two main fields, namely sleep and pain. This first literature review chapter provides background information describing current knowledge about the structure, control and function of sleep, and the importance of the sleep-wake cycle. This information lays the foundation for the subsequent discussion of factors affecting normal sleep which are the concern of clinical nurses. Finally, evidence that difficulties with sleeping are encountered by patients in hospital is presented.

1.1 Structure of sleep

For the most part, modern researchers have tended to use objective criteria to describe sleep, usually in terms of physiological events occurring during different states of consciousness. The electroencephalograph (EEG) has enabled sleep researchers to describe the structure of sleep in terms of the type of gross electrical activity of the brain. EEG and other recordings have shown that there are two distinct types of sleep.

1.1.1 NREM Sleep

NREM (Non-REM, sometimes called 'orthodox' or 'delta' sleep) is subdivided into four stages; stage 1 (drowsing) through to stage 4 ('deep' sleep) as described by Rechtschaffen and Kales (1968). In each of these stages electrical activity of the brain progressively slows and increases in amplitude. By convention, and throughout this text, stages 3 and 4 are termed slow wave sleep (SWS). On falling asleep, body temperature begins to fall slightly, pulse and respiration rates slow and BP drops. There are other specific physiological changes which occur during SWS, in particular a large increase in the secretion of growth hormone (GH).

1.1.2 REM Sleep

The second type of sleep is known as REM (rapid eye movement) or paradoxical sleep. EOG (electro-oculogram) and EMG (electromyogram) traces indicate the changes in eye movement and muscle tone characteristic of this stage of sleep. The EEG is virtually indistinguishable from wakefulness, with low amplitude, mixed frequency activity. During REM, however, muscle tone is lower than in any other sleep stage, the pulse and blood pressure increase, respiration rates increase and may become irregular, and oxygen consumption increases. Periods of REM sleep are associated with penile tumescence in men and increased vaginal secretion in women. REM sleep, as might be expected, is characterised by bursts of rapid eye movement, and if subjects are woken up they frequently report that they were dreaming.

1.1.3 Cycles of Sleep

During a night's sleep, all of these stages may occur many times, tending to occur in a repeating cycle. In healthy young adults, sleep usually begins with drowsing (stage 1) and progresses through stage 2 to SWS. This 'deep' sleep is frequently followed by an episode of REM, and then back into stage 2 and the pattern is then repeated. This cycle lasts approximately 100 minutes, though the first part of the night tends to contain more SWS while the latter part of the night contains a higher proportion of REM. Shifts from stage to stage tend to accompany body movements, and shifts to light sleep tend to occur suddenly, whereas shifts to deep sleep tend to be gradual. Normally sleep stages 1 and 2 comprise 54%, SWS 23% and REM 23% of total sleep in healthy young adults (Johns 1984).

Although knowledge of the structure of sleep is important for nurses to be able to understand sleep problems, it is the subjective quality of sleep which is of greatest importance to the sleeper. This issue will be discussed more fully later.

1.2 Physiological control of sleep

The physiological regulation of sleep is highly complex, almost certainly involving several areas of the brain, several sleep substances and several neurotransmitters. At present it appears that the brain has several interlinked sleep centres. Some relate to the onset and timing of sleep, some to REM some to NREM and others to wakefulness. NREM sleep mechanisms in the basal forebrain interact with reticular systems producing characteristic slow wave electrical activity in the cerebral cortex. The REM sleep generator in the pons interrupts this process periodically, reactivating the brain (Steriade and Hobson 1979). In addition there are several putative naturally occurring sleep substances which seem to be diffuse throughout the brain (Horne 1988).

How sleep is controlled and precisely how or why people sleep is poorly understood. It is perhaps not appropriate to explore such a vague area in detail here, so the main points only of this complex interaction have been summarized.

1.3. Functions of sleep

As yet there appears to be no consensus of opinion regarding the function of sleep. As Empson (1989) said, "It must be admitted straight away that the function of sleep remains a mystery, and its evolution remains a matter for conjecture". It is generally considered that sleep is either a restorative process, both physiological and psychological or that it is an instinct allowing humans to occupy the normally unproductive hours of darkness, and to conserve energy.

In a review of research literature pertaining to the role of sleep in bodily renewal, Adam and Oswald (1983) concluded that the main function of sleep is associated with healing:

> "The literature demonstrates that, in the majority of tissues, peak rates of protein synthesis and peak rates of cell division coincide with the time of sleep. In contrast, degradative metabolism is greater during wakefulness."

Webb (1988) identified the possibility that sleep has a protective function, limiting excessive exercise and stimulation that might lead to exhaustion. Taking a different view, Horne (1983) proposed that sleep has a combination of instinctive and restorative functions:

> "At sleep onset two processes may work in parallel, that of obligatory and restorative sleep, oriented towards brain restitution, and that of the more facultative sleep drive. The former appears to necessitate only some of sleep, presumably the first few hours (wherein SWS is found), and then declines, leaving the latter to maintain sleep for the required length".

Horne (1985) suggested that the brain is the only organ which enters "an essential physiological state clearly unique to sleep". He concluded in a later publication (Horne 1986) that the 'obligatory' portion of sleep is essential only for the functioning of the brain and that other organs may require only physical rest and feeding for restitution.

None of these theories is fully accepted. The notion, however, that sleep has a restorative role is certainly one which may have important implications for the physical and psychological nursing care of patients recovering from surgery. Research which has addressed these issues is discussed below.

1.3.1 Sleep and physiological restoration

Direct study of sleep and healing in hospital presents enormous practical difficulties, partly because of the number of uncontrollable variables, and partly due to the ethical issues involved. For example, it is unacceptable to deprive one group of sleep in order to compare their rate of tissue healing with another group who have been allowed to sleep. Fortunately there is considerable evidence from animal studies which demonstrates the importance of sleep for tissue renewal.

Several studies have shown that not only do more cells divide during normal sleep, but also that they take less than half the time they would during wakefulness (Kirk, 1972; Burns et al 1976; Clausen et al 1979). Reeve (1975, 1977) studied the repair of rectal mucosa and tympanic membrane following trauma and showed that reparative processes rhythmically rose to peaks coinciding with the normal sleep period. Observations of rats following partial nephrectomy (Saetren 1972), hepatectomy (Barbason 1974) and post-fracture linear bone growth (Simmons and Cohen 1980) showed that peak cell replacement took place around mid-day when the rats were asleep (rats being nocturnal creatures). Unfortunately the evidence regarding humans is somewhat sparse. Valk and Van Den Bosch (1978) found that the rate of bone growth in boys increased during sleep, as did proliferative activity in bone marrow (Mauer 1965) and epidermis (Fisher 1968). Even though there is relatively little evidence from human studies that anabolism occurs during sleep, there have been numerous animal experiments which have produced findings supporting the theory that sleep coincides with restorative processes.

Circadian variations in the levels of anabolic and catabolic hormones also suggest that anabolic processes occur during the sleep period. In humans, protein synthesis is inhibited by hormones such as cortisol, glucagon and catecholamines, which reach their highest levels during the day (Rannels and Jefferson 1980) and fall during sleep (Akerstedt and Froberg 1979; Weitzman et al 1983). During sleep, energy expenditure in the tissues falls and the energy stored within the cells as adenosine triphosphate (ATP) rises to levels which become sufficiently high for protein synthesis to occur. Growth hormone (GH), which stimulates protein and RNA synthesis, and amino acid uptake, reaches peak secretion rates during SWS (Korner 1965), and Adamson et al (1974) found that an increase in day-time exercise led to an increase in night-time secretion of GH.

Total sleep deprivation has been shown to result in clear signs of CNS impairment and there is evidence of physiological damage. Rechtschaffen et al (1983) deprived rats of sleep for 5-33 days and found that they suffered "severe pathology and death" whereas control rats did not. The causes of death were not uniform, rendering the mechanism of sleep deprivation in causing such damage unclear.

Finally, SWS is the sleep state which has the highest positive correlation with the length of prior wakefulness and therefore appears to have restorative properties (Webb and Agnew 1971; Czeisler et al, 1980; Akerstedt and Gilberg, 1981).

Taken together, even though all this evidence is not completely conclusive, it does support the assertion that sleep, and in particular SWS, is essential for tissue restoration.

1.3.2. Psychological functions of sleep

In humans, total sleep deprivation for 48 hours may result in changes in CNS function, such as behavioural irritability, suspiciousness, speech slurring and minor visual misperceptions (Horne 1983). These may be accompanied by increased suggestibility and/or a reduction in motivation and willingness to perform tasks which could include mobilisation and other aspects of self care. Such detrimental psychological effects of sleep deprivation in hospital patients have been observed, including lethargy, irritability, confusion, and eventually, delusions and paranoia. Both acute and prolonged sleep disturbances including delirium have been observed following open heart surgery (Orr and Stahl, 1977). The effects of sleep on mood have been examined by Shaver et al (1989). They recorded morning and evening mood states in normal women with varying sleep efficiencies. They found that better sleep was associated with positive mood.

The function of REM sleep is more difficult to explain than that of SWS and has generally been considered to have some psychological function. Babies have large amounts of REM sleep (Roffwarg et al, 1966), whereas elderly sufferers of chronic brain syndrome have a reduced duration of REM compared with age-matched controls, implying that REM sleep has a possible role in brain metabolism.

It seems possible that REM sleep is involved in learning and memory, but research has so far failed to provide convincing evidence to support this idea. Vertes (1986) put forward the theory that the primary purpose of REM sleep is to "to provide periodic endogenous stimulation to the brain which serves to maintain minimum requisite levels of CNS activity throughout sleep." He further suggested that this would ensure recovery (ie waking up) from sleep. Evidence from drug trials do not support this theory. Some individuals who took antidepressant drugs on a long-term basis sustained complete abolition of REM sleep without any appreciable ill effects (Petre-Quadens and Schlag, 1974), suggesting that REM sleep is not essential to normal functioning. Individuals who were sleep deprived for several nights showed that not all of the sleep that was missed was reclaimed (Gulevich et al, 1966; Kales et al, 1970; Horne, 1976). Only about one-third of the total sleep loss appeared to be reclaimed, and this was mostly SWS, with about two-thirds of the REM. Stages 1 and 2 were never made up, thereby appearing to be dispensible constituents of sleep.

Hartmann (1973) assessed sleep requirements by interview and questionnaire, and found that stress and illness were virtually always accompanied by an increased subjective sleep need. Studies of coronary care patients have shown generally disturbed sleep, but suggest increased total sleep time (Karacan et al, 1974; Broughton and Baron, 1978). Since coronary care patients tend to have relatively more favourable conditions for sleeping than other inpatients, it might therefore be supposed that they sleep longer as a response to a physical need for that sleep.

Overall, these research findings support the hypothesis that sleep aids healing, or at least that a lack of sleep creates conditions which are likely to impede recovery. An environment conducive to sleep should be encouraged in all areas where patients are suffering from infection, trauma, or are recovering following surgery. The research suggests not only that sleep may enhance physical post-operative recovery, but also that it might reduce negative mood states liable to hinder recovery.

1.4 The importance of the sleep-wake cycle

It is inevitable that hospital admission leads to changes in many personal routines, including the sleep-wake patterns of patients. Under normal circumstances these circadian rhythms are synchronised by external time cues such as the light-dark cycle, and also by social time cues, such as mealtimes. The synchronising cues are known as zeitgebers (German for 'timegivers'). When humans are placed in an environment free of time cues their circadian rhythms usually take on a 'natural period', different from 24 hours. This is known as free-running. The disruptions which occur as a result of admission to hospital may be due to the absence or adjustment of the zeitgebers normally responsible for synchronisation, as well as extra stresses such as pain and anxiety. Acute care units in particular would be likely to disrupt normal circadian rhythmicity, since there would be unfamiliar lighting conditions, and altered times both of meals (or their absence) and awakening. Floyd (1984) found that psychiatric hospital inpatients slept less than a matched group of outpatients, and appeared to have their normal times of sleeping and activity altered by the hospital's rest/activity schedule. Psychiatric pathology itself may, however, interfere with sleep patterns, a point which is discussed later.

The sleep-wake cycle coincides with other circadian rhythms, such as 24-hour fluctuations in body temperature, heart rate, and plasma levels of anabolic and catabolic hormones. Catecholamines and cortisol potentiate stress responses, which are likely to be high among special unit patients. If subjects are allowed to free-run, that is, if the subject is isolated from all cues signalling the time of day, then the various circadian rhythms tend to dissociate from one another (Aschoff 1965; Wever 1979). For example, it has been demonstrated that such internal desynchronisation may lead to the rest-activity cycle having a period of, perhaps, 33 hours, whereas body temperature might have a 24.5 hour period. Subsequent work has shown that when a subject becomes internally desynchronised, the various physiological and behavioural indices tend to cluster into two groups, following either the rest-activity cycle or the body temperature rhythm (Czeisler et al 1980; Moore-Ede 1983).

There is considerable individual variation in circadian rhythmicity, one aspect of which was identified by Horne and Ostberg (1976). They found that people could be classified into two distinct groups, which they called 'morning' (larks) and 'evening' (owls) types. Morning people preferred to rise early and retire to bed early, whereas evening people rose and retired later in the day and tended to function better in the evenings.

Desynchronisation of circadian rhythms has been shown to disrupt pulse rate, respiration, arterial pressure, diuresis, and excretion of potassium, sodium and 17-hydroxycorticosteroids, as well as temperature and sleep-wake patterns (Stepanova 1974). Symptoms of acute desynchronisation include fever, alcohol hangover, migraine and some mental disorders (Winget et al 1984). Weitzman et al (1970) showed that EEG recordings of subjects following a phase shift of the sleep-wake cycle revealed changes in sleep structure similar to those found in endogenously depressed individuals; an increased REM latency and more night-time awakenings. Wehr et al (1979) suggested that endogenous depression might result from "chronic abnormal circadian rhythm phase relationships between metabolically related rhythms and the sleep-wake cycle".

It may be seen then, that the disruption of normal circadian rhythms, and in particular that of sleep, leads to numerous adverse physiological and psychological consequences, which could be particularly undesirable for hospital patients who are subject to many additional stresses. In addition, individual variations such as those shown by morning and evening types are rarely taken into account, particularly in areas where routine is strictly adhered to. Since the two major synchronising rhythms appear to be those of sleep and body temperature, nurses should maintain an awareness of these and attempt to keep them in step with patients' normal patterns where appropriate.

1.5 General factors affecting normal sleep

Normal sleep is difficult to define since its quantity and quality varies widely between healthy adult subjects. A range of 3-12 hours sleep per night has been cited (Johns 1984), with a mean of 7.25 hours and a normal frequency distribution. Sleep is influenced by many extraneous factors which may affect the sleep of individuals in different ways.

Research has demonstrated that there are many factors which affect normal sleep. These include age, gender, anxiety, depression pain, diet, drugs, sleep position, respiration, body weight, temperature and genetic constitution. These influences require consideration when making nursing assessments of patients' sleep, since the normal habits and needs of the individual vary enormously.

1.5.1 Age

Age in particular should be taken into account, since the changes in sleep patterns associated with age are well documented (Williams et al 1974; Reynolds et al 1985). Elderly people sustain an absolute and relative reduction in time spent in stage 4 sleep, which may even disappear in a quarter of those in their sixties. They have an increased total duration of stages 1 and 2 sleep, however, and an increase in the number of shifts between stages, particularly into stage 1. The total sleep time (TST) is either reduced or unchanged in the elderly as compared with younger groups, though the time in bed tends to increase. This appears to be because they spend more time lying in bed at night without attempting to sleep, unsuccessfully trying to sleep, and lying in bed resting or napping during the day. Obviously these patterns would be considered abnormal in a younger age group, but should cause no concern amongst the elderly. Knowledge of these normal changes must be understood by nurses on wards with large proportions of elderly patients. It may be necessary to adjust some of their routines in order to accommodate such sleep habits.

McGhie and Russell (1962) found a significant increase in the proportion of patients over 65 years claiming to sleep for five hours or less. The elderly have increased amounts of wakefulness after sleep onset. Webb and Swinburne (1971) attributed 38% of night-time awakenings among the elderly to pain and physical discomforts such as bladder distension and urinary urgency. An awareness of these problems might encourage the nurse to attempt to alleviate discomfort as far as possible, as well as encouraging regular bowel and bladder habits.

Zepelin et al (1984) studied subjects aged 18-71 years and found a significant decline in the intensity of noise required to arouse them from sleep with increasing age. This reduction was present in all sleep stages, but greatest in stage 4. Since noise disturbs normal sleep stage progression and increases the frequency of awakening, it may be that noise reduction in hospital is of particular importance in maintaining the more fragile sleep of the elderly.

1.5.2 Gender

Gender should also be considered when assessing sleep. Men have more disturbances in sleep than women from early adulthood onward (Webb 1982), frequently due to nocturnal penile tumescence occurring during REM sleep. Wever (1984) found that women sleep significantly longer that men, though it is well recognised that women complain of problems with sleeping more than men (McGhie and Russell 1962) and also consume far more sleep-inducing drugs (Murray et al 1981). A small study of 20 healthy elderly people who were sleep deprived showed that women developed a greater decrease in vigour with a greater increase in fatigue and tension than the men. Interestingly, the women then had better quality recovery sleep ie higher sleep efficiency and more SWS (Reynolds et al 1986).

1.5.3 Anxiety and depression

Both anxiety and depression frequently interfere with sleep, and each may be associated with admission to hospital. Anxiety results in an increase in plasma noradrenaline levels due to increased activity of the sympathetic nervous system. This in turn results in sleep changes similar to those seen in normal elderly adults (less stage 4 and REM, and more stage shifts and awakenings), who also undergo elevations of day-time and night-time plasma noradrenaline (Vitiello et al 1983). Admission to hospital itself may be a major cause of anxiety (Lucente and Fleck 1972) with all the accompanying worries regarding illness, investigations, surgery and so on.

Insomnia due to depression has been associated with difficulty in falling asleep, an increased number of awakenings during the night and a shortened REM latency.

These findings have implications for nursing practice; some insomnia might be alleviated by encouraging depressed and anxious patients to discuss their feelings, and where possible, assisting them in dealing with underlying difficulties. Alerting medical staff to the apparent existence of anxiety and depression should ensure that the patient receives the appropriate medical or psychological treatment.

1.5.4 Pre-sleep routines

Little research has examined the effects of bedtime routines on sleep in hospital, although it has often been suggested that they are highly significant in promoting a good night's sleep. In 1969 Luce and Segal proposed that many people may be unaware that they have a bedtime ritual. The reason was that these are frequently inconspicuous, for example, cleaning teeth or arranging bedclothes in a particular way. Nevertheless, they suggested that the comfort provided by such acts improved sleep.

Johnson (1988) studied 45 institutionalized and 42 non-institutionalized elderly women. She found that those in nursing homes whose routines had changed had less sound sleep, took longer to fall asleep and woke earlier. Of the women who lived at home, those with a routine tended to feel calmer at bedtime, fell asleep more quickly, woke less often and were more satisfied with their sleep.

Many bedtime routines involve diet or exercise, which are mentioned below.

1.5.5 Exercise

The effect of exercise on normal sleep is not straightforward. Research studies have produced conflicting evidence. Some have shown that exercise increases the duration of SWS (Baekeland and Lasky 1966; Shapiro et al 1975; Shapiro and Verschoor 1979), others have shown no effect on sleep (Hauri 1968; Adamson et al 1974; Walker et al 1978). More recently it has been shown, however, that subjectively exercise was perceived as having a sleep promoting effect for one-third of a sample of 200 men and women aged 36-50 years (Vuori et al 1988), provided that it was not taken in the late evening.

1.5.6 Diet

There has been much research into the effects of diet on sleep. Brezinova and Oswald (1972) found that Horlicks apparently enhanced sleep by increasing its total duration and decreasing periods of wakefulness. It was noted that amongst the older subjects (mean age 55 years) such improvements were most apparent late in the night and that repeated administration further enhanced sleep. Unfortunately the volunteers who had participated in the study were a self-selected group, that is, they had responded to an advertisement asking for subjects willing to take night-time drinks. A link was noted between habitual bedtime practices and sleep; those who normally ate little or nothing before bedtime slept better after a dummy capsule than Horlicks, and those who normally had a bedtime drink slept better after Horlicks. Hot milky drinks are usually provided in hospital in the late evening, but it should be remembered that many people take an alcoholic 'nightcap' at home. If they are normally heavy drinkers they will suffer from withdrawal symptoms in hospital if they are not allowed their usual drink.

Withdrawal from alcohol (Oswald 1984) as well as hypnotic drugs (Petursson and Lader 1984), results in disturbed sleep. It should be noted that alcohol is not a good hypnotic since, although it accelerates sleep onset, it disturbs sleep patterns later on in the night (Williams et al 1983). Not only that, but alcohol frequently causes wakenings in the early hours due to a full bladder. Drinks such as tea, coffee and cola contain caffeine and therefore act as stimulants, disturbing normal sleep patterns. Karacan et al (1976) showed that coffee disturbed normal sleep even in those who felt unaffected by it.

Starvation has been shown to change sleep (MacFadyen et al 1973). Four days of fasting produced a slight decrease in the amount of REM sleep and an increase in SWS in 10 young healthy men. Peri-operative fasting, therefore, may produce small effects on sleep structure.

In recent years there has been controversy over the role of tryptophan, an essential amino acid found in meat, milk and many other food proteins. Tryptophan is the amino acid precursor of the neurotransmitter 5-hydroxytryptamine (5-HT). As yet there is no conclusive evidence that a high tryptophan diet enhances sleep. Yogman and Zeisel (1984) found that newborn infants given a high tryptophan feed entered sleep significantly quicker than a control group given a high valine feed. The authors suggested that tryptophan's availability resulted in increased 5-HT synthesis which therefore facilitated sleep onset. This is in conflict with work by Moja et al (1984) who found that in a group of healthy adults a tryptophan-free diet caused a decrease in stage 4 sleep latency and an increase in stage 4 sleep during the first three hours of sleep. Little information is available regarding the effects of other nutritional substances, though Vitiello et al (1983) found that for a group of ten healthy adult males, a low sodium diet decreased REM and SWS and increased wakefulness.

Although the biochemical effects of diet on sleep are unclear, adherence to routine habits appears to enhance sleep. This suggests that hospital inpatients might benefit from eating or drinking as normal before settling down to sleep.

1.5.7 Drugs

There are many drugs which affect sleep, hypnotics and analgesics as well as others with side-effects which interfere with sleep. The majority of hypnotics which are currently prescribed belong to the benzodiazepine group, and include temazepam, triazolam, and nitrazepam. The sleep produced by these drugs does not resemble natural sleep; the duration of stage 2 sleep is increased at the expense of REM and SWS. Adam (1984) pointed out, however, that even though the structure of sleep is changed by these drugs, most physiological processes associated with SWS continue as usual. It is difficult, therefore, to comment on the difference between the quality of sleep induced by hypnotics and that of normal sleep.

While these drugs are initially effective in inducing sleep, regular use produces 'tolerance'. As time goes on the body requires increasingly large doses of the drug to achieve the same effect. It has been suggested that the effectiveness of most hypnotic drugs is diminished after 3-14 days of use (Committee on the Review of Medicines, 1980).

Opiate drugs also induce sleep when given in sufficient quantities, though they are currently used only for their analgesic properties. Morphine, however, has been shown to suppress REM sleep time in a linear dose-related manner (Kay et al 1969; Moote et al 1989). It is not clear whether this produces any ill-effects since little is known about the function of REM. The side-effects of opiate drugs, including respiratory depression and nausea, as well as their addictive nature, mean that they are generally used with caution and they are unsuitable for use as hypnotic agents.

1.5.8 Sleep position

Sleep positions have been associated with both objective and subjective reports of sleep quality. A comparison of sleep positions of good and poor sleepers showed that the poor sleepers spent more time on their backs with their heads straight and changed position more frequently (Koninck et al 1983). Snoring and sleep apnoea have been associated with subjects who slept flat on their backs (Koskenvuo et al 1985). Since these are undesirable for the sleeper himself, and snoring may disturb others sleeping within earshot, nurses could perhaps encourage and assist poor sleepers to adopt alternative positions for sleeping. Long periods of bedrest have been shown to disrupt other aspects of circadian rhythmicity. Winget et al (1984) found that after 56 days of bedrest, the body temperature waveform remained the same but at a lower level; a low-grade hypothermia occurred. In addition heart rate gradually increased. According to Selye (1950) these phenomena are characteristic of acute stress, regardless of its cause.

1.5.9 Respiration

Total sleep deprivation appears to reduce the hypercapnic ventilatory response by 17-20% (Cooper and Phillips 1982; Schiffman et al 1983). White et al (1983) found that total sleep deprivation reduced the hypoxic response by approximately 29%. Conversely, several studies have indicated that hypercapnia and hypoxaemia have adverse effects on the sleep patterns of rats. (Pappenheimer 1977; Megirian et al 1980; Ryan and Megirian 1982). Both increase sleep onset latency, decrease total sleep time and increase the duration of episodes of wakefulness. In addition, Ioffe et al (1984) found that hypercapnia and hypoxaemia prolonged episodes of REM sleep. Although these experiments involved animals, the suggestion that hypercapnia and hypoxaemia interfere with normal sleep patterns could be seen to have implications for nursing. Nurses can ensure that any patients with respiratory difficulties, such as post-operative patients or those with respiratory tract infections receive adequate support and assistance. This could include the administration of oxygen, maintaining an appropriate posture, and encouragement to breathe deeply and cough up secretions.

1.5.10 Body weight

Crisp and Stonehill (1971) reported that weight gain was associated with an increased duration of sleep, while weight loss was associated with shorter sleep. A small study (n=10) by Adam (1977) found a significant positive correlation between body weight and REM; the greater the weight, the more REM sleep. A larger study of 36 subjects by the same author (Adam 1987) showed that both total and percentage REM correlated positively with body weight.

1.5.11 Temperature

Temperature may also affect the normal sleep-wake cycle. Muzet et al (1984) found that "even slight changes of the ambient temperature within the thermoneutral zone can induce modifications of sleep structure". Kendel and Schmidt-Kessen (1973) pointed out that unclothed and uncovered subjects awoke from cold at 26°C and below. Total sleep deprivation has been shown to decrease the mean daily body temperature and increase subjective feelings of cold (Horne 1985).

Zulley (1980) and Zulley and Schultz (1980) found a negative correlation between REM sleep and body temperature. They also reported that body temperature influenced sleep duration. Fever has been found to be associated with a greater number of awakenings, increased total waking time, and reduced amounts of SWS and REM. Elevated ambient temperature has produced similar results. (Karacan et al 1978; Otto 1973). The duration of the REM phase is shortened in artificially induced fever (Karacan et al 1968) as well as at high ambient temperature.

These findings suggest that active management of pyrexial patients, perhaps by giving antipyretic drugs such as aspirin (or paracetamol for children), might improve their sleep. Room temperature should be carefully monitored on general wards so that it may be maintained at a comfortable level, and patients should be encouraged to request more or less bedclothes as required.

1.5.12 Genetics

Finally, sleep quality and duration appear to have a genetic component. This was demonstrated by Partinen et al (1983) who studied the sleep of 2,238 monozygotic and 4,545 dizygotic twin pairs. Familial clustering of narcolepsy (Kessler 1976) has also been observed. It may be worth noting any familial sleep difficulties when assessing a patient, since it is unlikely that any nursing intervention could remedy these.

Obviously, then, many different factors influence quality and quantity of sleep. Some are inherent within the individual, such as age, gender and genetic make-up. Others are environmental, such as ambient temperature, sleep position and diet. Factors which researchers have found to be important in disrupting sleep of hospital inpatients in particular are discussed in the next section.

1.6. Sleep disruption in hospital

1.6.1 Repeated interruptions of sleep and their effects

Many authors have commented on the extent of sleep disruptions suffered by hospital inpatients. Walker (1972), in a study of cardiotomy patients, found that they were disturbed approximately 14 times per hour immediately post-operatively. This was corroborated by Woods (1972) who documented as many as 56 interruptions of sleep on the first post-operative night, for a similar group of patients. In 1985 Bonnet investigated the effect of constant interruptions in a group of 11 healthy young adults, all of whom were woken up after each complete minute of EEG defined sleep for two consecutive nights. Their TST (total sleep time) was only reduced by one hour, but they received very small amounts of SWS and REM. After 48 hours the subjects became increasingly sleepy and their performance declined in a manner comparable with 40-64 hours of total sleep deprivation. When considering healthy adults however, it should not be assumed that all reductions in sleep are deleterious. Horne and Wilkinson (1984) found that in a group of 8-hour sleepers who had their sleep limited to six hours, no significant day-time effects were observed. This level of reduction was achieved easily, at the expense of REM and stage 2 sleep, with SWS not being affected.

1.6.2 Sleep disturbance in acute care areas

Much of the work investigating sleep disturbances in hospital has concentrated on acute care areas. Fabijan and Gosselin (1973) suggested that ICU patients show signs and symptoms of sleep deprivation within 48 hours of admission, and recommended various interventions to prevent their occurrence. Morgan and White (1983) studied the attitudes of ICU nurses toward their patients' sleep and found that although they were aware of its importance, they did not differentiate between essential and non-essential nursing tasks and often disturbed patients unnecessarily. Hilton (1976), in her descriptive study of nine ICU patients, used 48-hour EEG recordings in order to evaluate sleep quantity and quality. She found a mean TST of 2.6 hours (excluding stage 1) of the first 24 hours and 3.9 of the second 24 hours of monitoring. More recently, Aurell and Elmqvist (1985) also monitored the sleep of nine ICU patients with 48-hour EEGs and demonstrated similar trends. The mean TST (excluding stage 1) for this period was less than two hours, with stages 3, 4 and REM severely or completely suppressed. These two studies have findings consistent with other research (Johns et al 1974; Orr and Stahl 1977; Ellis and Dudley 1976).

1.6.3 The effects of surgery on sleep

Several small studies have attempted to observe the effects of surgery on sleep. Johns et al (1974) monitored four cardiac surgery patients and one abdominal surgery patient. They found that although patients were disturbed frequently for nursing care during the immediate post-operative period, they were unable to sleep when left alone. This phenomenon persisted for several days. REM sleep was absent from all but the man who had abdominal surgery during the first two post-operative days. Orr and Stahl (1977) monitored the sleep of six patients undergoing cardiac surgery polygraphically both pre- and post-operatively. For all but one of these patients sleep was absent until the second post-operative night with REM absent until the fourth night. Half of the patients still showed REM suppression two to four weeks post discharge, while two showed SWS suppression. These are very small studies with results which are difficult to interpret. In neither study, however, was pain measured or considered as a possible contributor to disturbed sleep.

Kavey and Altshuler (1979) studied the sleep of 10 herniorrhaphy (repair of hernia) patients. They showed a dramatic loss of REM and SWS for the first two post-operative nights and suggested that the main causes of disturbed sleep at this stage were pain and the nursing staff "performing the necessary routine procedures". No association was noted with the type of anaesthesia (general or spinal). A more recent study of 12 patients following abdominal surgery showed similar severe disruption of post-operative sleep, with REM absent. This was followed by a sudden release of highly intense REM sleep about the middle of the first post-operative week (Knill et al 1990). Further, these authors considered that the effects of pain and analgesics played principal roles in the nature and time course of sleep disruption.

Several researchers have concerned themselves with post-operative pain and discomfort as major factors interfering with sleep in general wards. In 1980, Cohen found that 69% of 109 patients said that the major area of function disturbed by pain was sleep. Similarly, Sriwatanakul et al (1983) found that 73 of 81 patients were woken by pain. Jones et al (1979) studied intensive care patients and found that "pain was ranked second to discomfort as a contributory factor to sleep loss". Murphy et al (1977) studied 110 surgical patients and concluded that "pain relief receives less attention than it should". This was corroborated by Seers (1987) who found that 41 out of 67 patients suffered sleep disturbance due to pain on the first post-operative night. This number was reduced to 31 patients on the fourth night, and 13 by the seventh, indicating a progressive reduction in the intensity over time, as might be expected. Further information has been presented by Donovan et al (1987) who investigated pain in 353 medical and surgical patients. Sixty-one per cent had been awakened by pain during hospitalisation. They challenged the common belief that patients who sleep do not experience pain, having found that some patients with mild pain had sleep interrupted while others with moderate to severe pain did not.

There is little doubt that surgery produces post-operative pain which frequently interferes with sleep. It is less clear what the precise effects of surgery are on the structure of sleep, although significant REM suppression has been observed in the initial post-operative period. The interactions between analgesic and anaesthetic drugs, pain and sleep require further scrutiny.

1.6.4 Sleep disturbance in general wards

Subjective methods have been used in order to assess the causes and extent of sleep disruptions of less acutely ill patients. Back in 1961, Haywood et al found that being woken too early was one of the main reasons for inpatient dissatisfaction. The Royal Commission Survey (1978) indicated that 27% of the 699 patients interviewed were generally disturbed during the night, and that being woken too early was one of two leading causes of dissatisfaction. Murphy et al (1977) studied the sleep of 93 surgical patients using questionnaires and the Eysenck Personality Inventory. They found a striking reduction in mean sleep duration, both pre- and post-operatively, when compared with each patient's normal sleep. They suggested that much of this deficit was due to early awakening, although some was due to delay in getting to sleep. The patients recorded decreased sleep quality, more awakenings, and for the first three post-operative days, attributed much of the disturbance to noise and pain.

Carter (1984) studied sleep patterns in low dependency patients using an interview schedule. Patients were also observed overnight and their apparent conscious levels recorded. A sample of 50 was included, of whom 76% "accrued sleep deficit over 3 nights" compared with sleep at home. Forty-four percent of these sustained a four hour deficit, and 18% more than a 6-hour deficit. Patients felt that the main cause of difficulty in getting to sleep was psychological (49%), night awakenings were said to be mainly due to physical (51%) and environmental (20%) factors, while the difficulty experienced in getting back to sleep was mainly due to physical factors.

Dodds (1980) in her study of 100 patients on a variety of wards, found that 78% of them were woken at least once during the night in hospital. The commonest cause of this was noise due to equipment, other patients and nursing staff. Just over half (56%) felt that they were able to sleep for long enough, but although over 71% of the group preferred to sleep at least until 0700 hours, 90% of them were woken earlier. Stead (1985) reiterated this point in his study of 78 surgical patients, emphasising the disruptive effect of hospital routines. He recommended that 0600 hours drug rounds should be kept to a minimum. Of Dodds' sample, 34% thought that "lights out" at 2300 hours was too late in view of early awakening and some forced themselves to stay awake for the 2200 drug round, which often included the dispensing of hypnotic drugs. Interestingly, although 77% of the sample never took hypnotic drugs at home, 60% of them did take hypnotics during their stay in hospital. Bailey (1981) found that noise was the most important reason for patients opting to take hypnotic drugs while in hospital.

1.7 Noise levels in hospital

Although many factors are involved in the disturbance of patients' sleep in hospital, the one which has been most thoroughly documented is noise. Hinks (1974) discussed sources of noise in hospital identified by patients, and found that these were extensive, including noise on the ward (trolleys, crockery, television, doors, etc.) as well as elsewhere in hospital, such as building works, traffic, waste disposal, and lastly, noise made by people, such as staff talking, and walking around, and other patients and their visitors. Ogilvie (1980) compared noise levels on a Nightingale ward with those on a more modern 'racetrack' ward with cubicles, and found that the Nightingale ward was significantly noisier.

Several investigators have found noise levels to be excessively high in special units. Falk and Woods (1973) found that noise levels in infant incubators, recovery room and acute care unit rooms were "incompatible with sleep", with mean values ranging from 55.8 to 65.6db(A). Both the

US Environmental Protection Agency (1974) and the World Health Organisation (WHO 1980) have recommended that noise levels should be kept below 35db(A) in order to create an environment compatible with sleep. Bentley et al (1977) found that noise levels in a ward, in a cubicle off the ward and in an ICU were higher than internationally recommended levels at all times of the day, frequently reaching 70db(A). This finding is corroborated by Hilton's (1985) study of 25 patients from four ICUs and two wards, which indicated similarly high noise levels. The highest continuous noise levels were found in the ICUs (32.5-68.5db(A)), whereas the levels tended to vary more on the general wards (34.25-62.5db(A)). Some equipment created noise levels reaching 90db(A).

Although acute areas appear to be the noisiest, Soutar and Wilson (1986) found a mean level of 68db(A) on general medical wards and 66db(A) on acute admission wards. Psychiatric wards were significantly quieter with mean noise levels of 49db(A). The increase from 49 to 66db(A) is equivalent to a fourfold increase in perceived noise. Only one of the hospital environments investigated by these researchers (the psychiatric ward) provided night-time noise levels compatible with sleep.

Many researchers have studied the effects of noise on sleep. Of course, noise may result in wakefulness, but even if it does not, it is possible that both stage 4 and REM may be reduced. Wilkinson and Campbell (1984) found that providing double glazing for residents of areas with high traffic noise increased amounts of SWS gained. This finding is somewhat tentative, and it is more certain that stages 1 and 2 are not affected. LeVere and Davis (1977) found that sudden noise (a sonic boom) affected the heart during sleep, causing an increase in heart rate. Other authors (Muzet and Erhart 1978; Muzet et al 1981) reported an acceleration in heart rate followed by a deceleration; this effect may be undesirable in patients with cardiopulmonary disorders. The amplitude of this fluctuation did not change over 15 consecutive nights of simulated traffic noise. This suggests that patients who stay in hospital for less than two weeks are unlikely to become habituated to unaccustomed noise during that time, at least as regards their cardiovascular responses.

1.8 Conclusions

Overall, the literature provides a large amount of evidence to support the theory of a restorative role for sleep. This restoration may be both physiological and psychological, aiding physical and mental recovery from surgery or other trauma in hospital patients. Evidence of the importance of maintaining the individual's normal sleep-wake cycle suggests that optimum well-being will occur when the individual is able to adhere closely to his own usual patterns. The sleep-wake cycle appears to synchronise many other circadian rhythms to the benefit of the individual. The adverse effects of desynchronisation are well documented.

Knowledge of the structure and function of sleep together with an understanding of the uniqueness of each individual's sleep and how being in hospital interferes with their normal habits is surely the cornerstone of good night-time nursing practice. The many factors which affect normal sleep, some inherent to the individual, others due to environmental influences have been discussed. Nurses' awareness of these factors could help them to prevent or alleviate some problems related to sleep. Individual assessment of patients should facilitate such action. There are several reports stating that the extent of sleep disruption in hospital is underestimated and several nurse researchers have attempted to describe the reasons for this. Noise, pain and early morning waking would appear to be the major problems. Further research to validate and expand on these findings in a surgical setting would be a step towards improving the sleep of patients in these areas.

CHAPTER 2

LITERATURE REVIEW (2)

Post-Operative Pain

The first study in this thesis was based on the sleep literature presented in Chapter 1. Having ascertained from that study that pain was a major factor disturbing the sleep of surgical patients, it seemed important to investigate this further. An exploratory analysis of analgesic provision comprised the second study and the third explored the relationships between sleep, pain and analgesic provision more fully. The extent and effects of sleep disruption in hospital have already been discussed in Chapter 1. This second part of the literature review includes discussion of the adverse effects of pain on post-operative recovery, methods and adequacy of post-operative pain relief and factors affecting the experience of post-operative pain. How patients cope with pain and the effects of patients' beliefs on their recovery are also mentioned briefly.

2.1 The undesirability of post-operative pain

Many researchers have reported that post-operative patients received variable and often poor pain relief (Cohen 1980; Sriwatanakul et al 1983; Donovan et al 1987; Melzack et al 1987; Seers 1987; Carr 1990; Kuhn et al 1990; Owen et al 1990). According to Leibeskind and Melzack (1987),

> "By any reasonable code, freedom from pain should be a basic human right, limited only by our knowledge to achieve it.".

While unnecessary pain should not be permitted simply on humanitarian grounds, pain may also lead to undesirable consequences. As Bonica (1987) said,

> "severe acute pain in the post-operative period...has no useful function, and if not adequately relieved,

> produces abnormal physiologic and psychologic reactions which often cause complications".

Five main areas of concern are outlined below.

2.1.1 Reduced mobility

Severe pain reduces movement, increasing the likelihood of post-operative complications. Venous stasis increases the risk of developing deep vein thrombosis (Modig 1952). This problem may well be exacerbated by pain-induced anxiety, which causes an increase in blood viscosity, fibrinolysis, platelet aggregation and clotting (see Bonica 1990).

Difficulty in moving can also result in damage to pressure areas, sometimes leading to the development of pressure sores. In addition, pain may cause reduced respiratory movements (Craig 1981), especially following thoracic surgery. This leads to difficulties in deep breathing and coughing, contributing to post-operative hypoxia and increasing the risk of respiratory tract infection.

Pain makes early ambulation more difficult. Reluctance to mobilise due to persistent post-operative pain may impair muscle metabolism (see Bonica 1990, p467). This may lead to atrophy of muscle, further slowing down a return to normal movement.

2.1.2 Nervous, metabolic and hormonal disruption

Pain increases the activity of the sympathetic nervous system. The consequent increase in the levels of circulating catecholamines can cause increases in heart rate and blood pressure. These in turn can lead to myocardial ischaemia and a reduction in blood flow to some tissues.

There is also an increase in levels of hormones responsible for tissue breakdown, such as cortisol and ACTH (Wilmore et al 1976). Pain exacerbates the metabolic and hormonal responses to surgery, which tend for the most part to be catabolic. These responses include greater breakdown of protein and mobilisation of free fatty acids (Nimmo and Duthie 1987), at a time when anabolic processes are highly desirable.

Bowel and bladder functions may be inhibited as a result of pain. Bing (1936) demonstrated that visceral post-operative pain stimulated segmental sympathetic hyperactivity via reflex responses. This then inhibited gastrointestinal functions, resulting in ileus, nausea and sometimes vomiting. Bonica and Benedetti (1980) showed how persistent post-operative pain caused a reflex reduction in motility of the bladder and urethra, making micturition difficult, and increasing the possibility of urinary tract infection.

2.1.3 Psychological effects

The cerebral cortex responds to pain by initiating anxiety, apprehension and fear. This greatly enhances the hypothalamic responses characteristic of stress (see Bonica 1987). It has been suggested that unrelieved, severe post-operative pain produces long-term as well as short term emotional problems (see Cantor and Fox 1956). The prospect of further surgery can then provoke extreme fear and anxiety.

2.1.4 Long-term pain

Surgery itself produces a stream of afferent nervous impulses which make the central nervous system (CNS) hyperexcitable (Woolf 1983). This priming of the CNS results in innocuous stimuli producing pain. The hypersensitive spinal cord may then continue to respond excessively to nervous impulses for long periods of time, sometimes months or even longer. Once this state has been established, extremely high doses of opioids are needed to return it to normal (Woolf and Wall 1986).

Prevention of this hyperexcitable state has been shown to reduce long-term pain for up to 12 months after surgery (Bach et al 1988). It has been suggested that giving opioid drugs before and during as well as after surgery can suppress this hyperexcitable state, and reduce the risk of long-term pain.

2.1.5 Sleep disruption

Finally, severe pain and anxiety disrupt sleep which, theoretically could interfere with sleep's restorative role (Adam and Oswald 1983). Carli et al

(1987) found that in cats (which have long been used successfully as models for human sleep), persistent pain reduced total sleep and led to a reduction in SWS and REM relative to stages 1 and 2. The tiredness resulting from disturbed sleep may have adverse psychological effects, such as reduced motivation. This could then compound problems resulting from impaired movement and, in turn, impede recovery.

Pain is evidently a potential cause of many problems during the post-operative period, both short and long-term. According to the Commission on the Provision of Surgical Services (1990), "Treatment of pain after surgery is central to the care of post-operative patients. Failure to relieve pain is morally and ethically unacceptable". The combination of adverse effects resulting from post-operative pain could have considerable implications for the cost-effectiveness of patient care. Avoiding impaired mobility, deep vein thrombosis, pressure sores, respiratory tract infections, adverse hormonal responses and sleep deprivation all due to pain, could certainly contribute to keeping the length of hospital stay to a minimum. In turn, this could prevent problems in the post-discharge period of recovery at home.

2.2 Pain and sleep in hospital

There has been a small number of studies which have looked at the association between patients' pain and sleep. In 1973 Marks and Sachar interviewed 37 medical patients about areas of distress due to pain. They found that sleep was the function most commonly interfered with by pain, with three-quarters of the sample reporting significant difficulty. Sriwatanakul et al (1983) interviewed 81 post-operative patients about various areas of distress due to pain, with the finding that 56.7% of the group expressed some level of distress regarding their sleep. Donovan et al (1987) found from interviews with 353 inpatients that sleep was considered to be one of four major factors decreasing pain. These results suggest that patients perceive some kind of interrelationship of pain and sleep, whereby pain disrupts sleep and sleep reduces pain. The nature of this interaction requires further investigation if the effects and amelioration of night-time pain are to be better understood.

Research to date does not present a clear picture of the nursing management of pain at night and how it is related to sleep. Nevertheless, it is evident that these areas present problems, both separately and together.

2.3 Methods of relieving post-operative pain

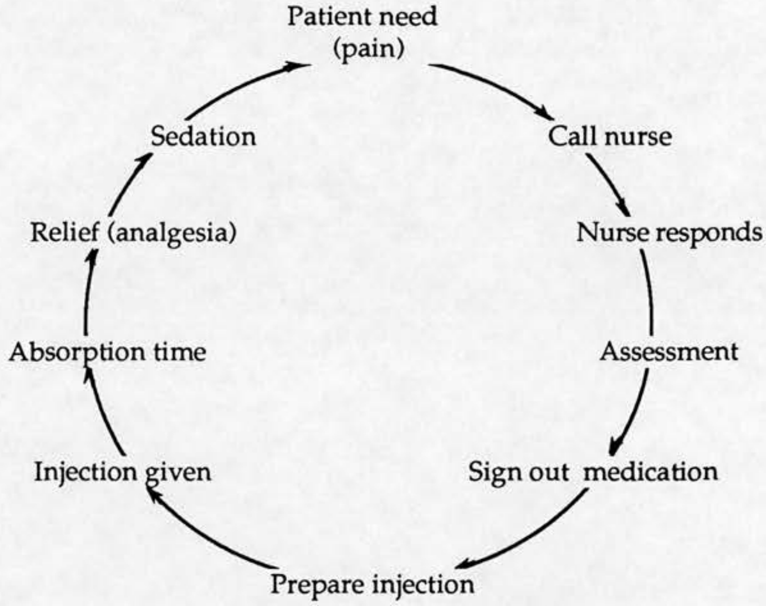
Prevention of sleep disruption due to post-operative pain can be achieved only if patients experience effective pain relief. The most commonly used methods of relieving post-operative pain currently practised in hospital are pharmacological in nature. They include intercostal and epidural nerve blocks as well as systemic opioids. The latter may be given either intramuscularly, intravenously or sublingually. The use of TENS (transcutaneous electrical nerve stimulation) and acupuncture are becoming more popular, but are still relatively uncommon in the majority of hospitals in the UK. The most appropriate methods of pain relief are decided on by doctors who prescribe according to the regime of their choice.

The methods discussed below, ie intramuscular, intravenous and epidural routes of analgesic provision are those which it was anticipated would be used at the sites where the research reported in this thesis was carried out.

2.3.1 'On demand' intramuscular injection

The most common system is the 'on demand' prescription. Usually an opioid drug is prescribed as an intramuscular injection. The term 'opioid' refers to all naturally occurring opiates as well as synthetic morphine-like drugs. Opioids may be administered as required by the patient, though usually no more frequently than every four hours, depending on the dose. Nurses then assess the patient's needs for analgesia and at their own discretion provide intramuscular or oral drugs, within the limits of the prescribed regime. This 'on demand' system leaves much leeway for pain to become more severe than need be. The very individual nature of pain means that some people need more analgesics than are prescribed while others may need less. Patients may wait until pain is becoming intolerable before requesting analgesics and may then have to wait until two nurses (a legal requirement in the UK) are available to check controlled drugs. The absorption of drugs given intramuscularly might be slowed down if blood circulation to the site of injection is poor, or if the patient were lying on the site. Graves et al (1983) described the cycle of events following a patient's request for analgesics showing the great potential for delay when using conventional analgesic therapy (Figure 1).

Figure 1: Pain Relief Cycle



Adapted from Graves et al. (1983)

Apart from problems of delay when using intramuscular doses of opioid, there is also the complication of fluctuating plasma levels of narcotic analgesics. These swing from high levels where sedation may occur, through the optimum levels where pain is relieved but consciousness is not clouded. The concentration of narcotics is then reduced to inadequate levels where pain is poorly controlled (Graves et al 1983). The patient might then request more analgesics. If the requisite minimum of four hours between doses had passed, the nurse would then assess the patient's needs. If not, the patient would almost certainly have to wait until the four hours had elapsed before obtaining this type of pain relief.

There are also large differences between individuals in the time taken for the peak plasma levels to be reached, as well as the actual level of that peak concentration. Not only that, but it is impossible to predict for individual patients what the relationship between plasma opioid concentration, analgesic effect and side-effects will be.

2.3.2 Intravenous patient-controlled analgesia (PCA)

Since 'the only arbiter of pain is - or should be - the patient' (Rosen 1984) it makes a good deal of sense to allow patients to control their own pain relief regime. The concept of allowing post-operative patients to control the amount of opioid analgesia they receive is only about 20 years old. Usually a pre-programmed infusion pump allows the patient to adjust the dose according to need, usually via intravenous, though more rarely via epidural or extradural routes (Marlowe et al 1989). This method of administration avoids the peaks and troughs in serum levels of opiates produced by intramuscular administration. Thus, effective analgesia is obtained because of the maintenance of a therapeutic level of narcotics in the blood. Tamsen and others (1982) reported of PCA that 'patients seem to self-administer narcotic analgesics in a consistent way...not in excess of usually recommended doses'. Regular monitoring of respiratory rate is essential, but contrary to expectations, respiratory depression has not so far been a problem when using PCA.

Kleiman and others (1987) found that nurses promoting the use of PCA suggested that 'the feeling of control PCA provides may enhance patients' pain relief'. This was corroborated by Clark and her colleagues (1989) who observed that patients' anxiety and perceived intensity of pain may therefore be reduced because they are in control of their own pain relief. The major impediment to widespread introduction of PCA appears to be the prohibitive cost of infusion equipment. Hecker and Albert (1988) examined the relative cost of this type of equipment. They compared two types of PCA pump and conventional anlgesic therapy for efficacy and cost. They concluded that 'PCA provides superior pain management at minimal extra cost'. Virtually all research to date in this field suggests that the benefits of PCA to post-operative patients could be enormous. Unfortunately an initial outlay of about £2,000 per machine is needed, and it is unlikely that this expenditure would be given priority in the current financial climate of the NHS.

2.3.3 Epidural analgesia

This is achieved by infusing either a local anaesthetic or a narcotic analgesic into the epidural space surrounding the spinal cord. Either continuous or intermittent administration may be provided via a catheter. Drugs such as morphine produce effective analgesia, but often with fewer side-effects such as respiratory depression and nausea when compared with systemic provision. Local anaesthetics such as bupivacaine also produce pain relief, though this is often accompanied by numbness and decreased temperature sensation below the site of catheter placement.

2.4 Factors affecting patients' experiences of post-operative pain

Patients' experiences and expressions of pain are affected by numerous factors. Those which have been reported by researchers are mentioned below, with particular reference to those which may be of importance at night.

2.4.1 Age

Belville et al (1971) noted that older patients received greater analgesic effect from pain-killers than younger patients did. Similarly, Donovan (1983) found that younger patients were less satisfied with pain control. This age difference in analgesic requirements was corroborated by Burns et al (1989) and Zacharias et al (1990) who found an inverse correlation between intravenous morphine consumption and age. Similarly, Moore et al (1990) found that epidurally administered morphine produced more effective analgesic effect in older patients.

This age difference may be either because of different expectations of different generations regarding pain control, or perhaps older patients had less efficient liver functions, allowing analgesic drugs to produce pain relief for longer. It is possible that age may be associated with the experience of pain at night. The elderly may become confused and anxious at night, leading to changes in pain perception.

2.4.2 Gender

There have been some conflicting findings regarding pain experience and gender. Taenzer et al (1986) found that female cholecystectomy patients consumed greater amounts of analgesic than males. Given that in this society men are generally expected to be brave and stoic, while women are allowed to express their 'weaknesses' publicly, this finding might be expected. Conversely, however, both Cohen (1980) and Burns et al (1989) found that men required more analgesics. In Burns et al's study, however, the possibility that nurses influence analgesic provision was eliminated, since all the patients involved were in control of their own analgesics. Although these findings appear to conflict, it may be that social expectations allow women to express more pain and request more analgesics than men, while there is some fundamental physiological difference between the sexes resulting in men requiring more pain relief than women.

2.4.3 Social conditioning

In the early 1970s Craig and Weiss (1971) showed that people tolerated pain according to social training. For example, some had grown up in an environment where they were encouraged to be 'brave', while others had been allowed to express their distress openly. These coping strategies for pain appear to develop during childhood. In a discussion of this phenomenon, Copp (1985) recommends that eliciting a 'pain history' could help patients to use coping strategies that they had found helpful in the past.

2.4.4 Social class

In cases where patients and nurses were of the same social class, nurses tended to give more sympathetic treatment (Meinhart and McCaffery 1983). They found that patients with good verbal skills, frequently from higher social classes, appeared to express pain more effectively.

2.4.5 Culture

There are some major cultural differences in terms of how pain is expressed. Zborowski (1952) demonstrated differences between three groups of Americans with different ethnic origins. He reported that Italian and Jewish groups expressed their pain far more freely than 'Old' Americans, who tended to withdraw, preferring to be alone. In 1981 Streltzer and Wade examined the number of narcotics taken during the first five post-operative days, relative to culture. They found no differences between Philipino, Chinese and Japanese people while Hawaiians, and particularly Caucasions, consumed significantly more.

2.4.6 Personality

Some attention has been paid to whether introverts and extroverts have different experiences of pain. Bond and Pearson (1969) found that introverts experienced more intense pain, but tended to complain about it less than extroverts. Taenzer et al (1986) found that extroverted people received more post-operative analgesics although this was not, in turn, associated with more pain. Other researchers have not found a clear relationship between neuroticism and pain intensity experienced, but that in general, neuroticism scores increased for people in pain (Jacox and Stewart 1973).

2.4.7 Anxiety and depression

There are many factors which affect how patients experience pain, including anxiety and depression (Taenzer et al 1986). Breughel (1971) did not find any relationship between anxiety and post-operative perception of pain. Work by Martinez-Urruta (1975) found a decline in state-anxiety when comparing pre to post operative mood. This did not appear to be related to any changes in trait-anxiety. More recently, Scott et al (1983) found a significant association between state-anxiety, amount of information about surgery provided and post-operative pain. Cornwall and Donderi (1988) found that both relevant and irrelevant anxiety evoking stimuli increased pain ratings when painful pressure was applied to the skin.

2.4.8 Physical characteristics

Frequently, analgesics are prescribed and provided according to the height and weight of the patient. Burns et al (1989) found no association between either height, weight, or body surface area and pain relief after a single dose of morphine. Obviously, then, analgesics need to be provided according to other, probably more subjective, criteria.

2.4.9 The meaning assigned to the pain

The connotations of pain may affect precisely how it is experienced. This was noted by Beecher (1956 p164). He said 'Great wounds with great significance...are made painless by small doses of morphine, whereas fleeting experimental pains with no serious significance are not blocked by morphine'. He concluded that morphine acted on the significant pain and not the other.

The reason for the pain, for example as a step towards a cure or as a constant reminder of terminal disease makes a considerable difference to how it is experienced. In addition, patients' experiences of pain in the past, for example having unrelieved post-operative pain is likely to influence how they feel about their current pain.

2.4.10 Circadian variations in pain perceptions

While clinicians have known about cyclical variations in pain for some considerable time, research has, for the most part, failed to produce a clear and consistent picture of such fluctuations. It seems unlikely that pain should demonstrate pronounced circadian variations because of its protective effect. It is likely, however, that there are other factors demonstrating diurnal fluctuations which influence pain perception.

Strian et al (1989) looked for diurnal variations in experimental pain, finding small and inconsistent variations between individuals. Research into non-experimental pain has been more fruitful. Following oral surgery, Pollman and Hildebrandt (1987) found that the greatest number of doses of analgesics were given around 0600 hours on days 2-3 after operation. Burns et al (1989) noted a circadian pattern of morphine use among patients who were self-administering, with peak requirements at 0900 and 2000 hours. In clinical situations, then, analgesic requirements appear to be highest early in the morning and mid-evening.

There is no immediately obvious physiological explanation for this diurnal variation. Levels of plasma cortisol and beta-endorphin fluctuate in a circadian manner, with peak levels around 0400-1000 hours and troughs occurring at 2200-0300 hours. The anti-inflammatory property of cortisol and the analgesic property of beta-endorphin might be expected to produce lowest levels of pain relief round about midnight. As this is not the case, there must be an alternative explanation.

It is possible that increased morphine requirements first thing in the morning and mid-evening are associated with ward activity. Burns et al (1989) suggested that "increased requirements around 0900 hours could be associated with the morning ward round and routine nursing duties, and the early evening demands by increased ward activity around visiting time". Another explanation might be that patients self-medicate with more morphine in anticipation of certain events. The 0900 hours peak in morphine requirements might be due to expectation of pain due to mobilisation, physiotherapy and so on. The evening peak might be in order to gain as pain-free a night as possible.

2.5 Pain at night

Although it is clear that many factors influence pain, little is known about changes in patients' pain experience in hospital at night. Circadian fluctuations in pain may require further consideration, together with a more comprehensive examination of how night-time pain affects patients, and in particular their sleep in the unfamiliar ward environment.

Raiman (1986) suggested that changes to the environment which involve an element of sensory deprivation, such as darkness and isolation increase anxiety, pain and therefore analgesic requirements. The hospital often provides this kind of environment at night. There seems, however, to be very little research which has focused specifically on the phenomenon of night-time pain in hospital. In 1975 Freed wrote a letter to The Lancet almost a year following surgery in hospital. He said:

> "My mind has been gradually strengthening itself to write this letter, since I now know what I didn't know before, and my fellow doctors *must* be enlightened.
>
> Let no-one fall into the belief that he can measure the severity of someone else's pain. After the first twelve hours you can survive the days with reasonable composure...but during the dreadful nights you face the pain, and the horrors brought by half-sleep, alone. It cannot be described."

More than ten years later Raiman (1986) quoted from a patient,

> "I fear the nights most of all, I try and get a grip on myself but the dark presses in on me and there seems no escape from the pain, or my thoughts."

Another report of post-operative experience was provided by Holgate (1988). He said:

> "I have never dreaded nights before, but nights in hospital came to fill me with horror."

Although there is considerable anecdotal evidence that pain at night persists as a problem for hospital patients, little research is available to explain this phenomenon. As Copp (1990) said,

> "All nurses have observed changes in patients' pain need at night, yet research validating these observations is sparse".

2.6 How patients cope with post-operative pain

Each patient may have a variety of stressors to contend with during the immediate post-operative period. These can be physiological, psychological, or both, and include anxiety, nausea, hypoxaemia, fluid imbalance, hypotension, pain and others. Obviously pain has both physiological and psychological aspects, implying that the way patients cope with their pain is likely to be complex.

The literature on coping is extensive and a detailed examination of it is outwith the limits of this thesis. For the purpose of providing a background for the proposed study coping can be viewed as having two functions (Lazarus and Launier 1978). The first is emotion-focused coping where emotions or distress are regulated. The second is problem-focused coping, which involves the management of the problem causing the distress. These two aspects of coping are frequently used at the same time. The co-existence of these functions is important, since it is necessary for an individual to have a certain amount of control over their emotions if they are to be able to manage or change a difficult situation successfully (see Folkman 1984).

2.6.1 Coping with post-operative pain

Post-operative pain is one of many stressors with which patients have to cope. Coping refers to behaviours and psychological processes that occur in response to a threat. In general there are three main ways in which patients may attempt to cope. These are active cognitive coping, active behavioural coping and avoidance (Billings and Moos 1981). The research literature which has investigated how patients cope independently of medical and nursing interventions is extensive but inconclusive, due to variations in method and terminology (see Fordham 1988 p139). Sofaer (1984) suggested that nursing records could usefully contain information about patients' normal strategies for coping with pain. It may be that such strategies are as effective as clinician supplied strategies, suggesting that some kind of assessment of types of strategy would be useful. Work in this area has begun, but has tended to concentrate on chronic pain (eg Rosenstiel and Keefe 1983; Keefe et al 1990). Although both of these studies focussed on chronic rather than acute pain, they suggest the lack of personal control, ie helplessness was a significant problem. Butler et al (1989) have begun the development of an instrument for the assessment of cognitive coping strategies for acute post-surgical pain, but their preliminary findings suggest that further development of the method is required before it can be put to more general use.

The third study presented here, while not having a particular emphasis on the coping strategies of post-operative patients, did aim to gain some insight into how patients cope with their pain, and their views on the relationship between sleep and coping with pain.

2.6.2 Patients' beliefs

The possibility that patients' beliefs about pain and sleep might affect their recovery was considered. Evidence that beliefs affect health is gradually accumulating (see Cousins 1989). Such is the interest in this field, that in 1984 a task force was set up at the University of California, Los Angeles in order to further research into mind-body interactions. To date there is a considerable number of studies into how the mind converts ideas and expectations into biochemical realities. Several of these have addressed topics such as the placebo effect, and the power of suggestion.

2.6.3 The placebo effect

There are many convincing pieces of research which demonstrate the reality of the placebo effect. Katz (1977) studied the placebo effect among a group of surgical patients. They were told that they were to have spinal anaesthesia and that a side-effect of this procedure was headache. Immediately before surgery they were told that they would in fact receive general anaesthesia. In spite of this, patients subsequently reported "classical examples of spinal anesthesia headache". In 1983 Fielding et al reported a study of 411 patients undergoing chemotherapy. They were all told that they could expect hair loss as a consequence. One third of the patients received a placebo instead of chemotherapy, but they still suffered hair loss. Levine et al (1978) investigated pain relief in dental patients. They found that the expectations of analgesia following the administration of a placebo triggered the body's production of endorphins, thereby producing pain relief. These and other studies show that expectations can produce physical responses and that these responses are real, even though the mechanisms of action are not always clear.

2.6.4 The power of suggestion

Several studies have attempted to assess the effect of therapeutic suggestions on post-operative recovery. Pearson (1961) played tape-recordings of therapeutic suggestions to surgical patients and found that they left hospital significantly sooner than those played music or blank tapes. Bonke et al (1986) reported similar findings, but only among older patients. Evans and Richardson (1988) played therapeutic suggestions to 19 hysterectomy patients while a control group of 20 patients were played a blank tape. The patients in the suggestion group went home significantly sooner than the others, they were pyrexial for a shorter time, and nurses generally rated them as having a better than expected recovery. More recently, McLintock et al (1990) investigated the effect of therapeutic intra-operative suggestion on subsequent analgesic requirement. They found that immediately post-operatively, therapeutic suggestions were associated with a significant reduction in morphine requirements, although pain scores were the same for control and suggestion groups. This area of research indicates that the power of suggestion can produce significant positive effects on post-operative pain and recovery.

There is, therefore, a growing body of evidence which suggests that patients' beliefs can influence their health, including recovery following surgery. Most of the related research has studied the effect of beliefs resulting from information provided by medical staff. Less, however, is known about patients' own beliefs and how these might influence their health. For this reason it seemed important to find out about post-operative patients' beliefs about the interactions between pain, sleep and recovery.

2.7 Conclusion

The research literature has drawn attention to several areas of concern. Sleep was the focus of the first half of this literature review (Chapter 1). It is a phenomenon integral to the maintenance of circadian rhythmicity, and may be disturbed by many factors following hospitalisation. The first study presented in this thesis, therefore, addressed the changes in sleep pattern which resulted from admission to surgical wards, as well as factors perceived to influence sleep and how nurses recorded sleep. It is clear that both sleep and pain control are important for the well-being of the post-operative patient.

The latter part of the literature review (Chapter 2) included an overview of the detrimental effects of poor pain relief, methods of pain control provided for the patients in the second and third studies and factors affecting post-operative patients' experiences of pain. A brief mention was made of how patients cope with post-operative pain, and the effects of patients' beliefs on their health. Little was found in the literature pertaining to particular factors influencing pain at night, patients' experiences of pain and analgesic provision at night or the interrelationship between sleep and pain. The neglected problem of pain at night and its relationship to sleep and circadian variations merits investigation if nurses are to have a sound basis for promoting sleep and controlling pain at night.

CHAPTER 3

STUDY 1

A STUDY OF PATIENTS' SLEEP ON SURGICAL WARDS

Methods

The methods used in the survey of patients' sleep on surgical wards and related factors are the focus of this chapter. It begins with a statement of the aims of this first study and a discussion of suitable methods of assessing sleep. Available methods include objective measurements of the physiological and psychological factors associated with sleep and subjective assessments of sleep by the sleeper. This discussion is followed by a report of pre-testing and piloting of the interview schedule used and an account of other details of the first study, including the choice of setting, sample, data collection, coding and analysis. Ethical considerations are mentioned.

3.1 Aims of the study

The study had four aims:

1. To compare patients' sleep in surgical wards with their usual sleep at home.

2. To find out which factors (if any) were perceived by patients as important in disrupting sleep, and which were important in promoting sleep in hospital.

3. To find out how nurses recorded patients' sleep.

4. To make recommendations for nursing interventions designed to improve sleep quality and quantity for patients.

The research design was derived for the most part from these aims, although practical considerations were also influential.

3.2 Selection of method

When deciding on which method to use, three basic issues were considered. First, and most importantly, the aims of the research. The variables of interest could then be measured using the most appropriate method. Since a comparison of a night's sleep in hospital with a night's sleep at home was required, some kind of one-off questionnaire or interview seemed suitable. Second, the cost of equipment and inconvenience to the patient were considered. Finally individual patient factors pertinent to the chosen method were considered.

3.2.1 Objective measurements of sleep

Objective measurements were considered inappropriate for this study. Polysomnography (all night recordings of EEG, eye movements and muscle tone) requires sophisticated equipment of prohibitive expense. Another drawback is that a single night's sleep recording may produce thousands of metres of recorder paper which then has to be scored by hand. These interpretations of EEG traces may not be as objective as they have frequently been claimed to be, since stage changes in the EEG trace usually occur gradually, with each stage of NREM merging into the next. Another disadvantage is that the results obtained from the first night's recordings are generally discarded because of the unusually disturbed sleep due mostly to the unfamiliarity of the presence of electrodes on the face and scalp; the so-called first night effect.

Observation of patients by nurses was another possibility. Aurell and Elmqvist (1985) found that when compared with polysomnograms, nurses grossly overestimated the duration of patients sleep. More recently, Fontaine (1989) compared both nurses' observations and patients' reports with polysomnograms for 20 trauma patients. She found some significant correlations, and concluded that observation of wakefulness after sleep onset was a valid measure of sleep. It is not clear, however, whether observation can produce accurate reflections of other aspects of sleep. At the time this approach did not appear sufficiently valid, and since the practicalities of night-time observation were considered too problematic, this method was rejected.

Another objective measure, namely the arousal threshold, was also considered unsuitable. This method depends upon disturbing the patient's sleep in order to determine its depth; obviously this would be unethical for post-operative subjects. Actogrammes, which indicate how 'restful' sleep is, are recordings of body movements in bed. These would be inappropate for use with patients in pain, since lack of mobility might indicate difficulty in moving, or having found one comfortable position, rather than the presence of sleep. Psychological tests of vigilance and objective sleepiness would be too stressful and time consuming for surgical patients. Many objective measures necessitate the use of specialised and expensive equipment, for which funding was unavailable. In addition it was thought that some patients might find such monitoring anxiety provoking, restrictive, or uncomfortable. These approaches were rejected.

3.2.2 Subjective reports of sleep

Subjective evaluations provide quantitative estimates or qualitative assessments of sleep as it is experienced by the sleeper. How a person feels about his sleep, whether it is restful and refreshing, or restless and disturbed by nightmares, can only be reported by the individual who experienced that sleep. Sleep and wakefulness are interdependent; a good night's sleep is associated with a good day's wakefulness before and after it. Normal sleep is difficult to define, since individuals vary enormously; sleep is affected by many factors, such as age, gender diet and physical and psychological health, as discussed in Chapter 1.

Individual assessments of sleep quality necessitate subjective ratings. These assessments do not necessarily accord with objective measures; satisfaction with sleep may not be related to time spent asleep, the number of sleep cycles, the duration of SWS and so on. No matter how much or how little sleep someone has, regardless of any objective sleep measures, if that person is satisfied with it then it may be considered normal for him or her.

Subjective reports of sleep have been shown to be inaccurate. Carskadon et al (1976) compared subjective and EEG data from subjects complaining of insomnia. Results indicated that most of them consistently underestimated the length of time spent asleep (total sleep time, TST) and overestimated the time taken to get to sleep (sleep onset latency, SOL). It has been demonstrated that responses to simple questions asking both normal and insomniac subjects for assessments of their own sleep duration or number of arousals during the night do not provide accurate information (Monroe 1967; Carskadon et al 1976; Frankel et al 1976). Interestingly, a degree of internal consistency existed in such estimates for both insomniacs and normal controls. That is, individuals were able to report **changes** in their own sleep patterns with some accuracy, even though their estimates overall were inaccurate.

Since no-one but a given sleeper has access to his personal experience of sleep, it is only he who can say whether or not he has 'slept well'. Each experience of sleep is unique, 'Sleep with which we feel satisfied on awakening is good sleep, and sleep with which we feel dissatisfied on awakening is not good sleep. Because of the personal introspective nature of these judgements, the only realistic way of assessing the quality of someone's sleep is to ask them about it.' (Morgan 1987). It seems, then, that normal individuals can provide a reasonably accurate estimate of changes in their own sleep patterns. It is therefore probable that self-assessments of sleep can produce useful information about changes in sleep for individuals, provided that any physical or psychological disorders are taken into account.

3.2.3 Subjective methods of assessment

A range of methods for assessing changes in sleep quality have been used successfully. Subjective methods of assessing sleep including visual analogue scales, subjective rating scales, questionnaires, interviews and daily sleep charting were considered as possible methods for this study.

Self-administered questionnaires or interview schedules have been used with some success in order for the subject to answer specific questions about his sleep pattern. For example, a question such as "What time do you usually wake up in the morning?" is followed by a range of possible answers such as:

1. Before 5 am ☐
2. 5 am - 5.59 am ☐
3. 6 am - 6.59 am ☐
4. 7 am - 7.59 am ☐
5. 8 am - 8.59 am ☐
6. 9 am or later ☐

The respondent or the interviewer is simply required to tick the appropriate box. The sensitivity of such instruments may be adjusted by changing the intervals from hourly (as above) to half-hourly, or whatever intervals are appropriate to the research question.

More detailed questionnaires have been devised which ask for precise answers to questions such as "What time do you usually settle down in bed ready to go to sleep?", "How long does it take you to fall asleep?" and "What time do you usually wake up in the morning?". Webb (1965) found that this method was reliable on test-retest administrations of the questionnaire; that is, when the questions were answered on several different occasions, the subjects gave the same response each time. A specific questionnaire which has been shown to be similarly reliable is the St. Mary's Hospital Sleep Questionnaire. This assesses the previous night's sleep of a subject via 14 questions which ask for descriptions of sleep and satisfaction with sleep (Ellis et al 1981). A factor analysis using data from 222 hospitalised rheumatic patients showed that the two most important aspects of subjectively perceived sleep were the process of going to sleep and the quality of sleep (Leigh et al 1988).

Such questionnaires are useful for investigating how a stay in hospital alters normal sleep patterns and routines. Unfortunately, asking inpatients to complete questionnaires may present some practical problems, such as the presence of an intravenous infusion sited in the dominant arm or hand, which could make it difficult to write. Reading might also present difficulties, where bulky facial dressings or inconveniently positioned naso-gastric tubes may make it awkward for patients to wear their spectacles. Finally, those who are tired or in pain may be reluctant to respond to the extra demand of completing a questionnaire.

Interviews can be structured in much the same way as questionnaires, but may be more appropriate for use with hospital patients who may have difficulty in reading or writing, either due to their illness or otherwise. This method enables the interviewer to clarify questions if necessary and to ensure that no data are missing. These are major advantages when compared with the use of self-administered questionnaires. One disadvantage is that it is more time-consuming for the interviewer. An example of such an interview is provided by Dodds (1980).

3.2.4 Information recorded on the interview schedule

For the purposes of this study subjective reports of sleep from the patients themselves were used as the main source of data. An interview schedule was used in preference to a questionnaire in order to avoid the practical difficulties of other methods as outlined.

In order to assess changes in sleep, the major dependent variables considered were subjective reports of:

1. Time of settling down to sleep
2. Sleep onset latency (SOL)
3. Total sleep time (TST)
4. Number of night-time awakenings
5. Morning waking time
6. Duration of day-time napping

In addition, sleep efficiency was calculated from these reports, and subjective comparisons of hospital and home sleep were made. With the exception of the last, each variable was recorded for both home and hospital. Sleep efficiency is a standard index of sleep which assumes that if while the patient is in bed he is at least trying to get to sleep, then the proportion of time in bed (TIB) spent asleep (TST) is an indication of sleep efficiency (SE). That proportion is derived thus:

$$TST/TIB = SE$$

For these patients TIB was taken as the difference between the time of settling down ready to sleep and time of final morning waking.

The effects of independent variables were also considered:

1. Day of the week
2. Age
3. Gender
4. Whether patients lived alone
5. Ward design
6. Whether wards were accepting emergency admissions
7. Number of days since admission
8. Number of days since surgery
9. Use of hypnotics and analgesics
10. Type of mattress
11. Whether patients were able to follow their usual pre-sleep routines

Patients' views on whether anything could be done to help them sleep better in hospital were also elicited. Finally, the nursing notes were examined in order to see how information about patients' sleep was recorded by nurses.

3.3 Pre-testing and the pilot study

The interview schedule was amended twice; once after pre-testing with 12 patients and again after a pilot study of 20 patients. Following these, the schedule was expanded to include information about lengths of time since admission and surgery, smoking habits, time spent napping, pre-sleep routines and how patients could be helped to sleep better. Several questions were reworded to avoid ambiguity. The final version of the interview schedule is in Appendix 1.

A method of obtaining a random stratified sample was tried out in the pilot study (Table 1). By staggering twice weekly visits to two wards by one day each week, it was hoped that interviews covering each weeknight would be approximately equal in number.

Table 1: Timetable of pilot interviews

	Mon	Tues	Wed	Thurs	Fri	Sat	Sun
Week 1	A	B			A	B	
Week 2		A	B			A	B
Week 3			A	B			A
Week 4	B			A	B		

Ward 1 = A
Ward 2 = B

There was a target of two interviews per ward per visit, and visits continued until a minimum of 20 interviews (10% of the projected sample of 200 for the main study) had been completed. This sampling technique produced 21 interviews out of a possible 28. It seemed that the turnover of patients was not rapid enough to obtain new patients on every visit. The frequency of visiting the wards was therefore reduced to once a week for the main study.

3.4 The main study

3.4.1 Plan of investigation

3.4.1.1 Setting

One of the aims of this study was to identify the patients' subjective assessment of sleep in one type of hospital setting, that is surgical wards. This setting was chosen for several reasons. First, it was selected because of personal experience of nursing in this area. Second, since the kinds of environments, patients and care vary considerably from ward to ward, it was desirable to reduce the amount of variation by narrowing the field. This was achieved by excluding medical wards, which would be likely to have somewhat different problems from surgical wards. Third, there was some interest in research expressed by nursing staff working in the wards included in the study.

The main study was conducted at two different teaching hospitals. Two mixed-sex ENT (ear nose and throat) wards, two vascular surgery wards (one male and one female) and four general surgery wards (two male and two female) were involved. Thus it was expected that the sample would be approximately equally divided into men and women. The wards varied in design. Six were Nightingale wards containing 20-24 beds in the main area, with smaller bays of one, two three or four attached to them. The remaining two wards were comprised entirely of bays of four and single rooms.

3.4.1.2 Data collection

Visits to the wards in order to interview patients were organised as shown in Table 2.

Table 2: Timetable of main study interviews

Weeks:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Mon		A	B	C	D				A	B	C	D				A	B	C	D	
Tues			A	B	C	D				A	B	C	D				A	B	C	D
Wed				A	B	C	D				A	B	C	D				A	B	C
Thurs					A	B	C	D				A	B	C	D				A	B
Fri	C	D				A	B	C	D				A	B	C	D				A
Sat	B	C	D				A	B	C	D				A	B	C	D			
Sun	A	B	C	D				A	B	C	D				A	B	C	D		

A = wards 1 and 2
B = wards 3 and 4
C = wards 5 and 6
D = wards 7 and 8

The patients were interviewed about their usual sleep at home and on a specific night in hospital (during the morning following that night). The duration of the interviews ranged from approximately 20-60 minutes and were conducted around mid-morning, when most patients had finished washing and doctors rounds were finished. The nursing notes or Kardex were consulted in order to obtain information about drugs usually taken at home, and how nurses had recorded usual sleep at home (on the 'front' or 'admission' sheet), as well as the previous night's sleep in hospital. The patients' drug charts were examined in order to ascertain which drugs had been given the previous night.

3.4.1.3 Sample

Sampling of patients was conducted in the same manner as for the pilot study. Patients aged between 50 - 65 years were invited to participate in a 'one-off' interview. This restricted age band was chosen in order to control for the effects of ageing on sleep. Patients were excluded if it was their first night in hospital or if they had undergone surgery during the previous 24 hours. They were also excluded if according to the nursing notes or on being approached for interview they were:

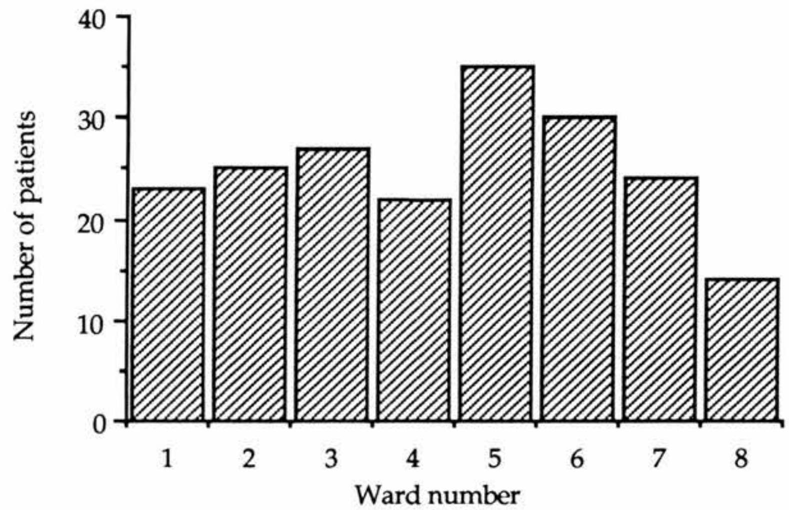
1. confused
2. aphasic
3. unconscious
4. deaf (requiring a hearing aid)
5. receiving terminal care
6. permanent night-shift workers

If more than two patients per ward were eligible, then the two youngest were approached. This meant that up to four patients could be interviewed per morning.

The careful method of sampling aimed to obtain equal proportions of each sex, equal numbers from each ward, and equal numbers of each week-night being reported on. This was successful with 103 women and 97 men of similar age distributions being interviewed. It took five months to complete the 200 interviews and one of the patients approached declined to participate. Ages ranged from 50-65 with a mean of 57.7 years. There was no significant difference in age distribution between men and women.

The sample consisted of 200 patients taken from the eight surgical wards involved in the study (Figure 2).

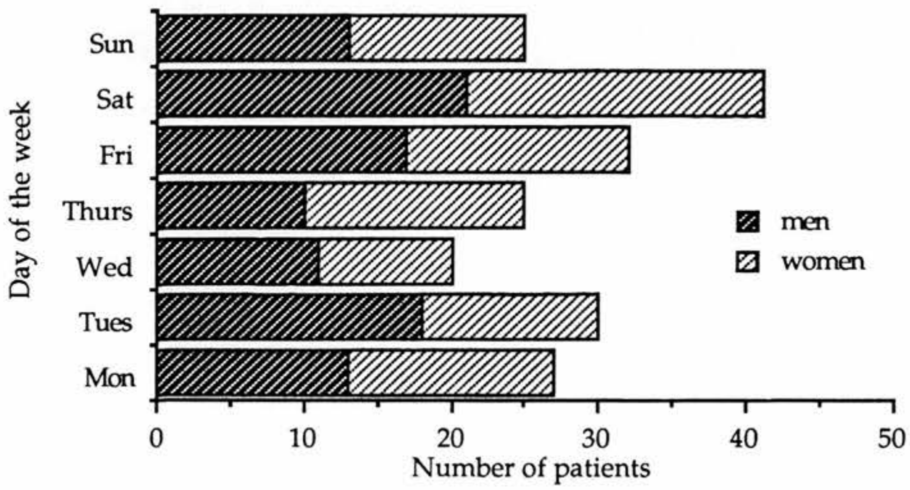
Figure 2: Number of patients interviewed from each ward (n=200)



Several reasons may account for the variation in numbers from each ward, the range being 14 - 35. Wards 5 and 6 provided the largest sub-samples, almost certainly because they admitted emergency patients at all times, thereby providing higher numbers of potential interviewees. Ward 8 produced the smallest number of patients, because the patients of the two consultants were transferred to another ward half-way through the data collection period, halving the number of admissions. Ward 4 also had a small number of interviewees, in this case because of the nature of the surgery, which was frequently minor and resulted in a rapid turnover of patients. This meant that fewer patients fitted the inclusion categories because they were often within 24 hours of admission or surgery.

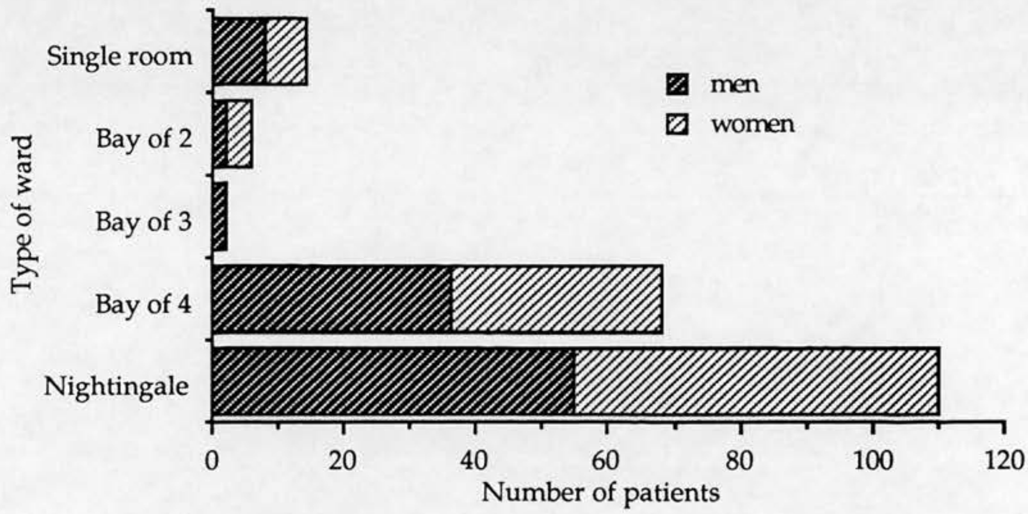
The variation in the numbers of different week-nights covered was probably due to the effect of fixed operating days biasing the nights on which patients fitted the inclusion categories.

Figure 3: Numbers of each sex interviewed for each week-night (n=200)



The number of patients sleeping in various designs of ward were as shown in Figure 4:

Figure 4: Numbers of each sex interviewed from each design of ward (n=200)



Just over half of the patients (n=110) were on Nightingale Wards, with the remaining 90 on small wards of four or fewer beds. The mean time since admission was 8.6 days. Of the 200, 129 had undergone surgery, 64 were having investigations or conservative treatment and the remaining seven were boarders from medical wards. Of those who had received surgery, the mean number of days since operation was 6.1. Thirty-seven lived alone and the other 163 lived with friends or relatives.

The sampling variations described were within acceptable limits and did not prevent comparisons of sub-groups producing useful data.

3.4.2 Ethical considerations

It was considered that the study did not present any ethical difficulties. Verbal consent was obtained from each subject who participated in the study and all were informed of their right to withhold information.

Approval was gained from the appropriate Ethics Committee prior to pre-testing. Permission was given by all relevant medical staff to approach patients under their care, and also by the Chief Area Nursing Officer and hospital nursing staff. Confidentiality of the individual respondent was maintained with interview schedules being numbered rather than named, and the coding key was destroyed after analysis.

3.4.3 Coding and analysis of interview schedules

The completed interview schedules were coded so that the data could be analysed using the SPSS-X (Statistical Package for Social Sciences, version X) computer program. For the most part this was done in the same way as for the pilot study, but several amendments were made in view of that work.

Difficulties were encountered regarding the coding of diagnoses. A list of all the diagnoses (taken from nursing notes or the Kardex) is given in Appendix 2. The idea of grouping patients under different diagnostic headings was not feasible, partly due to the great diversity of diagnoses, and partly due to varying formats for recording diagnoses by nursing staff. It was decided that patients would be allocated to one of three groups: those who had undergone surgery; those having conservative treatment or investigations; and medical patients 'boarding' from other wards. The question regarding reason for admission was discarded for similar reasons.

It was not anticipated that patients might give multiple responses to several of the questions. In order to deal with this information, supplementary sheets were added to each interview schedule, and the responses were recoded. This was necessary for questions 2, 8, 13, 19, 20, 21, 23 and 27 (see Appendix 1).

The accuracy of the coding was assessed by an independent researcher who checked a random sample of 20 schedules (10% of the sample). Five errors were found out of a possible 3,680 codes, indicating an error rate of 0.14%. This was considered acceptable.

CHAPTER 4

STUDY 1

A STUDY OF PATIENTS' SLEEP ON SURGICAL WARDS

Results

First in this chapter is a summary of the changes from home to hospital in reported sleep patterns. The influence of the independent variables on sleep was considered using both bivariate analyses (including chi^2, the Wilcoxon rank sum test, Mann-Whitney U test, Pearson's correlation, paired and unpaired t-tests); and analysis of variance and discriminant analysis. The SPSSX package (SPSS Inc. 1983) was used to run these tests.

Next is a description of changes in pre-sleep routines in hospital and the reasons given for those changes. This is followed by data describing the use of hypnotics and analgesics, and factors reported disturbing sleep both at home and in hospital. The patients' suggestions for improving sleep in hospital are reported briefly, and finally, nurses' recordings of sleep are mentioned.

4.1 Changes in reported sleep patterns

Paired t-tests were used to analyse the parametric (normally distributed) data while Wilcoxon signed rank tests were used to analyse the non-parametric (non-normally distributed) data. With the exception of time spent napping during the day, significant differences were observed between the values reported for sleep at home and those for sleep in hospital.

The two following tables show first, the characteristics of reported sleep at home and in hospital (Table 3), and second (Table 4), the differences between the two.

Table 3: Descriptive statistics showing sleep patterns at home and in hospital

Variable	Range	Median	Mean
HOME:			
Settling time	2100-0300h	2330h	2329h
*SOL	0-270 mins	12 mins	23.6 mins
*TST	2-12 hours	6.75h	6.54h
Awakenings	0-11	1	1.4
Morning waking	0355-1100h	0645h	0644h
Napping	15-400 mins	75 mins	98 mins
*SE	0.27-1.58	0.93	0.92
HOSPITAL:			
Settling time	18.50-0500h	2230h	2242h
*SOL	0-360 mins	20 mins	48.7 mins
*TST	1-10 hours	5.5h	5.37h
Awakenings	0-12	2	2.3
Morning waking	0230-0900h	0600h	0558h
Napping	1-450 mins	100 mins	112.99mins
*SE	0.12-1.38	0.79	0.76

*These are defined on page 50.

It is worth noting that while objectively measured SE should not exceed a value of 1, the values in this table have been calculated from subjective reports, and the inaccuracies inherent in this type of assessment led to values in excess of 1.

Table 4: Differences between sleep patterns at home and in hospital

Variable	t	df	p	
Paired t-tests:				
Settling time	7.75	186	<0.0001	*
TST	7.61	182	<0.0001	*
Morning waking time	2.86	188	0.005	*
SE	7.47	167	<0.0001	*
Variable		**z**	**p**	
Wilcoxon signed rank tests:				
SOL		-5.4145	<0.0001	*
Night wakenings		-5.8226	<0.0001	*
Napping		-0.6520	>0.5	

* = statistically significant differences

Highly significant changes in sleep pattern were reported. Both the time of settling down to sleep and morning waking were earlier, it took longer to fall asleep, total sleep time was shorter, and night-time awakenings were more frequent.

The estimated time taken to fall asleep virtually doubled in hospital, confirming the findings of previous studies (Murphy et al 1977; Dodds 1980; Carter 1984; Stead 1985). This may have been partly due to an earlier sleeping regime, with patients unable to fall asleep earlier than usual just because they had been settled down to sleep earlier. It is likely, however, that many other factors contributed to this, not least being in a strange environment, anxiety and discomfort. Both the time of settling down to sleep and morning waking were significantly earlier (each by approximately 50 minutes) in hospital, again almost certainly due to the imposition of ward routines, since the duration of time spent in bed trying to sleep was not changed, but the timing of it was.

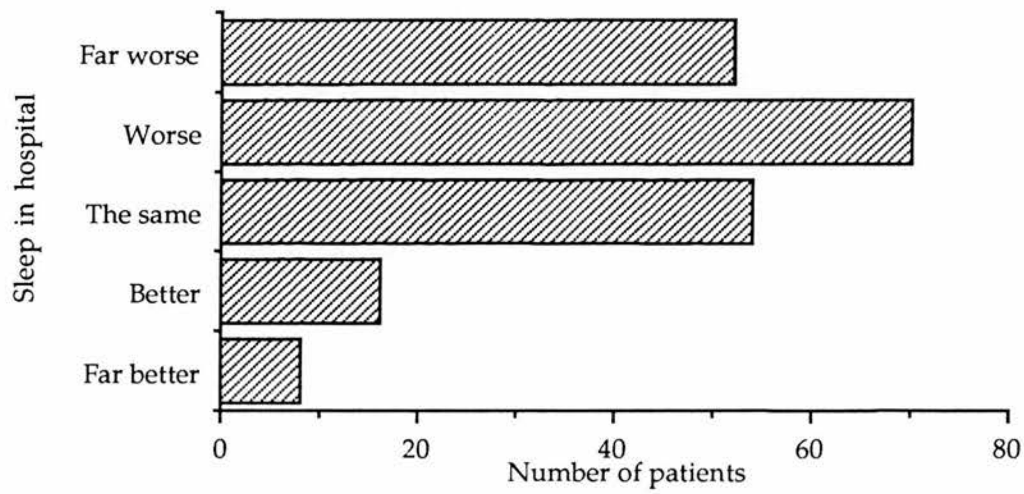
Not surprisingly, the causes of morning waking in hospital were different from those at home. Where 145 woke naturally at home, just 82 woke naturally in hospital. The causes of awakening are discussed later.

The estimated time spent asleep during the night was reduced from a mean value of 6.54 hours to 5.37 hours. This appeared to be due, at least in part, to the increased number of night-time wakenings (from a mean of 1.4 to 2.3), but may also have been partly attributable to the shift to an earlier sleep period. Day-time napping was unchanged, so any night-time sleep deficits accrued in hospital did not appear to be offset by extra day-time sleep.

Reported sleep efficiency (the proportion of time in bed spent sleeping) was calculated for the sample. Although normal values derived from objective measures are available for various ages and sexes, none are available for subjectively assessed data. For this group, reported sleep efficiency was normally 0.92, decreasing to 0.75 in hospital, a substantial decrease, clearly showing the decrement in sleep quality.

When patients were asked how their sleep in hospital compared with their sleep at home, the majority felt that it was worse or far worse (Figure 5).

Figure 5: Comparison of sleep in hospital with sleep at home (n=200)



Sixty-one per cent of the 200 patients felt that their sleep had worsened, 27% felt that it was the same and 12% felt that it had improved.

Overall, the picture patients reported of their sleep in hospital was one of a change in the normal timing of their sleep, with less time spent asleep and an increase in the number of factors disturbing sleep. Hospital routine dictated that patients both retired to bed and woke up earlier than usual by almost one hour. This earlier settling down to sleep may in part be responsible for the increase in reported sleep onset latency, with patients being unable to fall asleep earlier just because it fitted in better with the routine. The reduction in time spent asleep was probably due to a combination of factors, the major ones being the shift to an earlier routine and the increased number of night-time awakenings.

4.2 Factors affecting sleep

4.2.1 Day of the week

One-way analysis of variance (ANOVA) was used to identify possible variations in sleep according to the day of the week. No significant differences were found in any of the dependent variables. Although it had been supposed that wards might be quieter at weekends since there would be less routine surgery and fewer routine admissions, no differences were found between the seven days of the week. Perhaps emergency admissions and other unpredictable occurrences at the weekend removed any opportunity for quiet.

4.2.2 Age

The narrow age band (50-65 years) of the sample was chosen in the hope that the well documented effects of age on sleep could be controlled for. The sample was divided into three age groups: 50-54 years, 55-60 years and 61-65 years. One-way analysis of variance was then used to compare the sleep variables for the three groups; as expected, no significant differences were found.

4.2.3 Gender

Significant differences were observed between the sexes in several of the variables considered. Women reported that their normal duration of sleep at home was longer at 6.92 ± 0.15 (SEM) hours than for men at 6.19 ± 0.17 hours ($t=3.24$, $p=0.001$). The reasons for this difference are not clear, though the finding that men reported more disturbed sleep than women has been noted in previous work (Webb 1982; Wever 1984). Men, however, reported spending significantly longer napping during the day at home, for 114 ± 14 minutes compared with women at 75 ± 8 minutes ($t=2.37$, $p=0.021$). Both Webb and Swinburne (1971) and Zepelin (1973) found that daytime napping increased progressively with age for men, but was far less common among women.

In hospital, women again reported longer night-time sleep (5.77 ± 0.2 hours) than men (5 ± 0.18 hours) ($t=2.72$ $p=0.007$). No difference between the sexes was noted in the time spent napping in hospital.

Less relevant, perhaps, was a significant difference between the sexes observed in the number of days since admission ($t=2.21$, $p<0.03$) with a mean of 10.3 ± 1.5 days for men compared with 6.8 ± 0.5 days for women. A chi^2 test showed that the amount of alcohol normally consumed by men was greater than for women ($chi^2 = 16.2$, $p=0.0028$, 4df). Similarly, an unpaired t-test showed that men smoked significantly more than women (p=0.024).

4.2.4 Living alone

Although those who lived alone at home compared their sleep in hospital more favourably with sleep at home than those who lived with others (chi^2=20.55, p<0.001, 4df), the only difference in their reported sleep was more daytime napping at home; 164 ± 31 minutes compared with 83 ± 8 minutes. One explanation for this may have been boredom at home. Their more positive feelings about their sleep in hospital might possibly have been because they were more used to sleeping alone in bed, and also they may have felt more secure in hospital, particularly if they had been ill at home prior to admission. Unfortunately, it was not recorded whether those who lived with others slept alone or not.

4.2.5 Ward design

The patients who were interviewed for this study slept in wards of differing designs. These were either single rooms, bays of two, three or four patients, or Nightingale wards containing 20-24 beds. The numbers sleeping in each of these was as shown in table 5. For the purposes of analysis, patients sleeping in single rooms, or bays of two, three or four were combined to form a single category of 'small' wards which was then compared with patients from Nightingale, 'large' wards. Unpaired t-tests (for parametric data) and Mann-Whitney U tests (for non-parametric data) showed significant differences between the sleep patterns of patients on large and small wards (Table 5).

Table 5: Differences between sleep patterns on large and small wards

Variable	t	df	p	
Unpaired t-tests:				
Settling time	0.92	180.5	>0.3	
TST	3.5	183	<0.001	*
Compare with home sleep	2.54	185	<0.02	*
Morning waking time	0.98	185.25	>0.3	
Variable		**z**	**p**	
Mann-Whitney U tests:				
SOL		-1.4558	>0.1	
Night-time wakenings		-3.1841	<0.002	*
Time spent napping		-3.0121	<0.003	*

* = statistically significant differences

As might be expected, ward design produced a significant effect, confirming the findings of Ogilvie (1980). T-tests showed that patients on small wards reported TSTs approximately one hour longer (5.9 ± 0.2 hours) compared with those on large wards, whose mean duration of sleep was 4.9 ± 0.2 hours. They also had fewer night-time awakenings (mean values of 1.9 compared with 2.7) and spent more time napping during the day than patients on Nightingale wards (136 ± 14 minutes compared with 88 ± 11 minutes).

It is probable that these differences were mainly because small wards tended to be quieter, but may also be due to the fact that small wards were more 'bedroom sized', and therefore a less strange environment than a Nightingale ward. These differences might also be due to the fact that the patients in the small wards were there because the nurses considered them to be less ill than the patients on large wards, though no attempt was made to assess this.

4.2.6 Waiting nights

No differences were found between waiting nights (when wards accepted emergency admissions) and non-waiting nights, though it had been anticipated that sleep might be worse on waiting nights due to the extra noise and disturbance caused by night-time admissions. Presumably, care of post-operative and other ill patients on non-waiting nights reduced any contrast which might have been expected, particularly on Nightingale wards. It is likely that disturbances due to admissions could be more easily minimised on wards comprised of bays of four or less beds.

Chi^2 tests, however, showed that there were significant differences both in the prescribing ($chi^2=13.7$, $p<0.004$, 3df) and administration of analgesics ($chi^2=7.45$, $p=0.024$, 2df) between waiting and other nights. The analgesics prescribed were as shown below:

Table 6: Analgesics prescribed on 'waiting' and 'non-waiting' nights

Analgesics*	Waiting	Non-waiting
None	9	23
Mild	22	37
Intermediate	51	35
Major	14	9
Total	**96**	**104**

* The analgesics falling into each category are shown in Appendix 3

Nine percent of the waiting night sample and 22% of the non-waiting night sample had no analgesics prescribed. Fifty-eight percent of the waiting night sample received analgesics, compared with 39% of the non-waiting night sample. The finding that a greater proportion of patients received analgesia/stronger analgesia on waiting nights is difficult to explain. Perhaps more staff were on duty, making it possible to assess and treat pain more easily than otherwise. Unfortunately, the staffing levels were not recorded. Another possibility is that waiting nights were noisier than others, and that this increased patients' anxiety and therefore their perception of pain.

4.2.7 Days since admission and surgery

Pearson's correlation coefficients were calculated in order to identify any associations between the number of days since admission to hospital and the dependent sleep variables. No significant correlations were obtained. The same procedure was used for the number of days since surgery; the sample was smaller for this test since only 129 out of the 200 had undergone surgery. Again, no significant correlations were found.

These findings were unexpected, since it had been assumed that first, sleep might improve as patients became more familiar with the environment. Second, sleep might have shown progressive improvement post-operatively as the patients recovered. This absence of improvement may have been due to two processes working in opposite directions and cancelling each other out. It is possible that patients were sleeping more immediately post-operatively, for two reasons. These might be the postulated increased sleep need related to trauma or infection, and the residual effects of anaesthesia. The patients may then have slept less as they recovered. On the other hand, anxiety and discomfort may have tended to disrupt sleep immediately post-operatively, and these factors may have diminished, so that patients were able to sleep more as recovery progressed. In fact, the findings did not show any significant changes with time, so either opposing changes in sleep cancelled each other out, or there were no changes in sleep according to time.

4.2.8 Hypnotic drugs

The sleep patterns of those who had received hypnotic drugs the night prior to interview in hospital differed significantly from those who had not (Tables 7 and 8).

Table 7: Sleep patterns of patients who received hypnotic drugs in hospital (n=74)

Variable	Range	Median	Mean
Settling time	1830-0200	2300	2244h
SOL	0-360 mins	15 mins	37.7 mins
ST	1.5-10h	6h	5h 46 mins
No. night wakenings	0-6	2	2.078
Morning waking time	0230-0900	0600	0607
Day-time napping	17-450 mins	100 mins	125 mins

Table 8 : Sleep patterns of patients who did not receive hypnotic drugs in hospital (n=126)

Variable	Range	Median	Mean
Settling time	2000-0500	2230	2246h
SOL	0-360 mins	30 mins	60 mins
TST	1-10h	5h	5h 5mins
No. night wakenings	0-12	2	2.699
Morning waking time	0315-0800	0600	0552
Day-time napping	7-350 mins	100 mins	116 mins

The sleep of these two groups was compared, using unpaired t-tests and the Mann-Whitney U test (Table 9).

Table 9: Differences in sleep pattern between those who had and had not received hypnotic drugs

Variable	t	df	p	
Unpaired t-tests:				
Settling time	0.32	163.51	>0.7	
TST	2.07	142.89	<0.05	*
Morning waking time	2.36	148.03	<0.02	*
Variable		**z**	**p**	
Mann-Whitney U tests:				
SOL		-2.3305	<0.02	*
No. night wakenings		-1.7686	>0.07	
Day-time napping		-0.3188	>0.7	

* significant differences

Hypnotic drugs appeared to be effective in improving reported sleep. Time taken to fall asleep was shorter, time spent asleep was longer and time of morning waking was later. Since 20% of those who took sleeping pills were apparently unaware that they had done so, and they had reported the same improvements in sleep as those who knew they had taken hypnotics, it is likely that the improved sleep was due to the hypnotic drug rather than any other factor.

4.2.9 Analgesic drugs

Similarly, differences in sleep were assessed for those who had received analgesics the previous night and those who had not (Table 10).

Table 10 : Differences in sleep pattern between those who had and had not received analgesics

Variable	t	df	p
Unpaired t-tests:			
Settling time	0.91	183.16	>0.3
TST	0.97	181.77	>0.3
Morning waking time	0.53	184.44	>0.5
Variable		**z**	**p**
Mann-Whitney U tests:			
SOL		-0.6511	>0.5
No. night wakenings		-0.8338	>0.4
Day-time napping		-0.5213	>0.6

The provision of analgesics appeared to have no significant association with reported sleep patterns. This could be because those who received no analgesics were not in pain anyway, and those who did receive analgesics had their pain well controlled. Equally, the opposite could have been the case; that those who had no analgesics were in pain, and those who had received analgesics were also in pain. It may have been a combination of these two explanations, but the second of the two is the more likely since pain was the most frequently cited cause of night-time awakening.

4.2.10 Mattresses

The patients in this sample slept on a variety of mattresses, and one slept in a wheelchair. Several were provided with a synthetic sheepskin to sit/lie on as a means of reducing possible damage to pressure areas.

'Eggshell' mattresses were used by a small proportion of patients - these are foam mattresses which lie on top of the standard hospital mattresses, whose upper surfaces are shaped like an eggbox and are approximately 10 cm thick. The types of mattress used are shown in Table 11.

Table 11: Types of mattress

Plastic covered foam	72
Plastic covered horsehair	87
Foam 'eggshell'	17
Foam and sheepskin	5
Horsehair and sheepskin	9
'Eggshell' and sheepskin	9
Wheelchair	1
Total	**200**

Unpaired t-tests were used to compare sleep patterns for patients sleeping on foam or horsehair mattresses only. Patients who slept on foam mattresses reported sleeping for a longer time than those who slept on horsehair ones; a mean of 5.7 hours compared with 4.98 hours. The mean time of morning waking was significantly earlier for those sleeping on horsehair mattresses, at 05.43h compared with 06.12h for the foam group.

Obviously the horsehair mattresses were considerably less comfortable than the foam ones. Several patients commented on how hard the horsehair ones were. Most surgical patients slept in unaccustomed positions, usually sitting up immediately post-operatively, to facilitate breathing; this increased the possibility of a sore sacral area, particularly on a hard mattress. The site of their wounds frequently meant that patients were unable to sleep in their usual position, thereby making it more difficult to sleep.

4.2.11 Pre-sleep routines

Unpaired t-tests were used to compare sleep variables for those who were able to conduct their usual bed-time routines in hospital with those who were not. Pre-sleep routines appeared to have no effect on reported sleep. It had been supposed that being able to perform habitual pre-sleep practices would make patients feel more 'at home', and therefore more relaxed and able to sleep as normal. However, this was not the case for this sample, perhaps because there were so many stressful stimuli in hospital whose effects could not be ameliorated by familiar practices.

It had been supposed that regular drinkers might find it more difficult to relax before going to bed if they had to omit their usual evening drink while in hospital. This did not appear to be the case for this sample. No differences were observed between low (teetotal or occasional drinkers) and high (social and regular drinkers) alcohol consumers, pertaining to their sleep in hospital.

Similarly, it was considered possible that smokers would reduce their rate of cigarette consumption in hospital (which proved to be the case) and that this might affect sleep. The only difference between smokers (n=96) and non-smokers (n=104), however, was that the smokers tended to settle down to sleep later in hospital. Perhaps without the relaxing effect of a cigarette they did not feel ready to settle down as early as they did at home.

4.3 Predicting the poorest sleepers

Although much useful information has been gained from the bivariate analyses used up to this point, it is possible that there was some interdependence of the factors affecting subjective assessments of sleep. This may be taken into account using discriminant analysis. This statistical technique calculates which combination of independent variables best predicts into which of two (or more) discriminant groups each case (patient) will fall. The two groups here are first, those who felt they slept the same, better, or far better in hospital than at home, and second, those who felt they slept worse or far worse.

Week-day, age, gender, living alone or not, ward, ward design, waiting night or not, number of days since admission, number of days since surgery, whether hypnotics were taken, analgesics received, type of mattress, smoking and pre-sleep routines were combined in a stepwise discriminant analysis. Wilks' lambda indicates the degree to which a group of variables contributes to the separation of the discriminant groups. Values of 1 occur when the group means are equal, while values approaching 0 indicate a high degree of separation. The F ratio provides the significance of lambda and, for this analysis, variables were only entered into the calculation if the F value was 5 or more. The Wilks method was used, which aims to minimise the overall Wilks' lambda by maximising the between-group to within-group differences (SPSSX Users Guide 1983, p627). In order to include all 200 cases, mean values were inserted for any missing data.

Three variables reached the level of significance for inclusion, as shown in Table 12.

Table 12: Factors predicting how patients felt about their sleep in hospital

Variables included in model	**Wilks' lambda**	**p**
Living alone	0.94945	0.0014
Ward design	0.92140	0.0003
Type of mattress	0.88975	0.0000

When using the Wilks' method, discriminant analysis selects factors predictive of the chosen discriminant groups, in order of significance, with the most highly significant variables being entered into the model first. As progressively more variables are entered into the model, more of the separation of the discriminant groups is accounted for. The single most important factor in predicting whether patients felt that their sleep was better in hospital was living alone; those living with others tended to report sleeping worse.

The second factor (with the next highest significance) included was ward design. As shown by bivariate analysis, those sleeping on small wards tended to sleep better than those on large wards. A chi^2 test showed that there was no association between living alone and ward design.

The third factor entered into the model was the type of mattress. In combination, these three variables successfully predicted which of the discriminant groups 65.5% of cases fell into. How sleep was influenced by the type of mattress, however, was less clear. A significant association was found between type of mattress and ward design ($chi^2=15.8$, 1df, $p=0.0001$). There were more foam mattresses on small wards, while there were more horsehair ones on large wards. This means that it is not possible to tell how much each of these variables (type of mattress and ward design) contributed to the perception of sleep as being worse in hospital. Their effects were not exactly the same, however, since both were included in the discriminant model.

Further analysis showed that the association between mattress type and ward design existed only for those who felt worse about their sleep ($chi^2=13.04$, $p<0.0005$, 1df). For the patients who felt that their sleep was the same/better in hospital, there was no association between ward design and type of mattress.

This finding was also approached in a slightly different way, by attempting to identify how mattress type affected perceptions of sleep. This showed that for patients on horsehair mattresses there was a significant association between large wards and feeling worse about sleep in hospital than sleep at home. ($chi^2=6.4$, $p=0.01$, 1df). It may be that although the harder horsehair mattresses made no difference to sleep satisfaction on small wards, on the large Nightingale wards where conditions were more adverse to sleep, the horsehair mattresses exacerbated the situation. In addition, if the patients perceived as more 'ill' tended to be out on the main ward, they may have spent more time in bed, and therefore considered the beds more uncomfortable than patients in side-wards.

To sum up then, the combination of factors which best predicted whether patients slept either the same/better or worse in hospital than at home, were living alone, ward design and type of mattress. Those who slept worse tended to live with others, they slept on large wards and, finally, horsehair mattresses appeared to have a negative effect on sleep when patients were on Nightingale wards.

4.4 Changes in pre-sleep routines

Patients were asked to describe any routines normally performed before settling down to sleep at home. Twenty patients reported no particular pre-sleep routines and two felt that the question was inappropriate due to their grossly disturbed and irregular sleep patterns. The remaining 178 described a total of 303 routines, many of which were similar. These activities were divided into four categories (Table 13). The detail of activities placed into each category may be seen in Appendix 4.

Table 13: Usual pre-sleep routines

Category of home pre-sleep routine	**n**
Eating and/or drinking	94
Alcohol and/or cigarettes	52
General relaxation	149
Other routines	8
Total	**303**

In hospital, 20 patients had no routines to adhere to, 42 were able to perform their usual routines and the remaining 138 offered a total of 174 reasons why they were unable to perform their usual routines. The reasons were categorised (Table 14) and details may be found in Appendix 5.

Table 14: Reasons why usual pre-sleep routines were not performed in hospital

Category of reason routine was not performed	**n**
Ward routine	52
Alcohol or cigarettes unavailable	31
Distractions	25
Treatment	21
Inappropriate/inadequate facilities	16
Too unwell	12
Other	8
Noise	5
Pain	4
Total	**174**

It had been supposed that adherence to usual pre-sleep routines in hospital would be likely to facilitate sleep. Most of the routines practised at home appeared (in theory at least) to be possible in hospital for a large proporton of patients. Of the 94 patients who normally had a drink (non-alcoholic) and/or a snack before retiring, just ten were unable to eat due to their condition, that is, they were taking either nothing or clear fluids only by mouth. The remaining 84 patients might well have benefitted from taking their accustomed evening drink or snack, as suggested by Brezinova and Oswald 1972.

As regards social drugs, there were two wards where smoking was not allowed at all, though the others provided an area for smokers. This meant that patients whose mobility was restricted were unable to smoke on six of the wards and, obviously, no-one could smoke on the other two. Twenty two patients normally smoked before going to sleep and this was reduced to none in hospital. Thirty patients normally had an alcoholic drink before retiring, and this was reduced to three in hospital. Two did so with the knowledge of the nursing staff of the two different wards they were on, and one did so without consulting the nurses.

4.5 Hypnotic and analgesic drugs

Recordings were made of the nurse' reports of hynotic drugs taken by patients at home. Current hospital prescriptions were taken from the patients' drug charts (Table 15).

Table 15: Types of hypnotic drug prescribed at home and in hospital

Drug	Home	Hospital
None	176	103
Temazepam	14	84
Nitrazepam	6	5
Diazepam	2	4
Triazolam	1	1
Other	1	3
Totals	**200**	**200**

In addition, patients were asked whether they had had any tablets to help them sleep the previous night. Some patients described the drugs they had received in general terms, i.e. as painkillers or sleeping pills, whereas others were able to name them (Table 16).

Table 16: Patients' descriptions of tablets taken to 'help them sleep'

Description	No. of patients
None	79
Sleeping pills	46
Painkillers	34
Painkillers and sleeping pills	13
Named analgesic	12
Named hypnotic	11
Named analgesic and hypnotic	2
Other	1
Don't know	2
Total	**200**

Use of hypnotic drugs was changed substantially by admission to hospital. Only 24 of the 200 patients took hypnotics either regularly or occasionally at home. Ninety-seven were prescribed such a drug in hospital and 74 had received these on the night prior to interview. Interestingly, only 59 of these patients were apparently aware that they had taken sleeping pills. The reason why approximately half the sample were prescribed sleeping pills in hospital is not clear, though 90 patients said that they were offered 'something to help them sleep' (in fact not necessarily a hypnotic) while 40 had taken the initiative to request something. It may have been routine policy for half the surgical teams, or it may have been prescribed for patients considered to be particularly anxious on admission. Only 15% of those patients who had received a hypnotic were able to name it correctly and 12% of those who had received an analgesic named it correctly. Temazepam was the most commonly prescribed hypnotic drug (84 cases) with nitrazepam and diazepam next (5 and 4 cases respectively).

Comparisons were made between the sleep patterns of those who knew they had received hypnotics and those who did not realise that they had.

The only significant finding ($p=0.005$) was in the number of reported night-time awakenings. Those who knew they had taken a hypnotic reported waking a mean of 2.07 times while the others woke only 1.09 times.

Similarly, medication charts indicated that 97 patients had received some form of analgesic the previous night, while only 61 acknowledged this fact. No differences in sleep pattern were found between patients who knew they had received analgesics and those who apparently did not.

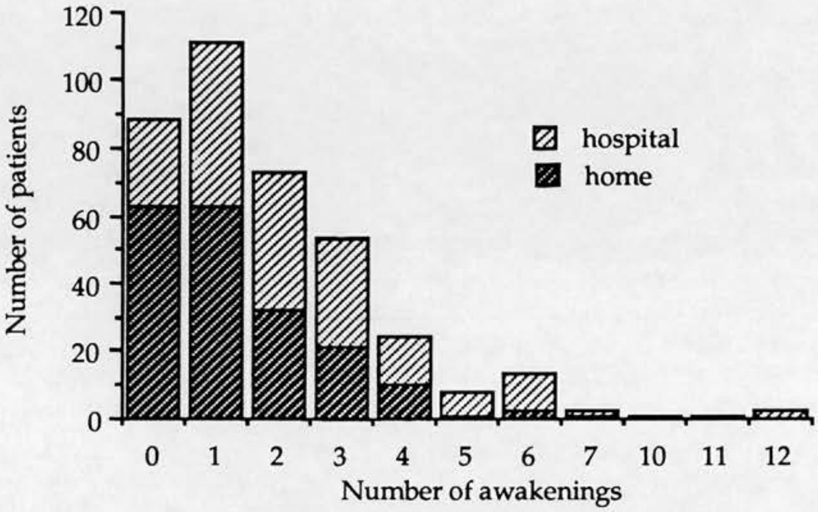
This apparent unawareness of their drugs could have several explanations. They may have forgotten taking them, they might have been unwilling to admit that they had taken sleeping pills or painkillers, they may not have known what the drugs were for, or they may have assumed that they had some other function.

Other drugs known to affect sleep, such as ß-blockers and methyl-dopa, were considered, but were being taken by such a small proportion of the sample (less than 2%) that no analysis was possible.

4.6 Causes of night-time waking in hospital

Of the sample, 131 normally woke up at least once during the night at home, while in hospital 157 woke at least once during the night prior to interview.

Figure 6: Number of night-time awakenings at home and in hospital (n=200)



A relatively short list of causes of night-time awakening at home was elicited (see Appendix 6) and categorised as shown in table 17.

Table 17: Number of patients who mentioned each cause of night-time awakening at home

	No. of patients
Need to go to toilet	75
Pain or discomfort	17
Other	14
Noise	12
Anxiety and worry	12
Breathing difficulties	6
Total	**136**

Patients were asked what had woken them up during the night prior to interview. Many claimed that it was the best night's sleep they had had since admission, so a second question was also asked to find out what had disturbed their sleep during the whole of their stay in hospital. The number of times each cause of disturbance was mentioned is shown in Table 18. Appendix 7 illustrates which causes of disturbance were placed in each of the categories.

Table 18: Number of patients who mentioned each cause of night-time awakening in hospital

	Previous night	**All nights**
Noise	88	195
Pain or discomfort	59	172
Environmental temperature	26	122
'Bed problems'	16	110
Needed to go to toilet	67	93
Other	36	93
Anxiety and worry	7	73
Bad dreams	5	28
Lighting	5	5
Treatment	12	5
Breathing difficulties	3	0
Totals	**324**	**896**

Noise and pain appear to be the main factors perceived as disturbing to sleep in hospital (when considering the whole stay) with 123 patients being woken by noise and 127 by pain (excluding those who suffered discomfort). One hundred and twenty-two were disturbed by the environmental temperature, with 91 complaints of being too hot and 31 of being too cold.

The most frequently cited cause of night-time waking was pain, mentioned by 127 patients. A further 45 reported other kinds of discomfort, such as cramp, nausea and indigestion (see Appendix 7). The incidence of pain in this context is perhaps rather unexpected, since post-operative analgesics, theoretically at least, are given according to need. It might be that patients were expected to ask for analgesics when they felt they required it, leaving some patients who would only ask when the pain was severe.

The number of disturbances at night was significantly greater in hospital than at home. As may be seen, many of these items were noises. The sources of noises which disturbed each patient were categorised, for both the night prior to interview, and for all nights, as shown in Table 19.

Table 19: Sources of noise disturbing patients in hospital at night

	Previous night	**All nights**
Other patients	18	31
Nurses	8	14
Nurses with patients	20	31
Nurses and patients	1	12
Equipment	5	17
Outside of ward	11	14
No noise	136	77
Don't know	1	4
Totals	**200**	**200**

Noise was the second most common cause of night-time disturbance, with 123 patients giving 195 examples of noises which had disturbed them. Only 12 patients reported being woken by noise at home. Most of the hospital disturbances came under the heading of noises which were apparently unavoidable, such as those made by other patients (n=31) and nurses with patients (n=31), and noise outside the ward, such as ambulances and rowdies (n=14). Only a few noises were considered unnecessary, such as nurses chatting to one another and loud footsteps (n=14), and those due to inappropriately designed or old equipment. The latter included metal bedpans, IVI alarms, radiators and refrigerators.

One-hundred and twenty-two complaints of uncomfortable environmental temperatures were made. Ninety-one patients were too hot and 31 too cold. Although this may have been due to inappropriate ambient temperatures on wards, it may also have been due to post-operative pyrexia changing normal perceptions of temperature. Those with a fever may have felt cold, while those recovering from fever would have felt hot. Regardless of the reason (with the exception of severe pyrexia), nurses could encourage patients to request more/less bedding, as required. Such encouragement may be of considerable importance, since patients perceiving nurses as being very busy would in all probability be reluctant to ask for help.

There was a slight increase in the numbers of patients who woke up needing to go to the toilet during the night; 93 in hospital compared with 75 at home. This may have been due to receiving intravenous fluids, which would increase the frequency of needing to pass urine, particularly at night. Another explanation might have been a change of routine in the timing of drinks in hospital.

Seventy-three patients had felt anxious or worried during their stay in hospital, more than one third of the sample. Anxiety alone may affect sleep, reducing stage 4 and REM, and increasing awakenings (Vitiello et al 1983). In addition, fear may affect pain thresholds, as shown by Nisbett and Schachter (1966). At high fear levels pain may be perceived as being more intense than it would at low fear levels. Obviously, then, it is in the best interest of the patient that anxiety be kept to a minimum.

4.7 Getting back to sleep

Of the 157 who woke during the night prior to interview, just 39 told a nurse. Eighty-seven either had no difficulty in getting back to sleep, or felt that nothing helped. The remaining 70 mentioned actions taken either by themselves or the nursing staff which helped them get back to sleep.

Table 20: Actions considered helpful in getting back to sleep

Nurse action	n	Patient action	n
Gave analgesics	15	More/less bedding	4
Gave hot drink	15	Changed position	4
Talked to patient	6	Read/crossword	3
Made comfortable	6	Radio/Walkman	2
Gave blanket	3	'Nice thoughts'	2
Nursing procedures	3	Drink of water	1
Helped to toilet	2	Smoked cigarette	1
Screens drawn	1	Used inhaler	1
		Opened window	1
Total	**51**	Total	**19**

Some kind of nursing action was considered effective in helping patients to get back to sleep for 32% of those who woke up. The major items considered helpful were the provision of analgesics, or a hot drink. The making of cups of tea is likely to be considered a lower priority than the provision of analgesics for sleepless patients, particularly on busy wards. This study, however, suggests that one of the most important ways in which nurses helped patients to get back to sleep was by giving them a hot drink.

4.8 Causes of morning waking

A comprehensive list of the reported causes of morning waking both at home and in hospital is given in Appendix 8. A more concise version is given in table 21.

Table 21: Causes of morning waking at home and in hospital

Cause at home	n	Cause in hospital	n
Woke naturally	145	Woke naturally	82
Alarm clock	18	Ward activity/noise	60
Household member	15	Nursing/medical care	27
Other noise	12	Physical causes	22
Physical causes	10	Other	9
Total	**200**	Total	**200**

The number waking naturally in the morning fell from 145 at home to 82 in hospital. The ward environment inevitably introduced a whole series of new stimuli, the physical condition of the patients was worse, in many cases, than it was at home as a result of recent surgery, and some were woken for medical and nursing care.

Not surprisingly, there were double the number of physical causes of morning awakening in hospital, though no increase in the number waking due to pain. New physical causes included; needing to go to the toilet, feeling cold, unpleasant smell, nausea, and wanting a cigarette. Twenty- seven were woken for nursing or medical care, but it is not known whether or not it was essential that the care should be given at that time. Fifteen of these were woken for nursing observations; again it is difficult to know whether these were essential, or simply routine. It may be that the morning routine of recording temperature, pulse and blood pressure should be considered very carefully, and performed only for those patients who genuinely require them. Forty-two were woken by general ward activity (for the most part on Nightingale wards); 15 by the tea trolley, 25 by the noises from nurses walking and talking.

On the basis of these data it is not possible to make black and white judgements regarding which causes of morning waking were unavoidable and which were not.

4.9 Patients' suggestions for improving sleep

For the most part, patients were reluctant to make suggestions for improvements, since they did not wish it to be thought that they were complaining. They were reassured that this was not the case, and that any suggestions made could be offered without consideration of financial and staff resources.

Fifty-seven of the 200 patients were quite satisfied with their sleep and had no suggestions for improvements. The remaining 143 patients made a total of 284 suggestions which are listed in Appendix 9 in detail. A summary of the categories is shown below in Table 22.

Table 22: Patients' suggestions for improving sleep in hospital

Category	**No. of times suggested**
Noise reduction	65
Beds	63
Environment	41
Eating and/or drinking	33
Other	20
Pain control	17
Nurses	15
Hypnotic drugs	12
Other routines	9
Light	9
Total	**284**

Although the major cited cause of night-time waking for this sample was pain (n=127), only 17 patients suggested improving pain control as a means of enhancing sleep. This may have been because of their expectations regarding pain, perhaps they expected to suffer post-operative pain, and endured it as a matter of course, not assuming that the pain could or should be reduced further. Another explanation might be that patients assumed that they were automatically receiving all the analgesics they were entitled to, and it did not occur to them that they could request more. A third suggestion is that patients had been given the maximum amount of analgesic prescribed for them, but it was not adequate in controlling their pain. Whatever the case, this study suggests that the majority of patients on surgical wards suffer pain severe enough to disturb their sleep, and it is possible that this situation could be improved.

The largest category of suggestions for improving sleep was noise reduction. This is hardly surprising with 123 patients citing 195 different instances of noise waking them during the night. Sixty-five suggestions (some duplicated) were offered and are shown in Appendix 9. Fifteen of the suggestions were aimed at nurses, including generally being quieter, having the nurses' station off the main ward, washing their hands off the main ward and wearing soft-soled shoes. Twelve suggestions concerned the ward environment, for example quietening dressing trolleys, and carpeting floors.

The second largest category of suggestions covered the topic of beds. A total of 63 suggestions were made, 24 of which were simple requests for more comfortable beds. Given that foam mattresses appeared to have a positive effect on sleep when compared with horsehair ones, in an ideal world it might be helpful to dispense with horsehair mattresses. The remainder made more specific requests, including removing the plastic covers from mattresses (n=9) and pillows (n=8). Obviously it would be impractical to do so, but there are waterproof/vapour permeable materials available which might make more comfortable replacements. Seven patients would have preferred variable height beds, and six would have preferred duvets.

Many other suggestions were made, but in far smaller numbers. Forty-one suggestions regarding the ward environment were offered. Thirteen felt that smaller wards were beneficial in promoting sleep and eight expressed a preference for single rooms. Eleven patients would have preferred a hot drink later at night, while 12 would have liked the opportunity to take an alcoholic drink as a nightcap. A small proportion (n=12) felt that the option of taking hypnotic drugs should be offered, or that stronger hypnotics should be made available. Two of these patients suggested that hypnotics should automatically be prescribed and the patients themselves should be able to decide on which nights they wish to take them.

4.10 Nurses' recordings of sleep

The nurses' records of patients' sleep, both on admission and for the night prior to interview were copied down verbatim. These were then examined to see how often the presence of four different elements was mentioned; sleep quality, quantity, use of medication and pre-sleep routine. The results are shown in tables 23-25. None of the recordings contained all four elements.

Table 23: Number of patients for which at least one of the four elements was mentioned

	Home	**Hospital**
Quality	131	93
Quantity	15	13
Medication	43	2
Pre-sleep routine	9	0
Total	**198**	**108**

Table 24: Number of cases for which at least two of the four elements were mentioned

	Home	Hospital
Quality + Quantity	5	1
Quantity + Medication	1	0
Medication + Routine	4	0
Quality + Medication	20	2
Quality + Routine	4	0
Quantity + Routine	1	0

Table 25: Number of cases for which at least three of the four elements were mentioned

	Home	Hospital
Quality + Quantity + Medication	0	0
Quality + Medication + Routine	2	0
Quality + Quantity + Routine	1	0
Quantity + Medication + Routine	0	0

There was no mention of any aspect of sleep at home for 34 of the patients and no mention of the previous night's sleep for 95 patients. Frequencies were obtained in order to ascertain whether nurses tended to record sleep in the nursing notes more readily for those who felt that they had not slept well compared with those who had, with the result that no differences were evident.

Table 26: Elements of sleep recorded for patients who reported having slept worse or the same/better than at home

	Group 1 (slept worse, n=122)	**Group 2 (slept same/better, n=78)**
Quality	51	42
Quantity	11	2
Medication	1	1
Routine	0	0

The comments written in the nursing notes or Kardex tended to be brief, with the finding that of the 200 patients, 166 had a mention of at least one of the four aspects of their usual sleep on the admission sheet. More surprising, perhaps, was the finding that only about half (n=105) had a mention of any aspect of their sleep for the night prior to interview.

These findings confirm those of Georgopolous and Jackson (1970) who studied the Kardexes of 764 medical and surgical patients. They found that pain and sleep were the least well covered categories of care, and suggested that information might have been communicated via other means, perhaps verbally during the handover between shifts.

Even if patients appeared to sleep soundly all night, if the next morning they report that they have not slept a wink, then they must have some other problem needing consideration. Factors such as noise, pain, anxiety and drug side-effects may all contribute to a reduction in sleep quality without any observable (by the nurse) reduction in sleep quantity. Simply explaining that, for example, ß-blockers might be a cause of disturbed sleep allows the patient to attribute his sleep difficulties to some cause. This in itself may make the patient feel better about his sleep.

It may have been that the 'problem-solving' approach used by many nurses meant that unless a specific problem was offered by a patient, either a 'slept well' or nothing was recorded. Commenting on other people's sleep is extremely difficult since the sleepers themselves are the only ones who can give an account of the quality of their sleep. Several authors have noted that nurses' questioning techniques are inadequate (Maguire et al 1980; Faulkner 1979; Macleod Clark 1983). An improvement in nurses' questioning techniques and assessment skills might ultimately provide patients with more opportunities to express any difficulties they might have in sleeping.

4.11 Summary of results

1. Normal sleep patterns were significantly changed by admission to hospital. The majority of patients felt that their sleep was worse in hospital than at home. Patients reported that both their time of settling down to sleep and their time of morning waking had been brought forward by a mean of approximately 50 minutes. Significantly less time was spent asleep at night and significantly more night-time wakings occurred. Sleep efficiency was reduced.

2. Factors affecting sleep in hospital for this sample were gender (women reported a longer duration of night-time sleep than men), living alone (these people felt better about their sleep in hospital than those who lived with others), ward design (patients reported longer sleep times, fewer night-time awakenings and more daytime napping on small wards), type of mattress (duration of sleep was longer on foam than on horsehair mattresses), and hypnotic drugs (decreased sleep onset latency, increased sleep time and later morning waking).

3. Factors predicting how patients felt about their hospital sleep compared with their home sleep were calculated using discriminant analysis. The best predictors of poorer sleep in hospital were, living with others, and sleeping on large open wards, especially on horsehair mattresses.

4. Whether or not patients were able to perform their usual pre-sleep routines appeared to have no effect on reported sleep patterns.

5. Patients' knowledge of their night-time drugs was vague. Not all of the patients who had received analgesics were aware of it, and, of those who were, very few could name the drug. The same was true for hypnotic drugs.

6. A large number of factors disturbing sleep at night were cited; pain or discomfort was the most common, followed by noise, environmental temperature and dissatisfaction with beds.

7. The two nursing actions considered most helpful in assisting patients to get back to sleep during the night were the provision of analgesics and hot drinks.

8. Patients offered many suggestions for improving sleep in hospital, most of which were concerned with noise reduction and improving the beds.

9. Nurses' recordings of patients' sleep tended to be very brief, usually offering a qualitative description. In many cases no mention of patients' sleep was made.

4.12 Limitations of the study

1. The sample used in this study was a very specific one, of patients on surgical wards at two hospitals and aged between 50-65 years. Strictly speaking, this means that the results cannot be generalised to all patients at all hospitals.

2. The method used to collect data, that of recording patients' subjective assessments of their sleep, has limited validity. The errors inherent in self-reports have been reduced by using subjects as their own controls, since the literature indicates that subjects are able to report changes in their normal sleep patterns reasonably accurately.

3. The final question of the interview, which asked for suggestions of ways to improve sleep in hospital, may not have elicited all possible responses. This is because patients were reluctant to offer suggestions; they did not wish to criticise the nursing staff (upon whom they were reliant), towards whom all but one patient appeared to be positively disposed. In addition, data were collected at a time of increased awareness of the problems of the NHS, which may have influenced the patients' responses.

4. The theory that sleep aids physical healing, despite being supported by a large body of evidence, is open to discussion. Research into the association between sleep and healing using animals might produce results providing a firmer theoretical basis for further work in this area.

4.13 Conclusions

The four aims of the study (see 3.1) were achieved. The first aim was tc compare patients' self-assessments of sleep in hospital with their usual sleep at home. Significant differences were found, with less time spent asleep at night and more night-time awakenings. Patients both settled down to sleep and woke up approximately one hour earlier in hospital. The majority felt that their sleep in hospital was worse than their sleep at home.

The second aim was to find out which factors were perceived by patients as being important in disrupting and promoting sleep in hospital. It was found that the four major causes of night-time disturbance in hospital were pain, noise, environmental temperature and uncomfortable beds. The three major factors predicting which patients were most likely to feel that their sleep in hospital compared favourably with sleep at home were, living alone at home, sleeping in a small ward (four beds or less) in hospital, and sleeping on a foam rather than a horsehair mattress when in Nightingale wards. Patients made many suggestions for improving sleep in hospital, including noise reduction, more comfortable beds and improving pain control.

Many of these findings agree with those of previous work. Although the Royal Commission research paper on patients' attitudes to hospital services was published over a decade ago, in 1978, many of the same problems persist. Changing time-honoured practices is very slow; in general staff's attitudes towards hospital routines appear to be entrenched and extremely difficult to change, and research is needed to justify proposed changes. The inter-relationships between sleep and other factors, such as noise, pain and comfort have been clearly shown in this study and need to be considered together by clinicians, managers and researchers.

The third aim was to find out how nurses recorded patients' sleep. Recording of various aspects of sleep was sparse, suggesting that this was a low priority for nurses. If this was indeed the case, a lack of awareness of individual difficulties in sleeping would prevent nurses from being able to alleviate such problems.

The final aim was to make recommendations for improving sleep in hospital. These are listed in Chapter 8, incorporated with findings related to sleep from the other two studies presented in this thesis.

The notable findings that pain and discomfort were the most common factors which disturbed sleep, as well as patients' lack of knowledge of drugs they received at night prompted the second study (Chapter 5).

CHAPTER 5

STUDY 2

A RETROSPECTIVE ANALYSIS OF ANALGESICS PROVIDED FOR SURGICAL PATIENTS

Several issues arose from the first study, and the one selected for more careful consideration was that of the relationship between pain, analgesic provision and sleep for the post-operative patient. This chapter describes a small retrospective exploratory study of analgesic provision for a sub-sample of the patients in the earlier study. This study was undertaken in order to discover whether analgesic provision varied according to time of day and if so, whether this was associated with sleep disturbance due to pain at night.

5.1 The second study

5.1.1 Aims

1. To determine whether analgesic provision was associated with sleep disturbance due to pain at night.
2. To discover whether analgesic provision varied according to time of day.

5.1.2 Method

This was a retrospective study of two sub-samples of the 200 patients on surgical wards who had been interviewed in the earlier study. In order to achieve this the patients' medication charts were used as the source of information. These were stored in their medical notes in the medical records department of a large teaching hospital (which stored notes for both hospitals involved in the first study), and were accessed after gaining the necessary permission.

The intention was to gather exploratory data in order to compare analgesic provision as recorded on medication charts for the two sub-samples. These were selected from the 129 of the original 200 who had undergone surgery. Selection was based on hospital number (the first six digits of which were date of birth), those with the lowest being selected first. Data were collected for 20 patients whose sleep had been disturbed by pain and 16 whose sleep had not been disturbed by pain. Sixteen was the maximum number of patients whose medication charts were available for the latter group, due to missing or unusable charts. The proforma used for recording these data is shown in Appendix 10. The assumption was made that those whose sleep was disturbed by pain had more severe pain than the other group.

Each of the two sub-samples had an age range of 50-65 years and comprised equal numbers of men and women. These patients were from eight different surgical wards in two different hospitals; the two groups had undergone comparable types of operation, ranging from hernia repair to abdomino-perineal resection, as well as ENT surgery.

Doses and times of administration of all analgesic drugs were taken from the records, for the day of surgery through to the fifth post-operative day. The numbers of doses of controlled and other painkilling drugs at various times of the day were analysed, as well as what proportion of the maximum available dosage had been received.

5.1.3 Results

The analysis was kept very simple due to the exploratory nature of the study and the small sample size. For the most part, the two groups of patients were compared, although later the groups were considered together in order to describe time-related patterns of analgesic provision. The group of patients whose sleep had been disturbed by pain was designated group A, while those whose sleep had not been disturbed by pain were designated group B.

The numbers of doses of controlled and other painkilling drugs given during the night and the number given during the day were counted for the 36 patients. Doses given over the day of operation and for five days afterwards were used. The days were divided into three 8-hour time blocks; 11pm - 7am (the night-time period most closely corresponding to the patients' normal sleep period at home), 7am - 3pm and 3pm - 11pm. Any dose given on the border between these times was counted as being in the later of the two periods. The mean number of doses given per patient during each 8-hour period over the post-operative period were as shown in Tables 27 and 28.

Table 27: The mean number of doses of opioid analgesics given per patient per 8-hour period during the first five post-operative days

	11pm-7am	**7am-3pm**	**3pm-11pm**
Group A (disturbed by pain)	0.95	2.15	1.95
Group B (not disturbed by pain)	0.88	2.0	1.94

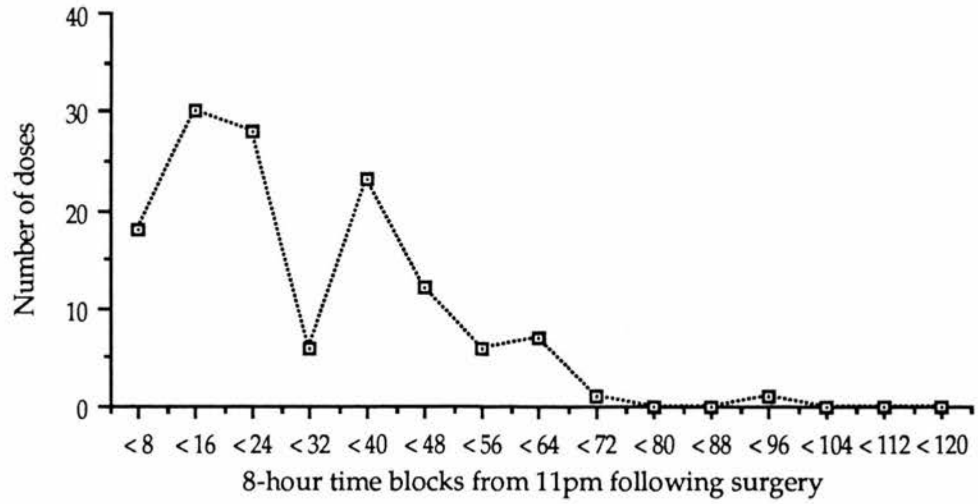
Table 28: The mean number of doses of non-opioid analgesics given per patient per 8-hour period during the first five post-operative days

	11pm-7am	**7am-3pm**	**3pm-11pm**
Group A (disturbed by pain)	1.15	2.1	2.45
Group B (not disturbed by pain)	0.75	2.4	2.25

It may be seen without using statistical comparisons that the time pattern of opioid drugs provision was almost the same for each group. The same was the case for non-opioid drugs, with slightly greater variation during the night-time period. Since temporal patterns of analgesic provision appeared to be similar for those who were and those who were not disturbed at night by pain, the data for the two groups of patients were combined.

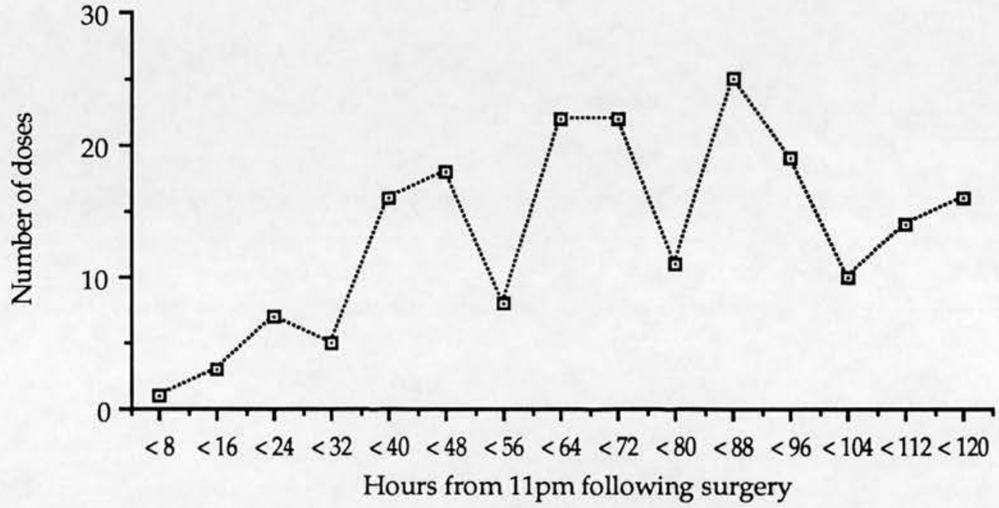
The pattern of provision of both opioid and non-opioid analgesics for all 36 patients over the first five days following surgery, therefore, may be seen in figures 7 and 8.

Figure 7: Frequency of administration of opioid analgesic drugs per 8 hours from 11pm following surgery



It may be seen that the night-time periods (points corresponding to <8, <32, <56, <80, and <104 hours) consistently coincide with the lowest numbers of doses of analgesics given. For the first three days the highest number of doses was given during morning periods.

Figure 8: Frequency of administration of non-opioid analgesic drugs per 8 hours from 11pm following surgery



A similar pattern may be seen, with fewest doses given at night.

A calculation was made of the proportion of prescribed opioid drugs which were actually given during the 48 hours immediately post-operatively. This was done by calculating the maximum possible dose each patient could theoretically receive between midnight following surgery and midnight 48 hours after that and expressing the amount given as a percentage of the maximum. For these 36 patients, a mean of 27 ± 0.1% (SEM) of the maximum permissible dose was administered over the specified time.

5.2 Conclusions

The two aims of the study were achieved. First, the pattern of provision was not associated with whether or not patients were disturbed by pain at night. Second, it was found that analgesic provision did vary according to the time of day with fewest doses of both opioids and non-opioids given at night. In addition it emerged that less than one-third of the maximum possible dose of opioids was received by patients during the first 48 hours following surgery.

Although the sample was small, time-related patterns of analgesic provision were evident. It was therefore decided to pursue this issue among a larger group of post-operative patients. The third study in the series, therefore, has taken the findings of the first two studies as a basis for exploring further the relationships between sleep, pain and analgesic provision for surgical patients at night.

CHAPTER 6

STUDY 3

A STUDY OF PATIENTS' NIGHT-TIME PAIN, ANALGESIC PROVISION AND SLEEP FOLLOWING SURGERY

Methods

The major issues which arose from the first two studies were the relationships between pain, analgesic provision and sleep for the post-operative patient. This section describes the aims of the third study, the selection of methods used, piloting and plan of investigation for the main study, and ethical considerations.

6.1 Aims

This study had seven aims:

1. To gather information from patients who had undergone abdominal surgery about their experiences of pain and pain control during the first three days following surgery.

2. To identify differences between day and night-time experiences of pain and pain control.

3. To ascertain whether this group of post-operative patients would consider using supplementary non-pharmacological methods of pain control, and if so, which particular methods they would favour.

4. To assess the extent of sleep disruption due to post-operative pain.

5. To explore patients' perceptions of the relationship between sleep and pain.

6. To examine patterns of analgesic provision over the first three post-operative days.

7. To examine possible relationships between nurse staffing levels and provision of analgesics.

6.2 Assessment of post-operative pain and sleep

The assessment of both pain and sleep has been attempted by many researchers, though the methods they have used have not always been suitable for general use by nurse researchers in clinical situations (see Oswald 1980, Chapman et al 1985, Closs 1988). Both pain and sleep are human experiences to which outsiders have no access. This fact alone means that validity of assessments of either of these phenomena is extremely difficult to establish.

6.2.1 Assessment of sleep

Methods of assessing sleep have already been discussed in Chapter 3, with the conclusion that subjective reports from the patients were the most appropriate assessments of sleep in hospital. Since the emphasis on sleep had been shifted towards its relationship with pain for this third study, fewer, more specific questions were included in the interviews. Leigh et al (1988) evaluated the St. Mary's Hospital Questionnaire using factor analysis. They found that for 222 hospitalized rheumatic patients the two most important aspects of subjectively perceived sleep were the process of going to sleep and the quality of sleep. Since the first survey of this research also showed that these aspects changed significantly in hospital it was decided that questions covering quality of sleep should be included in the interview schedule. Questions about duration of sleep, number of night-time awakenings, getting back to sleep and specific problems sleeping in hospital were included.

6.2.2 Assessment of pain

Until relatively recently, pain has been measured almost exclusively in terms of its sensory attributes, such as intensity, quality and location. Since the development of the gate control theory (Melzack and Wall

1965), more attention has been paid to the motivational and affective properties of pain. Melzack and Casey (1968) proposed that three main areas of the central nervous system were involved in the overall experience of pain. They suggested that the sensory-discriminative dimension of pain was determined primarily by the fast conducting nerve fibres of the spinal cord; the slowly conducting spinal fibres produced the powerful motivational drive and unpleasant affective characteristic of pain via the reticular and limbic structures of the brain; and the higher, cortical processes such as evaluation of pain in terms of past experience then exerted control over activity in both sensory and motivational systems. The gate theory proposes that pain is modulated by a 'gating' mechanism located in the spinal cord, within the substantia gelatinosa. Whether the pain gate is open, partially open or closed depends on both ascending and descending nervous impulses. If small diameter nerve fibres carrying pain impulses predominate, they will pass through the pain gate, activating trigger cells which send impulses to the brain. These small-diameter fibres may be overridden by afferent large-diameter fibres carrying non-pain impulses. Thus the pain gate may be closed by, for example massaging a painful area, thereby relieving pain. The trigger cells may also be inhibited by descending impulses coming from various areas of the brain, so, for example, the individual's emotional response to the pain may reduce or increase their perception of it. Thus individual experiences of pain appear to be subject to many and complex influences, making the task of assessment likewise complex and difficult.

Researchers have tended to consider acute and chronic pain separately, having different characteristics. Acute pain (including post-operative pain) has been described as "a transient, continually changing state that differs radically from normal daily life; it is linked to tissue pathology, and it is usually characterized by clear, well-focused sensory characteristics" (Chapman and Syrjala 1990, p580). Methods for assessing post-operative pain therefore differ from those used with chronic pain. Obviously then pain itself cannot be measured objectively and is very difficult to define. Margo McCaffrey (1972) offered a useful and widely quoted definition, "Pain is whatever the experiencing person says it is, existing whenever he says it does." Patients' reports of pain have probably been the most useful indices in the measurement of post-operative pain. There are some disadvantages of self-reports in that for many reasons, patients may report more or less pain than they actually experience. They may wish to appear brave, or not to create nuisance, and in hospital nurses may encourage this (McCaffery 1983). Conversely, asking patients about their pain may sensitize them to it, producing higher self-ratings of pain (Reading 1984). Many researchers, however, have agreed that pain is best defined by the individual who experiences it (Lasagna 1960; Scott and Huskisson 1976; Seers 1989). Although subjective reporting is likely to be the most appropriate method of finding out about patients' experiences of pain, both behavioural and physiological signs may be used in clinical assessment. These three approaches are discussed next.

6.2.2.1 Behavioural indicators of pain.

How patients behave can provide nurses with clues about the sort of pain they are suffering. It cannot, however, provide a direct measure of the pain itself. Craig and Prkachin (1983) described two groups of behaviour which might indicate painful distress. The first they referred to as "vocal behaviour", and it included language; eg complaint, appeals, descriptions and demands, as well as paralinguistic vocalisations; eg crying, screaming, moaning and sighing. The second group they called "non-vocal expression". This included distortion and grimacing of the face, guarded or unusual postures, and clutching or rubbing painful areas. These phenomena do not produce reliable information about pain, since they can also be influenced by patients' coping styles, as well as anxiety, depression and their social and cultural background. Importantly, the absence of pain behaviour does not rule out the presence of pain (Stewart 1977).

Observation of pain behaviour has been more successful with various kinds of chronic pain, but is limited by the fact that pain behaviours are highly specific to particular pain syndromes (Chapman and Syrjala 1990). Linton (1985) attempted to develop more global indicators of pain behaviour which could be applied to diverse clinical populations. He was unsuccessful, finding no relationship between activity levels and pain levels. Behavioural indicators appear to be useful for specific chronic pain states, but not as global indicators of pain.

6.2.2.2 *Physiological indicators of pain*

There are two main physiological approaches to the assessment of pain; respiratory function and autonomic indices. The most common index of respiratory function used is vital capacity; maximum inspiratory effort followed by maximum expiratory effort. This is "a measure of the person's overall ability to inspire and expire air" (Guyton 1984) which depends on the strength of the respiratory muscles and the elastic resistance of the chest cage and lungs to expansion and contraction. Lung function has been used as an indicator of post-operative pain relief (eg Dalrymple et al 1972; Knight and Mehta 1978), but results may be confounded by the fact that it also depends on how much energy patients are willing to expend (Huskisson 1974) and how fatigued they are (Felton et al 1981). In general it does not appear that vital capacity is a particularly valid measure of post-operative pain, since several other factors may influence this function.

Autonomic indices of pain include changes in pulse, blood pressure and respiration. Liberation of catecholamines may accelerate these functions. Changes in autonomic activity may lead to other more visible changes such as flushing, blanching, panting or vomiting (Craig and Prkachin 1983). The problem with using any such apparently objective indicators is that they may also be caused by other non-painful stimuli such as anger and fear (Stewart 1977). Some changes may depend on whether they are the result of sympathetic or parasympathetic stimulation. While in general pain produces sympathetic responses, increasing pulse, blood pressure and respiration rate, pain from the colon, rectum and bladder may produce a decrease in these functions (Bourbonnais 1981; Storlie 1978).

It is clear that no specific pattern of physiological responses to pain has been identified which could be used as a direct measure of the extent of that pain.

6.2.2.3 *Subjective reports of pain*

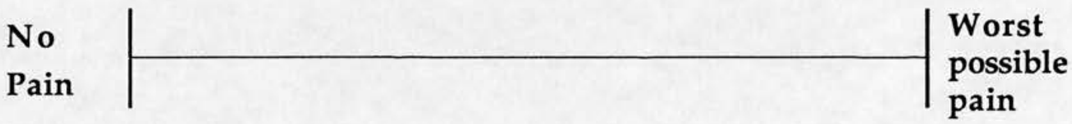
It seems that pain has many different aspects, but that "intensity is, without a doubt, the salient dimension of pain" (Melzack 1983, p2).

While a range of assessment instruments is available which focuses on various aspects of reported pain, for the proposed study it seemed important to select one which produced the desired information with least intrusion on the patients. Possibilities included the use of short instruments such as visual analogue scales, graphic rating scales and verbal descriptor scales.

a) Visual analogue scales (VAS)

A simple and effective way of assessing pain is the visual analogue scale (VAS). This is a line, usually 10 centimetres long with anchor words at each end to indicate extremes of the variable being measured. Most commonly, this has been used as a horizontal scale without any markings as shown in figure 9.

Figure 9: Visual analogue scale (VAS)



The patient is asked to place a mark across the 10cm line at a point corresponding with his/her own current pain. Revill et al (1976) compared 5, 10, 15 and 25 centimetre lines and concluded that the 5 centimetre line was less reliable than other lengths. Clark and Spear (1964) found that 10 centimetre scales were both sensitive and reliable. More recently, it has been used as a vertical scale, either with or without gradations. Dixon and Bird (1981) pointed out that the angle at which a vertical VAS is viewed may introduce errors not encountered with a horizontal scale. In addition, subjects have expressed preference for horizontal as compared with vertical scales (Sriwatanakul et al 1983).

The VAS may avoid the artificial categorization found in verbal descriptor scales (VDS), allowing patients to mark any point along the line, therefore providing a more sensitive assessment. The VAS has been shown to be more sensitive than the graphic rating scale (GRS) or 4-point VDS in the assessment of subjective phenomena (Joyce et al 1975). Revill et al (1976) found that subjects were able to reproduce pain scores on the VAS reliably over time.

It is vital that patients understand the two end points and that they may indicate any point they like on the scale if meaningful data are to be obtained (Chapman and Syrjala 1990). Although this kind of instrument is relatively simple, earlier research shows that 7-11% of patients have been unable to use them, some finding them confusing (Revill et al 1976; Kremer et al 1981). Elderly people seemed to have more difficulty than those who are younger. Researchers have successfully dealt with this difficulty by either providing detailed written information on how to use the scale or by careful teaching of subjects (Lorig 1984, Guyatt et al 1987).

There is considerable controversy about how data from VAS should be analyzed. Opinions differ as to whether VAS scores should be subjected to parametric or non-parametric tests. Huskisson (1982) proposed that the distribution of results from VAS was not normal, so that non-parametric statistics should be used. More recently, McGuire (1988) asserted that VAS produce interval level data, consequently the use of parametric statistics would be appropriate. Lee and Kieckhefer (1989) agree with this view, suggesting that VAS provide quantitative, interval-level data which are likely to be normally distributed. In their critical review of the use of VAS, Wewers and Lowe (1990) proposed that "in the absence of objective reality, there is no way for an investigator to do more than assume that VAS data are interval or ratio level". This lack of consensus about the type of data produced by VAS is not new, and was examined by Maxwell in 1978. He thought that if the method was understood by the subject, it was appropriate to assume that a VAS score represented at least ordinal measurement for that subject. He went on to test VAS scores and concluded that generally it made little difference whether parametric or non-parametric tests were used. He emphasised, however, that within-subject comparisons were more sensitive than between subject ones. Although it is not clear how best to handle VAS scores, it is probably safest to assume the lowest (ordinal) level of measurement. It is therefore probably (but not certainly) preferable to use non-parametric statistics to analyze data from VAS.

b) Graphic rating scales

If extra descriptive words are placed along the line of a VAS (eg mild, moderate, severe) it is known as a graphic rating scale (GRS). According to Scott and Huskisson (1976) scales without adjectives along their length were the most valid. Vertical scales with adjectives tended to have scores clustered around those adjectives rather than the entire length of the scale.

Chapman and Syrjala (1990) claim that for both patients and staff the "simplest and most frequently used approach to asessing pain states is a numerical rating scale (NRS)". This is a variation on the GRS. Patients may be asked to indicate the intensity of their pain on a scale from 1 (no pain at all) to 10 (the worst pain imaginable). The use of 20 divisions on such a scale has been supported by Hardy, et al (1952). They demonstrated that subjects could discriminate 21 distinct gradations between pain threshold and pain tolerance. A potential problem with this kind of scale, however, is that subjects may favour particular numbers. For example, Scott and Huskisson (1976) found that of 100 first time users of the NRS, 10 and 15 tended to be favoured.

c) Verbal descriptor scales (VDS)

Simple reporting of subjective pain may be achieved using categories of verbal descriptors. One of the earliest of such scales was devised by Keele (1948) and used the descriptors None, Slight, Moderate, Severe and Agonizing. Most VDS use words similar to these, and one which has been used widely in recent years is the Present Pain Inventory (PPI) which comprises part of the McGill Pain Questionnaire (MPQ) (Melzack 1975). The descriptors used are, Mild, Discomforting, Distressing, Horrible, and Excruciating. This kind of scale limits the number of possible responses, perhaps forcing choices in some cases. Moreover, patients tend to use the middle rather than the ends of the scale, further reducing the possible spread of responses. Kremer et al (1981) asked patients their preferences for using various scales. Of the PPI, VAS and NRS, most preferred the PPI, and it was the only one which all of them could complete.

Disadvantages of using verbal descriptors include semantic problems - the words used may hold different meaning for different people.

6.2.2.4 Selection of instruments

The discussion of pain assessment instruments has suggested that for post-operative patients a method of subjective reporting which places a minimal burden on patients should be used. It was decided, therefore, to concentrate on the sensory qualities of pain rather than the affective and evaluative components. Chapman and Syrjala (1990 p592) produced an algorithm for the selection of pain measurement instruments. This indicates that for brief, acute pain a rapidly administered self-report instrument such as VAS, NRS or VDS should be used, together with analgesic usage.

Two pain assessment instruments from the McGill Pain Questionnaire (MPQ) were selected (Melzack 1975). This questionnaire has been widely used and is considered to be valid and reliable when used appropriately. First, a horizontal, 10 centimetre visual analogue scale was used to assess pain at the time of interview. At the same time, the Present Pain Inventory (PPI) was used, partly because it is easier for patients to use and also as a check of the validity of the VAS. The PPI (Figure 10) is also part of the MPQ, and is a verbal descriptor scale, VDS.

Figure 10: Present Pain Inventory (PPI)

0	No pain	☐
1	Mild	☐
2	Discomforting	☐
3	Distressing	☐
4	Horrible	☐
5	Excruciating	☐

There have been several studies which have compared VDS and VAS. Correlation coefficients between 0.82 ($p=0.001$) and 0.87 ($p=0.001$) have been reported (Langley and Shepheard 1984; Woodforde and Merskey 1972). Reading (1980) found a correlation of r=0.57 - 0.71 between a VAS and PPI, somewhat lower than other researchers, but still significant. Downie et al (1978) examined the validity of the VAS and VDS. They found that the two correlated well with each other and concluded that the scales probably measured the same variable, ie pain intensity.

The VAS was also used later in the second study interview in order to find out how bad patients' pain would have to be before they got a nurse. They were asked to score how bad it would have to be during the day, and then how bad it would have to be during the night, in order to identify day-night differences in their attitudes towards complaining of pain. This is a slightly unorthodox way of using the VAS, since the questioning was hypothetical rather than asking patients for scores of actual pain. Patients were able to see both VAS at the same time when completing this part of the interview, since comparisons with previous scores have been considered to be important in gaining accurate sequential measures. Scott and Huskisson (1979) found that patients overestimated present pain severity when previous scores were not available.

The PPI was developed in Canada, so the slight language differences between Scotland and North America were considered potentially problematic.

Several sorts of nursing documentation were consulted in addition to recording the responses of the patients themselves. The nursing notes provided patients' demographic data, the patients' medication charts gave details of analgesic provision and the off-duty rota gave ward nurse staffing levels. All this information was gathered onto one proforma, including all of the above information for each patient.

For the purposes of this descriptive study then, the patients' own reports of their pain and sleep were used as the basis of assessment. In order to gain information about day-night differences in the experience of pain the ideal would have been to assess pain and pain relief during day and night throughout the three-day post-operative period. The practicalities of this made it impossible, since one researcher could not be present to make continuous assessments over 64 hours. It was decided that a single semistructured interview would be a realistic way of obtaining information about patients' experiences of post-operative pain and sleep. The interview schedule (see Appendix 11) included general questions about pain before and after surgery, differences between day and night-time pain, attitudes towards asking for pain relief, how patients coped with their pain, how they felt about using alternative methods of coping with pain, how they had slept and their views on the relationship between pain and sleep.

6.3 Pretesting and piloting

A pilot study of ten interviews was carried out on one ward. Following this some amendments were made to the interview schedule. Several questions were reworded to prevent ambiguity, and two questions which overlapped with others were discarded in order to prevent repetition, which obviously can be tiresome for patients. One of the verbal descriptors in the PPI was amended after the pilot study. The word 'discomforting' was replaced by 'uncomfortable', which was considered to be a more culturally appropriate alternative.

In effect, the analgesic provision data sheet (see Appendix 10) had already been pre-tested in the second study, so this was not repeated in the pilot for the third. A form for recording staffing levels (see Appendix 12) was piloted and no difficulties were encountered. More space was included on the interview section of the proforma for patients' discursive and explanatory comments.

6.4 Plan of investigation

Each patient was interviewed once only on the third post-operative day by agreement with ward sisters. This day was chosen for several reasons. It was felt that patients would generally be well enough to cope with the demand of participating in an interview, while still being able to remember their experiences of pain and sleep from the preceding two days. In addition, most patients tended to be weaned off controlled drugs and commenced on milder oral analgesics on about the third post-operative day. By interviewing them at this point it was intended that their experiences while having opioid drugs could be explored.

All interviews were conducted at approximately the same time of day, between 1600-1800 for two reasons. First, it was to standardise for any circadian fluctuations in pain. Second it was convenient for both patients and ward staff since visiting ended at 1600 and the wards were relatively quiet until supper was served around 1800.

6.4.1 Data collection

Four Nightingale wards were included in the main study, two male and two female surgical wards. In order to select patients as randomly as possible a rigid timetable for recruiting them was devised. Wards were visited daily. On the first day ward A was visited first, then ward B then C and finally ward D. On the second day ward B was visited first, followed by C, then D and finally A. This rotation continued on subsequent days. While on some days there were no suitable patients on any of the four wards, on others it was not possible to get round all of the wards in the available time. When this occurred, as many patients as possible were interviewed in order of rotation.

6.4.2 Composition of the sample

The sample consisted of 100 patients, 37 male and 63 female. Their ages ranged from 18 to 83 years, with a mean of 55.4 ± 1.8 (SEM) years. There was no significant difference in age distribution between males and females. Thirty of the patients lived alone. Sixty of the 100 patients had undergone surgery at some time in the past, while the remaining 40 had not. It was found at the time of interview that 55 patients had undergone upper abdominal surgery and 45 lower abdominal surgery (see Appendix 13). The numbers obtained from the four wards were 25 from ward A, 31 from ward B, 32 from ward C and 12 from ward D.

6.4.3 Ethical considerations

There were no ethical difficulties presented by this study. Approval was gained from the appropriate ethics committee and permission was given by all relevant medical and nursing staff to approach patients under their care. Verbal consent was obtained from each subject who participated in the study and all were informed of their rights to withhold particular information and to withdraw from the interview at any time. Three patients declined to participate in an interview. Anonymity of individual respondents was maintained, with interview schedules being numbered rather than named.

6.4.4 Coding and analysis of interview schedules

The completed interview schedules were coded numerically in order that data could be analysed using the SPSSX (Statistical Package for the Social Sciences, Version X) computer program. The accuracy of this coding was checked by an independent researcher who assessed a random sample of ten interview schedules (ie 10%). Three errors were found out of a possible 3,720, indicating an error rate of 0.08%. This was considered acceptable. Results are presented in Chapter 7.

CHAPTER 7

STUDY 3

A STUDY OF PATIENTS' NIGHT-TIME PAIN, ANALGESIC PROVISION AND SLEEP FOLLOWING SURGERY

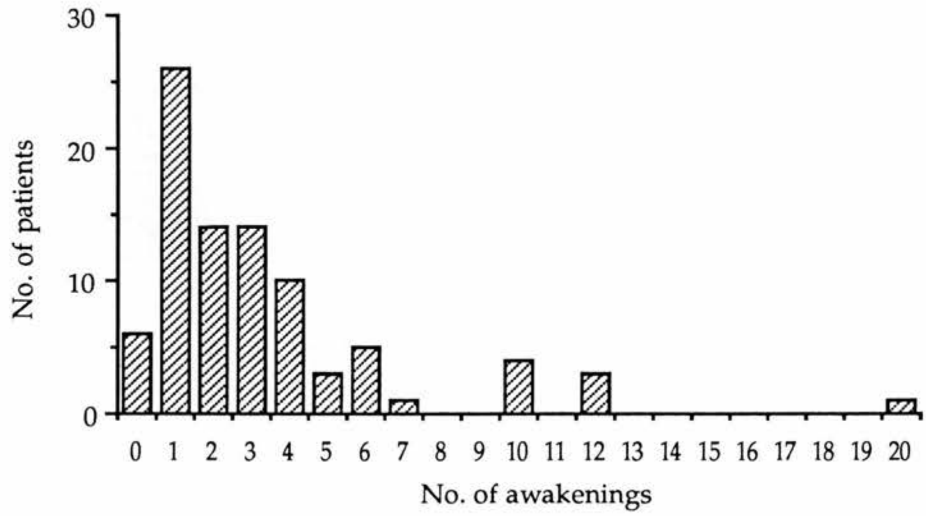
Results

This chapter opens with the findings concerning patients' sleep following abdominal surgery. Next are patients' descriptions of their pain, accounts of their most recent dose of analgesic, attitudes towards asking for pain relief, coping with post-operative pain and the relationship between pain and sleep. Finally, patterns of analgesic provision and staffing levels are described.

7.1 Patients' sleep in hospital

Patients were asked several questions about their sleep. First they were asked about their usual sleep at home, to be used as a baseline with which to compare their reports of sleep in hospital. When asked how well they usually slept, 71 claimed they slept well, 21 slept poorly and eight were intermediate. The mean duration of night-time sleep at home was 6.8 ± 0.2 (SEM) hours. This was reduced to 5.8 ± 0.9 hours for the night in hospital prior to interview. Patients reported how often they had woken up during that previous night (Figure 11).

Figure 11: No. of awakenings on the third post-operative night (n=100)



The number of night-time disturbances varied considerably between patients. Over a quarter of the sample, however, had woken up four or more times during the previous night. Patients were asked what had woken them up, with the following results (Table 29):

Table 29: Causes of night-time awakening

Cause	No. of patients
Pain	41
Noise	27
Needed toilet	12
No reason/don't know	12
Discomfort	4
Too hot	4
Anxious	3
For nursing care	3
Strange place	2
Plastic bedding	2
Nausea	1
Sore throat	1
Light	1
Hallucinations	1
Not tired	1
Total	**115**

As expected from the first study, pain and noise were the most common causes of sleep disturbance, pain clearly being the most frequent.

Those who had woken up during the previous night were asked whether anything or anyone had helped them to get back to sleep. Forty-one said yes, 33 said no, 16 said they had not needed help and the question was not applicable to ten patients. They were then asked to specify what had helped (Table 30). Interestingly, more than 41 offered comments as well:

Table 30: What helped patients get back to sleep

What helped	No. of patients
Analgesics	26
Made comfortable in bed	7
Used toilet	6
Radio/read/counted sheep	4
Hot/cold drink	3
Took hypnotic	1
Talked to nurse	1
Total	**48**

Again, as expected, the provision of analgesics helped more patients than any other action.

The next question in this section of the interview asked patients what their worst problem with sleeping in hospital had been (Table 31):

Table 31: Worst problems sleeping in hospital

Problem	No. of patients
Noise	25
Pain	23
No problem	10
Strange place/routine	10
Uncomfortable beds	9
Uncomfortable position in bed	5
Constant disturbances	4
Too hot	3
Discomfort	2
Drips and drains	2
Worry	2
No light to read by	1
No drinks available	1
Sore throat	1
Unable to relax	1
Don't know	1
Total	**100**

Many reasons were cited, mostly to do with the ward environment or personal discomfort. As expected from the first study, noise and pain were the two factors considered worst in terms of interfering with patients' sleep. Although earlier (see Table 29) patients had cited pain as being a more frequent cause of night-time wakening than noise, they considered it here almost equally with noise as the worst difficulty with sleeping. It is possible to speculate that this discrepancy was due to their expectations regarding pain and noise, perhaps more readily accepting pain as unavoidable.

Patients were then asked whether pain had interfered with their sleep in any way. Seventy-three said yes, 25 said no, and two had not had any pain. This was followed up by asking an open question about how pain had affected their sleep (Table 32). Some patients mentioned more than one way in which their sleep had been affected:

Table 32: How pain affected patients' sleep

Effects	**No. of patients**
Waking up during the night	44
Difficulty getting to sleep	26
Pain on moving	18
Could not lie in a comfortable position	13
Only got light sleep	6
Afraid of pain due to pulling drips/drains	5
Getting back to sleep	4
Total	**116**

It may be seen that waking up during the night and difficulty in getting to sleep were the two most frequently cited ways in which pain influenced sleep. These factors may have been associated with pain on moving and inability to lie in a comfortable position, factors also mentioned frequently.

7.2 Patients' descriptions of pain

7.2.1 Pre-operative pain

Of the 100 patients, 74 had experienced some kind of pain or discomfort before being admitted to hospital, while 26 had not. Twenty-five had had intermittent episodes of acute pain, such as that caused by cholelithiasis for several months prior to admission. Twenty-two had acute pain on admission (eg appendicitis), and 21 had suffered chronic pain for long periods of time before being admitted for surgery. Five said they had been in discomfort (rather than in pain) pre-operatively, and one patient was a drug addict who had suffered pain due to drug withdrawal.

7.2.2 Post-operative pain

Ninety-eight of the 100 patients experienced post-operative pain. When they were asked to say a little bit more about it, several common ways of describing their pain emerged from their responses (Table 33). The majority of patients gave general descriptions of the nature of their pain (n=59). Seventy-one patients commented on what made their pain worse; some factors were outwith their control (n=35 section ii, Table 33). Others (n=36 section iii, Table 33) depended on the patients own actions ie moving, coughing and deep breathing. Patients' had more control over this latter group and could reduce their pain by keeping still, avoiding coughing and so on. A small number (n=4) commented on their own assumptions about their pain (probably having realised that they were false). Surprisingly few commented on the actual site of their pain (n=3), presumably because they expected to have pain at the site of operation, but not elsewhere as was the case for these three.

Table 33: Patients' descriptions of post-operative pain

Description	**n of patients**
i) General descriptions of pain	
Discomfort	18
Moderate pain	20
Severe pain	15
Constant pain	6
	59
ii) Factors worsening pain	
OK until continuous analgesics stopped	11
Pain due to hiccups/burps	2
Pain due to wind	9
Pain from stitches/clips/drips/drains	9
Unable to find a comfortable position	4
	35
iii) Actions worsening pain	
Hurts to move	26
Hurts to cough/deep breathe	10
	36
iv) Assumptions about pain	
Assumed pain was inevitable	2
Assumed max pain relief being given	2
	4
v) Site of pain	
Referred pain	2
Whole body hurts	1
	3
Total	**137**

While 98 patients were prescribed intermittent doses of intramuscular analgesics, some patients received interpleural (n=5), epidural (n=6) or intravenously administered analgesics (n=29). Experience of pain seemed vary according to the mode of delivery. First, some comments from patients who had intermittent analgesics only:

> "It was very sore for the first two days, I couldn't move without painkillers." (No. 20)

> "It's a dull nagging pain - even with the painkillers you don't seem to be free of it - it seems to be there all the time." (No. 68)

> "It hurts mostly trying to move. If you settle in one position it's all right." (No. 66)

> "It was OK just after the operation, then it got worse and worse and was really sore this morning." (No. 46)

> "The pain's been worse mainly at night. The painkillers you get during the day are pretty effective. It hurts when you try to turn over and get comfortable. It feels like tearing and ripping through you when you're moving." (No. 98)

> "I was under the impression that I was expected to be in severe pain post-operatively. I assumed I was getting the maximum pain relief I could" (No. 13)

The next three comments indicate a considerable increase in pain once epidural or intravenous analgesics had been stopped and they were receiving intermittent doses of analgesics only.

> "There was nothing at all until the epidural catheter was removed - then it was very sore overnight." (No. 28)

> "It's not too bad unless you move, then it's really awful. It was OK till the tube [epidural] came out." (No. 73)

> "It was very sore once they stopped the morphine drip - I didn't realise till then. But they give me jags when I need them." (No.44)

Patients were asked to describe where their pain was, and were asked whether they had any pain other than in their wound (Table 34). The sites mentioned by patients were:

Table 34: Sites of pain as described by patients

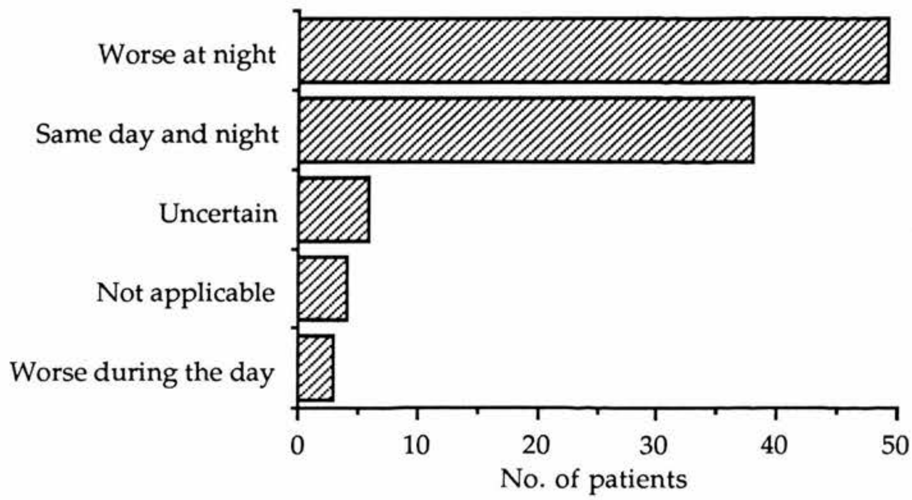
Site of pain	**No. of patients**
Site of operation	
Wound/scar	53
	53
Other	
Backache	21
Internal	12
Entire abdomen	9
Wind pain	9
Stitches/clips	7
Sore sacrum	5
Sore neck/knee/shoulder	4
Headache	3
Bruised ribs/sternum	2
Sore throat	1
Painful lungs	1
Sacral abcess	1
	75
Total	**128**

It can be seen that wound pain accounted for less than half of the sites mentioned. One-fifth of the sample were suffering from backache at the time of interview. A wide variety of other painful sites were also cited.

7.3 Post-operative pain: night versus day

A major aim of this study was to investigate differences between day and night-time experiences of post-operative pain. Patients were asked whether their pain was any different at night compared with during the day (Figure 12).

Figure 12: Day-night differences in patients' experiences of post-operative pain (n=100)



For the most part patients found either that pain was worse at night, or there was no difference between the day and the night. The four patients to whom the question was not applicable reported that they had experienced no pain during the night and therefore could not make a comparison.

Patients were then asked to comment further. Some patients had nothing to add while others made more than one point. Their responses were categorised as shown in Table 35.

Table 35: Patients' comments on differences between day-time and night-time experiences of their post-operative pain

Comments	No. of patients
Pain worse at night:	
Pain seems worse at night	31
Pain is worse at night	15
Pain worse when tired	10
Uncomfortable in bed	5
Pain worse when lying down	5
Hurts to move in bed	4
Pain worse at end of the day	3
More wind pain at night	2
Cough more at night	2
Pain causes nightmares	1
Less attention from nurses at night	1
Don't like to bother nurses at night	1
More feverish at night, so more pain	1
	81
Pain worse during the day:	
Easier to get painkillers at night	2
Pain less at night	1
More aware of pain during the day	1
	4

Fifteen patients felt that pain actually **was** worse during the night, while a further 31 felt that pain **seemed** worse, but that this was psychological. Some of the explanatory comments made by patients gave clearer ideas about pain experienced at night:

> "The pain is magnified at night because you don't sleep well. There's nothing to take your mind off it." (Pt. 11)

> "All pain gets worse at night. It's partly psychological because there are no doctors about. Wednesday night [the first post-operative night] was terrible, Thursday was bad and Friday was very uncomfortable. It seems to flare up during the night, and ease off around 9am, even though you don't have a painkiller." (Pt. 12)

> "You're tired at the end of the day so the pain gets worse. Then it seems worse as well if you can't sleep, but that's probably just in the mind." (Pt. 73)

> "It's more intense in the middle of the night, basically because you're tired and feel on your own." (Pt. 39)

> "It's terrible at night - it gives you nightmares if you can sleep at all. There's nothing to think about except the pain." (Pt. 47)

> "You're more aware of it at night, there's nothing to focus your mind on. Things go on during the day to take your mind off it." (Pt. 49)

Another of the questions used to elicit information about day-night differences was "Would you be more likely to tell the nurses about your pain during the night or during the day?". Fifty patients said they would be equally likely to tell nurses during the day or night. Of the remaining half of the sample, 33 said they would be more likely to tell nurses about their pain during the night and 17 said during the day. The 50 who had stated a preference were asked what their reasons were. Of those who were more likely to tell nurses about their pain at night, the most common reason was that they felt worse at night, both generally, and regarding their pain (n=15). Comments included:

> "You feel worse about everything at night." (Pt. 19)

> "You've more need for sympathy at night - you feel worse." (Pt. 98)

> "The pain feels twice as bad during the night - you can't get up and walk around at night." (Pt. 49)

> "The pain irritates more at night, **it** doesn't feel worse, **you** feel worse about it." (Pt. 32)

> "The pain does seem worse at night. There's nothing worse than having pain and watching the clock go round. You close your eyes at 4.20 and open them at 4.25 - it's terrible." (Pt. 79)

The second reason for being more likely to tell nurses about pain at night was that they felt they needed to sleep throughout the night (n=13). Patients said:

> "You expect to sleep so that you can stand up to the rigours of the next day." (Pt. 46)

> "I would need it [pain relief] more - I get bad tempered when I dinnae get my sleep." (Pt. 68)

> "The pain is more dominating at night and you need your sleep." (Pt. 73)

> "The pain feels worse at night because there's nothing to distract you. Also, you can cope with the pain if you've slept enough." (Pt. 75)

The third most common reason was that patients thought that nurses had more time at night (n=4).

Reasons given for being more likely to tell nurses about their pain during the day included there being more nurses on duty during the day (n=7), or nurses having less time at night (n=2). One felt that it was easier to be discreet during the day:

> "You can let them [the nurses] know without letting the whole ward know." (Pt. 81)

Two of the patients who had no preference said that they did not want to bother the nurses, and two felt that there were plenty of patients worse off than themselves.

7.4 Patients' descriptions of their most recent dose of analgesic

Patients were asked four questions in order to find out when they had last received an analgesic and how effective it had been. All patients were interviewed at approximately the same time of day, between 1600 hours and 1800 hours, and the majority of them had received analgesics sometime that day (Table 36).

Table 36: Patients' reports of when they last received analgesics

Time	No. of patients
Within the last hour	10
Since lunch	28
Since breakfast	24
Last night	14
Yesterday	5
Before yesterday	8
Did not know	7
Had none	4
Total	**100**

A Spearman's rank correlation was used to identify any relationship between their pain at the time of interview (as scored on the visual analogue scale) and the time since analgesics were last received. A significant negative correlation was found, rho=-0.25, p=<0.02, n=83. This suggested that the lower the pain score, the greater the length of time since analgesics were given. The opposite might have been expected, with least pain experienced by those who had received analgesics most recently, since they would be likely to have high blood levels of analgesics. This rather unexpected finding is difficult to explain. It may have been simply that those in least pain needed analgesics least frequently.

Patients were then asked whether they had been offered that particular dose of analgesic or whether they had requested it (Table 37).

Table 37: How patients obtained their analgesics

	No. of patients
Offered	47
Requested	38
Neither	2
N/A	13
Total	**100**

It can be seen that a high proportion of patients (38%) requested painkillers. The 13 in the N/A category either had not suffered severe enough pain to ask or accept an offer, or they could not remember. Next, those patients who remembered their last dose of analgesic were asked whether or not it had relieved the pain (Table 38).

Table 38: Extent of relief from last analgesic

Relief	**No. of patients**
Complete	35
Partial	49
None	1
N/A	15
Total	**100**

About one third obtained total relief, while half obtained partial relief. Only one person reported that they got no pain relief at all.

Several patients then commented further on the extent of pain relief (Table 39).

Table 39: Patients' comments on their pain relief

Comments	No. of patients
Took the 'edge' off the pain	12
Allowed movement	12
Allowed sleep	11
Pain free while immobile	9
Total relief for a short time	7
In constant pain	5
Painkiller relaxing	4
No comment	40
Total	**100**

It is evident from these comments that the degree of pain relief varied markedly between patients. Forty did not comment, five remained in constant pain, 51 obtained varying levels of pain relief. The remaining four commented that the analgesic had made them more relaxed, they felt better but did not think the pain had changed. The comments reproduced below show a variety of responses, beginning with descriptions of more effective pain relief and ranging through to poor relief.

> "It made it very comfortable; numbed it so I could move. You can still feel it though." (Pt. 6)

> "It eased it a little bit - it takes the edge off it. Makes it duller rather than sharper." (Pt. 88)

> "Enough to let me breathe easily." (Pt. 38)

> "It can't take it away completely, but it lets you relax a bit." (Pt. 81)

> "Eased it enough to get into a comfortable position. Then I didnae like to move." (Pt. 15)

> "It makes it bearable but I still can't move on my own." (Pt. 87)

> "Just took the edge off it - it didn't quite help me to move." (Pt. 82)

> "It sort of makes you less worried about the pain even though it's still a bit sore." (Pt. 99)

> "Not much help - It's very very painful when I need the bedpan." (Pt. 84)

> "It didn't make any difference. The injections helped - the tablets didn't." (Pt. 89)

7.5 Patients' attitudes towards asking for pain relief

Patients were asked whether they had any difficulty in asking nurses for a painkiller. Nineteen said yes, 74 said no and one did not know. The question was not applicable to six patients who had not needed to ask for painkillers. Some patients simply did not want to make a fuss, though several acknowledged that the nurses would not mind them asking:

> "You dinnae want to bother them. They're rushed off their feet. You expect to feel like this, you're feared to bother them, even though they tell you to." (Pt. 87)

> "I wouldn't ask at night. You don't like to annoy them. Even though you can ask, you don't like to." (Pt. 70)

> "I didn't ask because I thought I couldn't have any more analgesia. The nurses were horrified when they realised." (Pt. 13)

> "Just last night - I hadn't realised it would hurt so much and I didn't like to make a fuss. I'd been all right until the morphine drip stopped." (Pt. 44)

Other patients had felt that nurses would not give them anything for pain:

> "It's more difficult to ask during the night. They don't pay any attention to you. I asked for something at six this morning and never got it." (Pt. 3)

> "I don't like to ask when they're short-staffed. Also, they think you should do without for more than two hours." (Pt. 32)

> "Sometimes it's difficult because you wonder if they [the nurses] think you're asking for too much." (Pt. 34)

> "Yesterday afternoon - there was only one staff nurse on and she's quite crabbit. I feel too old to ask for things, feel silly." (Pt. 62)

A few patients gave reasons related to their own attitudes towards pain relief:

> "I like to do without them [painkillers] - I hate taking pills. The pain has to be very bad first." (Pt. 65)

> "You're prepared to put up with more pain in hospital because you feel safer." (Pt. 46)

> "I didn't expect to require as much pain relief as I did, even though I was told I could have it whenever I needed it. I didn't think it would be so bad for so long. I wish it was made clearer what the pain would be like before the operation - no-one said I couldn't have anything for pain, but I just didn't know how much morphine I'd need." (Pt. 25)

> "This morning - I felt I shouldn't ask for more. It's like being greedy, I'd already had some that didn't work." (Pt. 75)

> "I don't ask unless I really think I need it." (Pt. 41)

The 19 patients who had reported that they had been unwilling to ask for analgesics gave a variety of reasons why that was the case (Table 40).

Table 40: Reasons why patients were unwilling to ask for analgesics (n=19)

Reason	No. of patients
Nurses too busy	8
Felt unable to ask	5
Preferred not to take analgesics	3
Difficult to get nurses' attention	2
Did not realise they could ask	1
Total	**19**

When asked if they had ever been in pain, but not told the nurses, 39 said yes, 53 said no, three were not sure and the remaining four had not had pain sufficient to request analgesics. The 39 who had not told nurses about their pain gave several reasons why; 12 did not want to be a nuisance, eight accepted that they should have pain, seven did not realise that they could tell the nurses, five preferred not to take painkillers and four said they had been put off by nurses.

Several of the 39 patients who had not reported their pain pointed out that the nurses had encouraged them to do so.

> "You don't want to be a nuisance. The sister gave me a row and said I must tell them." (Pt. 17)

> "I felt a nuisance - the nurses didn't make you feel that though." (Pt. 49)

> "I was frightened to ask, the nurses have got enough to do. But they did tell me I must ask." (Pt. 67)

> "At the beginning I didn't like to ask. Then one of the nurses explained it was better for me to have it so I could move." (Pt. 76)

> "You don't like to bother them, even though they don't mind." (Pt. 42)

Others were less positive about nursing staff:

> "I asked twice and my brother asked once, but I didn't get anything for eight hours. I was afraid to keep on asking." (Pt. 68)

> "I felt so exhausted I thought I would drop off, and they were so busy. Other times I wasn't keen on the nurse; some fob you off." (Pt. 29)

> "Once I didn't say because earlier the nurse had asked if I really needed a painkiller." (Pt. 34)

Some patients did not know if/when they could ask for painkillers:

> "On the first day I was shy to ask, I thought I was expected to have pain. Last time I was in hospital I got nothing for pain." (Pt. 7)

> "It was a misunderstanding. I didn't know I could have more painkillers." (Pt. 13)

> "Well, I didn't think I should have had as much pain, so I didn't like to ask for anything." (Pt. 44)

> "You take it for granted that you'll have pain and they'll come round with painkillers at a certain time." (Pt. 16)

Others preferred not to take analgesics:

> "I prefer to be in control - you're in a permanent sleep otherwise." (Pt. 41)

> "I'm feared of taking painkillers all the time - I wait until the pain's quite bad before asking." (Pt. 79)

When asked whether they preferred the nurses to ask them if they were in pain, rather than them telling the nurses first, the sample was roughly equally divided. Forty-seven said yes and forty-one said no. Various reasons (Table 41) were given for preferring not to tell nurses if they were in pain.

Table 41: Reasons why patients preferred not to tell nurses if they were in pain

Reasons	No. of patients
Did not want to be a nuisance	13
Nurses were busy	13
Would only ask if pain was severe	10
Too shy to ask	4
'Macho' attitude	4
The nurses know best	4
Total	**48**

7.6 Factors affecting pain scores on visual analogue scales

7.6.1 Pain scores for the whole sample

Patients were asked to use a visual analogue scale (VAS) to score pain intensity three times during the interview. The first question involving the scale was "Do you have any pain just now? If so, could you describe how it feels using these scales?". The VAS was accompanied by the Present Pain Inventory from the McGill Pain Questionnaire (Figure 13):

Figure 13: Pain assessment scales used in third study

VAS:

PPI:	0	No pain	☐
	1	Mild	☐
	2	Uncomfortable	☐
	3	Distressing	☐
	4	Horrible	☐
	5	Excruciating	☐

Primarily this was regarded as a 'warm-up', allowing patients to try out using the VAS. It also provided some useful information about pain status of patients at the time of interview. The PPI was used in conjunction with the VAS in order to check its validity. Verbal descriptors of pain at the time of interview were as shown in Table 42:

Table 42: Numbers of patients who selected each PPI descriptor

Descriptor	**n**
No pain	24
Mild	14
Uncomfortable	46
Distressing	12
Horrible	2
Excruciating	2
Total	**100**

In order to check the validity of the VAS, a Spearman's rank correlation between the VAS and PPI was calculated. In order to do this, the VAS values were recoded into five categories; 1-19mm, 20-39mm 40-59mm 60-79mm and 80-100mm. A highly significant correlation between the two scales was found, rho=0.72, n=93, p<0.0001. This suggested that both scales measured the same phenomenon, ie pain intensity.

The remaining two questions for which the pain VAS was used were hypothetical, aiming to find out how patients felt about asking for help during the day and the night:

> "During the daytime, how bad would your pain have to be before you got a nurse?"

and:

> "During the night, how bad would your pain have to be before you got a nurse?"

Patients were asked to place a vertical line through the 10 centimetre wide VAS at the point corresponding to their response. Six of the patients were unable to use the scale, not understanding what was required of them. A further two felt unable to complete the scales for the day and night estimates of pain, because they reported having no post-operative pain whatsoever. Scores were then coded as the number of millimetres along the line at which the mark was made. Mean values for pain scores on visual analogue scales were calculated (Table 43):

Table 43: Mean scores from VAS in millimetres

	Score ± SEM	
Current pain score	22.6 ± 1.9	(n=94)
Night pain score	50.4 ± 2.9	(n=92)
Day pain score	59.3 ± 2.3	(n=92)

While mean scores provide a useful description of the data, there is some controversy about whether VAS should be analysed using parametric or non-parametric statistics, as discussed in Chapter 6. Comparisons between groups, therefore, were undertaken using non-parametric tests. Wilcoxon signed-rank tests were used to assess whether there were any significant differences between day and night in terms of how bad pain would have to be before getting a nurse. The differences were highly significant (z=-3.37, p=0.0007).

How these differences were scored varied, with patients falling into two main groups. Some patients had scored higher for the night than the day, while others had done the opposite. For 49 patients the pain intensity at which patients would ask for help would be less at night than during the day. For 38 patients the pain would have to have been worse at night than during the day before they would tell a nurse. For five patients the score was the same for day and night.

There was an inconsistency apparent here, since of the 49 who said earlier in the interview that pain was worse at night, 29 scored higher on the VAS for night-time, while 19 scored lower (one scored the same) on this later question. The association between the responses to these two questions was examined by crosstabulating the numbers of patients who scored either the same, higher or lower for pain at night on the visual analogue scale with whether they said that pain was the same, better or worse at night. No significant association was seen ($chi^2=8.43$, NS). This suggests either that the severity of pain was not associated with telling nurses about it, or that retrospective use of the VAS to assess pain was inappropriate.

The question of whether the two groups of patients (those who scored pain higher for day and those who scored higher for night) differed from one another was explored further. Various attributes were cross-tabulated with the two groups. These included age (below 60 or 60 and over), gender, whether or not they lived alone, whether they had undergone surgery before, whether their current operation was to the upper or the lower abdomen and whether they had had any pre-operative pain. No significant associations were found for any of these variables, thereby supporting the hypothesis that the two groups were similar. These results suggest that the two groups of patients may have differed simply in the way they described the same phenomenon. It seems likely that some patients would perceive their pain as worse at a lower level at night than during the day, therefore scoring lower on the VAS. Others scored their pain higher on the night VAS because they felt that pain seemed worse at night.

7.6.2 Pain scores according to gender

For the whole sample, Mann-Whitney U tests were used to detect possible differences in pain ratings, according to gender (Table 44):

Table 44: Differences in pain ratings according to gender (Mann-Whitney U tests)

	z	p
Current pain	-0.44	0.66
Night pain score	-0.66	0.51
Day pain score	-1.29	0.20

Although the women tended in each case to score their pain slightly higher than men, the difference was not statistically significant.

7.6.3 Differences in pain scores according to age

Ages ranged from 18 to 83 years, with a median of 59. For the purposes of analysis therefore, the sample was divided into two groups; 18-59 (n=48) and over 60 years (n=46). Results are shown in Table 45.

Table 45: Differences in pain scores according to age (Mann-Whitney U tests)

	z	p
Current pain	-1.18	0.24
Night pain score	-1.55	0.12
Day pain score	-0.79	0.43

No significances were found between the two groups for any of the pain scores.

7.6.4 Differences in pain scores according to type of surgery

All patients in the sample had undergone abdominal surgery (see appendix 13). Comparisons in pain scores were made between those who had had upper (n=50) and those who had had lower abdominal surgery (n=42). No significant differences were seen (Table 46).

Table 46: Differences in pain scores according to type of surgery (Mann-Whitney U tests)

	z	p
Current pain	-0.78	0.43
Night pain score	-1.48	0.14
Day pain score	-1.35	0.18

7.6.5 Differences in pain scores according to type of analgesia

The 40 patients who had received intravenous, epidural or interpleural post-operative analgesics were compared with 58 who had received only intramuscular analgesics. The two who had not required any analgesics were omitted from this analysis. Again no significant differences were observed (Table 47).

Table 47: Differences in pain scores according to type of analgesia (Mann-Whitney U tests)

	z	p
Current pain	-1.68	0.09
Night pain score	-0.91	0.36
Day pain score	-1.62	0.11

It is likely that more sensitive monitoring of post-operative pain and pain relief would be necessary in order to examine variations in experience according to gender, age, type of surgery and type of analgesic provision.

7.6.6 Measurement instruments

The results showed that the correlation between the scores of the Present Pain Inventory and the pain Visual Analogue Scale was highly significant, r=0.72, similar to that found by Taenzer (1983), r=0.65. This indicated a high convergent validity between the two pain measurement scales and therefore good construct validity. This in turn showed that the amendment of 'discomforting' in the original PPI to 'uncomfortable' in the version used for this study was appropriate. Since in this situation the PPI and the VAS produced the same result, it might be appropriate to use just one of these scales in future studies of a similar nature, since the less the burden placed on patients, the better. Further testing of the convergent validity of these two scales for specific types of pain would be useful. Since conceptually the VAS is the more difficult of the two for use by patients, the PPI could be a suitable alternative for situations where it is important to keep the effort required by the patient to a minimum.

The use of the VAS with hypothetical questions is not recommended. In this study the results produced were not clear and it is suggested that the use of the pain VAS is kept as simple and straightforward as possible.

7.7 Coping with post-operative pain

Patients were asked whether they had used any alternative (ie non-pharmacological) ways of coping with their pain, whether they would consider using specific alternative methods of pain control in addition to conventional treatment with analgesics, and whether they felt it would be helpful if nurses could suggest alternative methods of pain control.

The first of these three questions produced a wide range of responses, as shown in Table 48.

The main methods used by patients in order to cope with their pain fell into four categories. First was physical support of their wound, either from a dressing, or by using a pillow, or their hands. Second was deep breathing and relaxation. Third was distraction, including visitors, reading and watching the comings and goings on the ward. Fourth and finally, patients used mobilisation; getting up, walking around the ward and so on as a means of coping with their pain.

Table 48: Methods of coping with pain used by patients

Method	**No. of patients**
Wound support	25
Distraction	16
Deep breathing	15
Mobilising	15
Relaxation	9
Massage	5
Positive attitude	4
Position in bed	4
Counterirritant	2
No need	2
Warmth	1
Self-hypnosis	1
Valium	1
Applied tissues to wound	1
Good cough	1
Pressure off wound	1
Garlic	1
Bath	1
Avoid coughing	1
Prayer	1
Total	**107**

Patients were then asked to give a yes or no response to a list of six types of alternative pain relief therapy and to suggest any others they would consider using for post-operative pain. Results are shown in Table 49.

Table 49: Alternative therapies patients would consider using for post-operative pain

Type of therapy	No. of patients
Interviewer's suggestions:	
Relaxation	56
Hot/cold pads	49
Distraction	46
Acupressure/massage	46
Hypnosis	32
Acupuncture	25
Patients' suggestions:	
Transcutaneous electronic nerve stimulation	2
Reflexology	2
Wound support	1
Talking	1
Laughter	1
Deep breathing	1
Exercise	1
Herbal remedies	1
Faith healing	1
Prayer	1

Finally in this section of the interview, patients were asked if they thought it would be helpful if nurses could suggest alternative methods of coping with pain to them. Forty-four said yes, 27 said no and 29 were not sure. Some patients also added comments to their responses (see Table 50).

Table 50: Patients' comments on nurses suggesting alternative pain therapies

Comment	No. of patients
For alternative therapies:	
Like to be taught by nurse/OT/physio	8
Would give individuals choice	7
Good idea/like to try	5
Preferable to taking drugs	2
Patients rely on nurses	2
Would give patients some control	1
Useful between doses of painkiller	1
Nurses should discuss with patients	1
Against alternative therapies:	
Nurses are already too busy	14
An extra member of staff needed	4
Unconvinced of methods efficacy	4
Drs should tell nurses what care	3
Nurses would need training	3
Nurses already do their best	2
Alternative methods too much effort	2
No use for severe pain	2
Nurses do not understand the pain	1

This section of the interview was completed by asking patients if they had any suggestions for helping other patients to cope with pain that they thought could be used in hospital. Thirty-six patients made 42 suggestions (Table 51):

Table 51: Patients' suggestions for helping others to cope with their pain in hospital

Suggestion	**No. of patients**
Relaxation/deep breathing	7
Give more individual choice	5
Have a positive attitude	4
More communication	3
Pre-op information about pain	3
Should ask for help	3
Provide heat pads	2
Transcutaneous electronic nerve stimulator	2
Advice and support	2
Mobilise	2
Patient-controlled analgesia	2
Epidural analgesia	1
Explanation re analgesics	1
Reduce stress	1
Take painkillers at least until day 4	1
Leave supportive dressings in situ	1
Position pillows carefully	1
Humour	1
Total	**42**

It can be seen that less than half of the sample offered suggestions, and those that did produced a wide variety of ideas, leading to no consensus of opinion as to how best patients could be helped to cope with their pain, though it was apparent that a range of possibilities existed.

7.8 The relationship between pain and sleep in the post-operative patient

One of the aims of this study was to explore patients' beliefs regarding the relationship between pain and sleep. It is possible that such beliefs could affect the progress of recovery. Some general questions were put to patients in order to try to gain some insights into how they viewed their pain and sleep.

First patients were asked if their pain felt different when they were tired. Thirty-eight said yes, thirty-six said no, 18 were not sure and eight were unable to answer. The patients who had given a 'yes' response were asked in what ways tiredness affected their pain (Table 52), with a few giving more than one answer.

Table 52: Effects of tiredness on post-operative pain

Effects	No. of patients
Pain is worse	21
Harder to cope with pain	7
Easier to cope with pain	5
Pain feels worse	5
Pain more annoying	1
Pain is tiring	2
Total	**41**

Some patients described how tiredness changed the quality of the pain.

> "The pain is more nagging and it's harder to put up with if you're tired." (Pt. 47)

> "If you're tired the pain's more draining, more severe, a down-puller. It can actually make you feel depressed." (Pt. 75)

> "It's more gnawing, sort of more relentless and it seems to take over when you're tired - you can't think about anything else." (Pt. 10)

> "It feels more prominent. I suppose it's not, but it feels like it." (Pt. 21)

> "Pain feels stronger. Everything gets magnified when you're tired, it all gets out of proportion." (Pt. 33)

> "The pain seems worse, it's there constantly like toothache, it's more nagging." (Pt. 64)

> "It's a more overpowering sort of pain." (Pt. 78)

> "The pain starts drawing - can feel it when you try to get comfortable when you're tired - it's a sharper pain." (Pt. 87)

Others put more emphasis on the psychological aspect of tiredness and pain:

> "If you're tired and in pain you want to give up quicker. You could have shot me yesterday for all I cared." (Pt. 25)

> "It's worse, but I think it's psychological - there's nothing to take your mind off it at night." (Pt. 39)

> "Everything seems worse when you're tired, especially if you're a wee bit depressed." (Pt. 84)

> "You're more aware of it - the pain makes you cry. When you're tired and anxious it builds up the level of pain." (Pt. 92)

> "Pain frustrates you more [when you're tired], it makes you more annoyed." (Pt. 94)

Two patients found that the pain itself was tiring:

> "Pain makes you tired - you tense up and when you relax you find you're quite tired after it." (Pt. 41)

> "I do believe pain helps to make you tired. It seems worse when you're tired." (Pt. 63)

Two patients felt that pain became less of a problem when they were tired, though they were very much in a minority:

> "The pain lessens, your senses are less aware if you're tired." (Pt. 69)

> "Maybe the pain's a bit easier if you're drowsy and tired, you're a bit more relaxed." (Pt. 62)

Patients were then asked whether getting a good night's sleep affected the intensity of their pain the following day. Thirty-six said yes, 40 said no and 24 did not know. Those who said yes were asked to comment further (see Table 53).

Table 53: Effects of sleep on pain intensity

Effects	No. of patients
Pain is less intense	26
Less pain because relaxed	5
Pain is more intense	3
Pain seems more intense	2
Raises pain threshold	1
Total	**37**

Some of their comments are given in full:

> "After a good night's sleep, the pain would be quieter." (Pt. 21)

> "As I say, everything magnifies when you're tired, pain is less when you've had a good sleep." (Pt. 33)

> "If you can sleep, your pain gradually diminishes, when you wake up you feel it less." (Pt. 40)

> "The pain isn't so aggravating if you've had a good sleep." (Pt. 44)

"A good sleep might make it feel worse. If you're refreshed your senses are sharpened up and it feels more intense." (Pt. 54)

"If you're tired you're narky, if you're narky it hurts worse." (Pt. 64)

"It doesn't feel so bad if you've slept well, probably because your body's more relaxed." (Pt. 73)

"If you've slept well the pain isn't as bad a blow when you waken. If you don't sleep you wonder when it'll ever end. It's a vicious circle." (Pt. 75)

"Sleep makes you relax and takes away some of the pain." (Pt. 83)

"Definitely - a good night's sleep and the pain is less." (Pt. 90)

The next question asked whether getting a good night's sleep affected how they coped with their pain. Eighty-nine said yes, five said no and six did not know. Their comments were categorised as shown in Table 54:

Table 54: The effects of sleep on coping with pain

Effects	**No. of patients**
Cope better after sleep	77
Cope better when relaxed	13
Cope better when drowsy	2
Can fight pain better	2
Better attitude	2
Cope better mentally and physically	1
Sleep passes the time (ie less time to cope with pain)	1
Total	**98**

Some of the patients' comments were as follows:

> "You can cope with more pain after a good sleep." (Pt. 43)

> "It's much easier to cope with the pain when you're properly rested." (Pt. 44)

> "It's essential - you can't cope with anything unless you've slept, especially pain." (Pt. 47)

> "Oh yes! If you're finding it hard to cope it's vital to get a good night's sleep." (Pt. 80)

> "It's impossible to cope properly if you haven't slept well." (Pt. 81)

> "Most decidedly. Even an hour's sound sleep in the middle of the day can raise spirits and pain thresholds very greatly." (Pt. 84)

> "If you're tired you give in easily, resort to anything. Getting enough sleep makes it easier to overcome the pain." (Pt. 89)

> "Sleep gives you more strength to fight against it [pain], if you're well rested you're much better." (Pt. 98)

Some patients drew attention to the idea that sleep had a positive effect on their mood, which then improved their ability to cope:

> "If you get enough sleep you don't feel so tired and miserable and it's easier to cope." (Pt. 20)

> "It [sleep] puts you into a better frame of mind to cope with it [pain]. You give in to the pain when you're tired." (Pt. 63)

> "You're not so well able to cope if you're tired, you have a good attitude if you're rested." (Pt. 93)

Some patients emphasised the importance of relaxation resulting from sleep in helping them to cope with pain:

> "Without a doubt - when you're rested and relaxed both your mind and your body can deal better with pain." (Pt. 10)

> "It [sleep] relaxes you and you can cope with a bit more than you normally would." (Pt. 69)

> "It makes you feel better when you've slept, you're more relaxed. Pain and lack of sleep are the worst things." (Pt. 36)

Several patients described sleep as a way of passing time that would otherwise be spent in pain:

> "It helps pass the time, so you get to a stage when you've recovered a bit more." (Pt. 7)

> "If you've had a good night's sleep away from pain altogether, you can then accept it better." (Pt. 90)

Finally, patients were asked whether they thought that sleep had any effect on how people recovered from operations. Ninety-two said yes, three said no and five did not know. They commented on their responses (Table 55).

Table 55: Effects of sleep on recovery from surgery

Effects	**No. of patients**
Helps/hastens recovery	52
Aids healing	27
Relaxation aids recovery	14
Heals the mind	11
Passes the time	9
Aids coping	5
Total	**118**

Many patients were very definite in their opinions of the effects of sleep on recovery from surgery:

> "You've got to get a good sleep before you get anything else. You feel fresh and don't get crabby, you can deal with the pain and everything else, and it speeds up your recovery." (Pt. 23)

"You recover quick if you get a good sleep. I've got home from hospital before quicker than other people who've had the same operation, because I've been able to sleep better than them." (Pt. 38)

"Sleep is the best medicine - better than a feed when you're ill. If you're sleeping, you're getting better the whole time." (Pt. 64)

"I'm sure if you're feeling well rested and comfortable it helps you to recover better." (Pt. 74)

"Sleep helps recovery by resting the body, letting it sort itself out, get back to normal. If you don't sleep you feel lousy anyway, no matter how much pain you have." (Pt. 88)

"You recover better if you're sleeping well, it's very helpful. If you're lying awake all night it slows you down." (Pt. 93)

Other patients pointed out that sleep was specifically related to healing:

"If you get proper rest the healing process takes over - you heal while you're sleeping." (Pt. 35)

"Without a doubt. Your body heals better if you sleep well. Sleep heals the mind as well; both mind and body are restored by proper sleep." (Pt. 44)

"Definitely. Sleep is a great healer - that's why I don't understand why they wake you up early in the morning. I think why? what is it for? Certainly not for the patient. It makes you agitated. It's all done to their rules." (Pt. 75)

"Definitely - it makes you feel more positive and surely healing processes take place while you're sleeping." (Pt. 81)

"Absolutely - sleep is the best healer in the world. You know it's going to take longer to get better if you can't get your sleep." (Pt. 96)

Some of the patients emphasised that sleep was important for both physical and mental healing:

> "It [sleep] heals your body and your mind as well, you relax and can get going quicker." (Pt. 57)

> "I think it's [sleep] essential. If mentally and physically you're completely rested it helps you recover." (Pt. 71)

> "You need to sleep to heal your body and your mind as well." (Pt. 80)

Relaxation arising from sleep was mentioned as a key part of recovery:

> "Being able to relax and sleep helps an awful lot - it's most of your recovery really." (Pt. 29)

> "If you're sleeping, you're more relaxed so your body is getting a chance to heal better." (Pt. 34)

> "You're more rested and relaxed, it speeds up your recovery. Then, when you're awake you're better able to do things - it makes a big difference." (Pt. 69)

> "If you get a good sleep you're more relaxed and your body can recover better." (Pt. 99)

Again, several patients commented on sleep as a release from pain:

> "It's nice - it's a total release from pain and the whole situation." (Pt. 25)

> "If people could sleep through half the pain it would be easier and would help them get better." (Pt. 5)

> "If you've had your sleep it fills in your time, you get away from the pain and illness." (Pt. 16)

> "Yes, I think so. I put an awful lot of faith in it [sleep]. Your mind's blacked out for pain. Nature is the only healer, medicine only hurries it along, protects it." (Pt. 46)

7.9 Post-operative analgesic provision

7.9.1 Prescription of post-operative analgesics

Although it had been expected that patients would receive oral, intramuscular and/or intravenously administered analgesics, in the event a rather more complicated picture emerged. As anticipated, the majority (n=97) were prescribed intramuscular opioids on a p.r.n. basis. Of these, 29 were also receiving intravenous analgesics. However, other routes of drug administration, such as epidural (n=6) and interpleural (n=5) were also encountered.

For the purpose of clarity the, opioids given intramuscularly and non-opioid analgesics given orally have been designated 'standard' analgesia; while analgesics and local anaesthetics given via intravenous, epidural and interpleural routes have been labelled 'novel' analgesia throughout this chapter. Strictly speaking, these novel routes of administration are not new, but this term serves to distinguish these relatively uncommon approaches from the more standard practice of prescribing intramuscular opioid drugs and/or oral analgesics. Patients receiving novel analgesia were prescribed standard analgesia in addition, in case they required a 'top-up' in order to control their pain effectively.

The novel routes of administration were considered together for the purposes of analysis. Ninety-seven patients were prescribed intramuscular analgesics, 51 were prescribed oral analgesics and 40 were prescribed and received novel analgesia. Two received no standard analgesics of any kind, and claimed to have had no post-operative pain at all. Of these two, one had and the other had not received novel analgesia.

The actual drugs prescribed and their routes of administration were as shown in Table 56:

Table 56: Numbers of patients prescribed types of analgesic and anaesthetic drugs within each category of administration

Novel administration (intravenous, interpleural & epidural)	
Drug	*n*
Morphine	26
*Bupivacaine	9
*Bupivacaine and diamorphine	2
Diamorphine	2
Diamorphine and haloperidol	1
	40
Standard administration (intramuscular)	
Drug	*n*
Papaveretum	48
Morphine	35
Diamorphine	9
Pethidine	3
Cyclimorph	2
	97
Standard administration (oral)	
Drug	*n*
Coproxamol	39
Ibuprofen	5
Codydramol	4
Paracetamol	2
Dihydrocodeine	1
	51

*Bupivacaine is a local anaesthetic, the remainder are conventional analgesics.

The various combinations of method of administration and type of analgesic prescribed for this sample were as shown in Table 57.

*Table 57: Number of patients prescribed each combination of type of analgesic for the whole sample (n=100)**

	Prescribed novel analgesia	**Not prescribed novel analgesia**
1 Prescribed standard intramuscular opioids	38	59
2 Prescribed standard oral analgesics	10	41
3 Prescribed both standard, intramuscular and oral analgesics	10	40

*Because of the overlap between groups 1, 2 and 3, the numbers in the vertical columns are meaningless when totalled.

It had not been anticipated that there would be such an overlap between modes of analgesic provision. This unexpectedly complex picture of types of drug and routes of administration meant that useful comparisons of their effects on night-time pain were not possible.

7.9.2 Patterns of administration of post-operative analgesics

In order to observe patterns of post-operative analgesic provision, the period for which data had been collected was divided into 8-hour time blocks. These began at midnight following surgery and continued for 64 hours, producing eight consecutive periods of eight hours each. First, numbers of doses of standard intramuscular and oral analgesics per eight hours were observed and are shown in Tables 58 and 59.

Table 58: Number of doses of intramuscular opioids given per patient per 8-hour period following midnight on the day of surgery (n=97)

Time	**No. of doses received per patient**			
	0	**1**	**2**	**3**
0000-0800	49	39	11	1
0801-1600	37	41	20	2
1601-2400	43	40	17	0
2401-3200	66	29	4	1
3201-4000	54	27	18	1
4001-4800	58	34	8	0
4801-5600	82	16	2	0
5601-6400	70	22	8	0

Table 59: Numbers of doses of oral analgesics per patient per 8-hour period following midnight on the day of surgery (n=51)

Time	**No. of doses received per patient**		
	0	**1**	**2**
0000-0800	95	5	0
0801-1600	91	9	0
1601-2400	90	7	3
2401-3200	91	6	3
3201-4000	80	14	6
4001-4800	71	21	8
4801-5600	75	22	3
5601-6400	74	22	4

The raw data from the two previous tables were then expressed more succinctly as mean values, making the pattern of provision somewhat clearer. The mean numbers of doses of intramuscular and oral analgesics given per patient per 8-hour period were calculated (see Table 60).

Table 60: Mean number of doses of analgesics given per patient per 8-hour period following midnight on the day of surgery

Time	Intramuscular analgesics (n=97)	Oral analgesics (n=51)
0000-0800	0.66	0.1
0801-1600	0.89	0.18
1601-2400	0.76	0.25
2401-3200	0.41	0.24
3201-4000	0.68	0.5
4001-4800	0.52	0.73
4801-5600	0.21	0.55
5601-6400	0.39	0.59

For each of these two groups, a Friedman analysis of variance of the raw data indicated that there were significant changes within each of the groups according to time. For the intramuscular analgesics, $chi^2 = 50.5$, 7df giving a probability $p<0.001$. For the oral analgesics, $chi^2 = 16.9$, 7df giving $p<0.02$. This means that for both types of analgesic drug, there are significant variations in the numbers of doses given according to time. This result does not indicate where these differences lie, so further analysis was necessary to clarify this.

Having established that there were significant differences in the numbers of doses of analgesics given over 64 hours, visual representations of these patterns of intermittent analgesic provision were produced in order to see whether any obvious patterns existed. These are shown in Figures 14 and 15. The number of doses of intramuscular opioid analgesics given gradually diminished over the three days, while, as might be expected, the number of doses of oral analgesics tended to increase over the three days. In fact, two different effects are visible in the pattern of analgesic provision. Superimposed on the general downward trend for intramuscular provision is a diurnal fluctuation in the number of doses given. Fewest doses were given at night, more were given during the afternoon and most were given during mornings.

Figure 14: Numbers of doses of intramuscular opioid drugs given per 8-hour period following surgery (n=97)

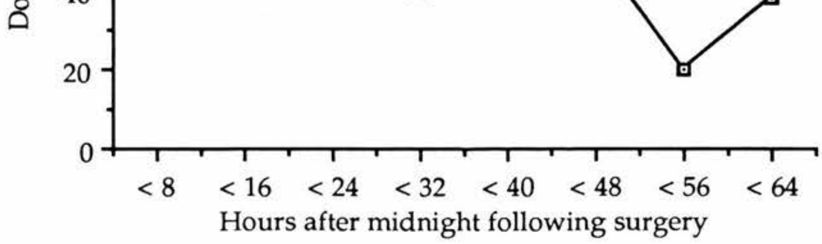
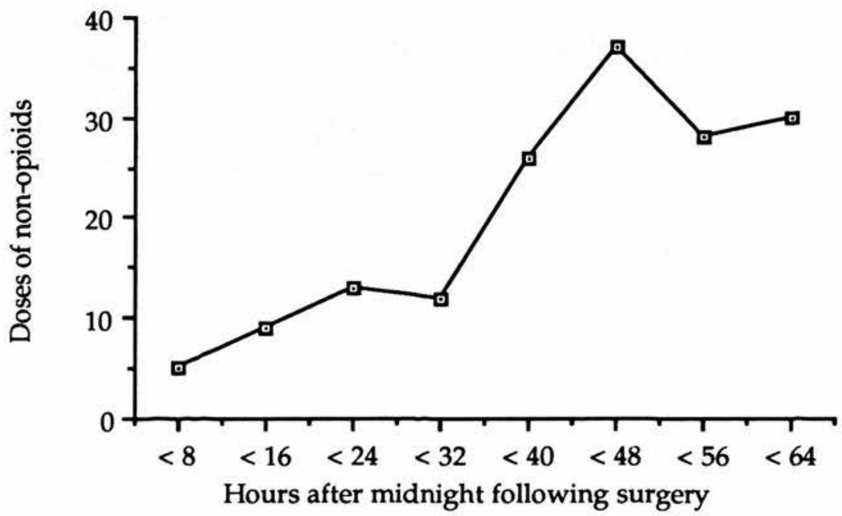
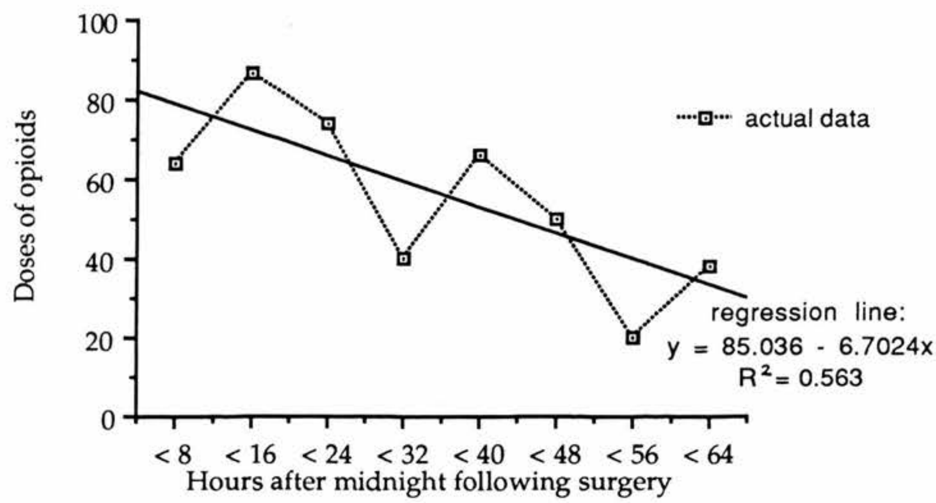


Figure 15: Numbers of doses of oral analgesics given per 8-hour period following surgery (n=51)



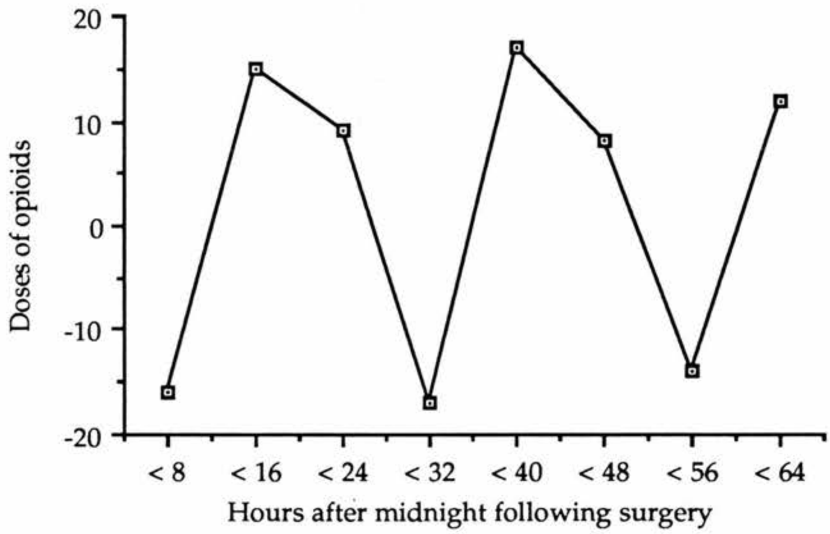
This diurnal effect was then separated out from the general downward trend. This was done by adding a regression line (line of best fit) indicating the downward trend over time (see Figure 16). The values on this plot were then subtracted from the actual number of doses given for each 8-hour time block, leaving a clear diurnal pattern of provision (Figure 17). The values on the vertical axis indicate the number of doses deviating from the regression line.

Figure 16: Number of doses of intramuscular opioid analgesics given per 8-hour time period after midnight following surgery with regression line showing general downward time trend (n=97)



A Friedman analysis of variance showed that the data presented in Figure 14 still varied according to time (chi^2=82.7, df 7, p<0.0001). This confirmed the significance of the diurnal fluctuations in the provision of post-operative opioids given intramuscularly. Given that only three values per 24 hours are given on Figure 17, this diurnal variation was considered to be a fairly crude representation of the daily pattern of analgesic provision.

Figure 17: Diurnal pattern of post-operative intramuscular opioid provision relative to downward trend (n=97)



This diurnal pattern was therefore examined in more detail by dividing each 8-hour time block into two 4-hour blocks (see Figure 18). As before, the general downward time trend was removed (Figure 19). It may be seen that remaining are two peaks per 24 hours, one occurring between 8am and 12pm, and the other between 8pm and 12am. Troughs occur between 12pm-8pm, and more markedly from 12am-4am.

Figure 18: Numbers of doses of intramuscular opioid analgesics given per 4-hour time period after midnight following surgery (n=97)

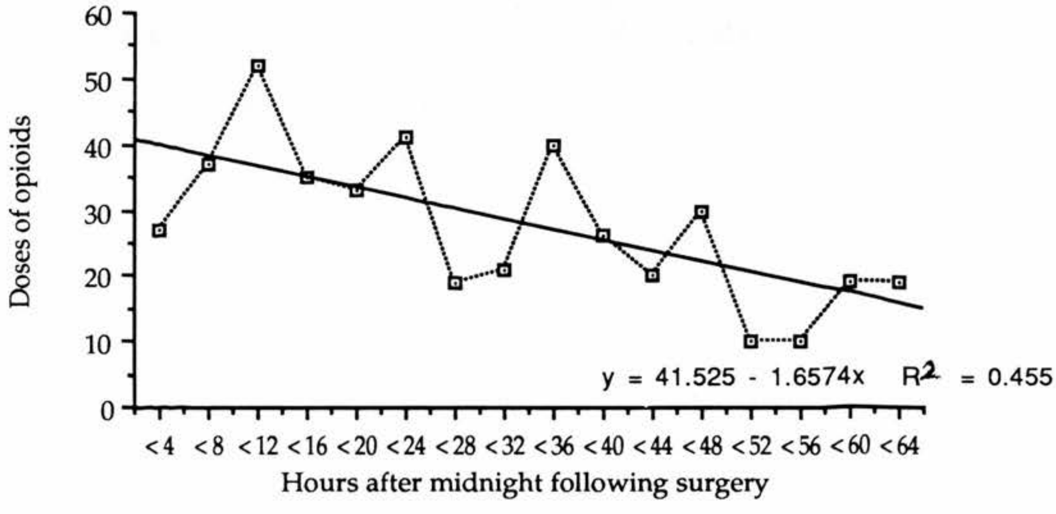
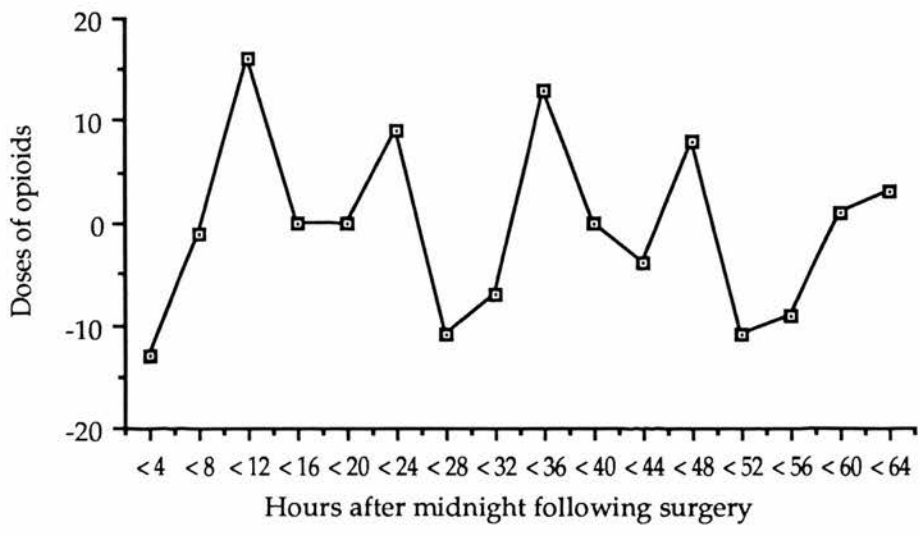
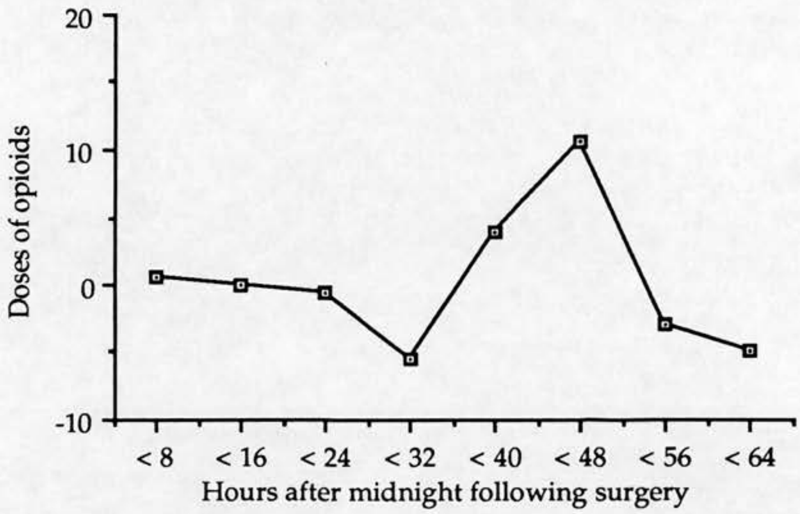


Figure 19: Diurnal pattern of post-operative intramuscular opioid provision relative to downward time trend (n=97)



This whole process of separating out the diurnal variations and testing for their possible significance was then repeated for oral analgesics (see Figure 20). A Friedman test showed that chi^2=283.4, 7 df, p<0.0001. This time the diurnal pattern was not evident, although there were still obvious variations according to time.

Figure 20: Time-related pattern of post-operative oral provision relative to downward time trend (n=51)



7.9.3 Patterns of analgesic provision for patients who did/did not receive novel post-operative analgesia

The patients who had been prescribed intramuscular opioid analgesics were then divided into two groups; those who had been prescribed both standard and novel analgesia (n=38), and those who had been prescribed only standard intramuscular analgesics (n=59). Information about the length of time for which patients had received novel pain control was not available, though nursing staff maintained that generally it continued for approximately 48 hours following surgery.

Again, the mean number of doses of intramuscular opioid analgesics given per patient per 8-hour period were calculated for the two groups (Table 61):

Table 61: Mean number of doses of intramuscular opioid analgesic drugs given to those who did/did not receive novel analgesia per patient per 8-hour period following surgery

Time	Received novel analgesia (n=38)	Did not receive novel analgesia (n=59)
0000-0800	0.32	0.86
0801-1600	0.79	0.97
1601-2400	0.63	0.83
2401-3200	0.39	0.42
3201-4000	0.79	0.59
4001-4800	0.71	0.39
4801-5600	0.34	0.12
5601-6400	0.37	0.41

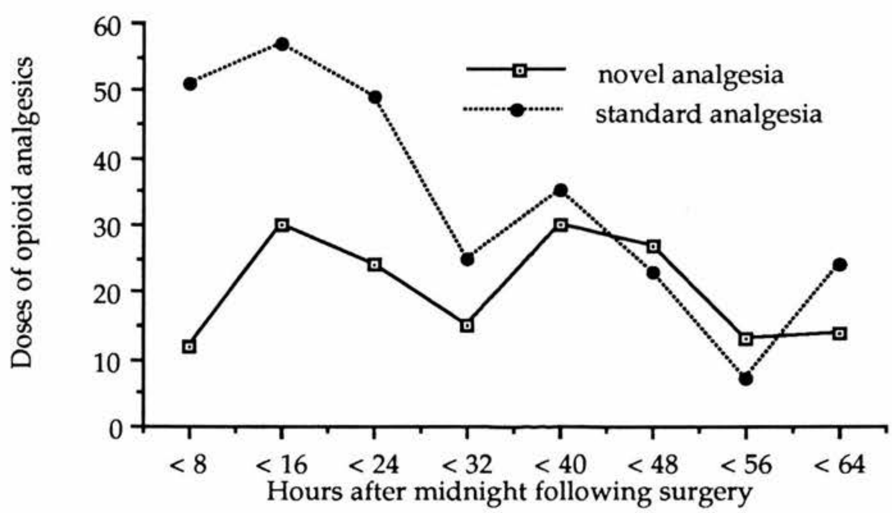
Similarly, the mean number of doses of oral analgesic drugs given were calculated for patients who had (n=10) and had not (n=41) also been prescribed novel analgesics (Table 62).

Table 62: Mean number of doses of oral analgesic drugs given to those who did/did not receive novel analgesia per patient per 8-hour period following surgery

Time	Received novel analgesia (n=10)	Did not receive novel analgesia (n=41)
0000-0800	0	0.12
0801-1600	0	0.22
1601-2400	0.1	0.29
2401-3200	0	0.29
3201-4000	0.2	0.59
4001-4800	0.6	0.76
4801-5600	0.5	0.54
5601-6400	0.6	0.56

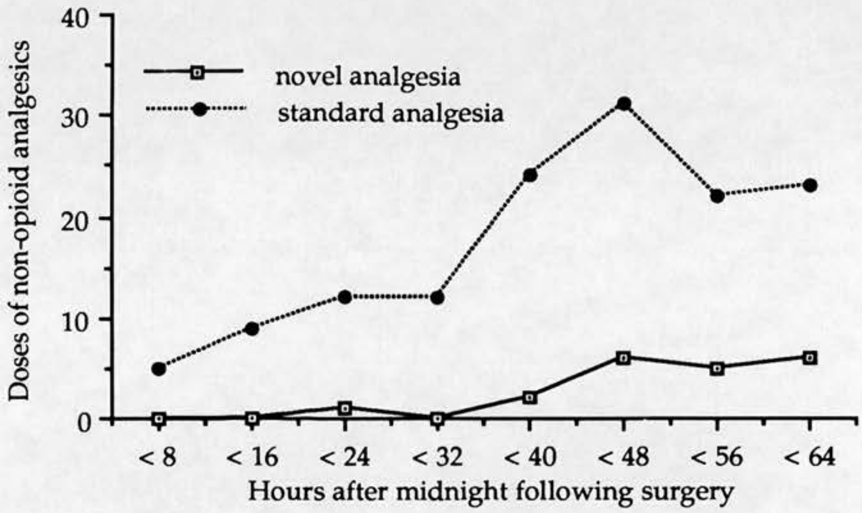
The patterns of provision were as shown in Figures 21 (opioids) and 22 (non-opioids). The two plots shown on Figure 21 are generally similar in form, though there is a steeper downward trend over the 64 hours for those who did not have novel analgesia. This is not evident in the plot for patients who did receive novel pain relief; the 24-hour pattern is roughly the same over the first two days for these patients. Peaks and troughs however, tended to occur at the same times for the two groups of patients. Most doses were received between 8am and 4pm and least between midnight and 8am for both groups.

Figure 21: Numbers of doses of intramuscular opioid analgesics given per 8-hour period following surgery for those who did (n=38)/did not (n=59) receive novel analgesia.



Although there appears to be a rise in the number of doses given at 56-64 hours, this probably represents nothing more than a repeat of the morning rise in provision seen on the two previous days at 8-16 hours and 32-40 hours.

Figure 22: Numbers of doses of oral analgesics given per 8-hour period following surgery for those who did (n=10)/ did not (n=41) receive novel analgesia



In Figure 18 it may be seen that the plots for the two groups are similar, the numbers of doses of intermittent oral analgesics showing a gradual increase over time. Again, peaks and troughs coincided, with the highest number of doses given between 4pm and midnight and the lowest number between midnight and 8am for both groups.

7.9.4 Proportion of prescribed analgesics administered

A calculation was made of the proportion of prescribed intramuscular opioid drugs which were actually given during the immediate post-operative period. This was done by calculating the maximum possible dose each patient theoretically could receive from midnight following surgery, for the ensuing 48 hours. The dose actually given was expressed as a percentage of the maximum it would have been possible to give over that period.

Those who were prescribed intramuscular opioids (n=97) received 23 ± 2% of their theoretical maximum. For those who received novel analgesia (n=38) the percentage received was 20 ± 2%, while for the remainder who received only intramuscular analgesics the proportion was slightly higher at 25 ± 2%. A t-test indicated that the difference between the two groups was not significant (t=1.54 NS), ie patients who received novel analgesia did not receive a significantly lower proportion of the intramuscular opioid analgesics prescribed for them.

These data were also tested for differences according to age and gender. The sample was divided into two groups according to age, below 60 years (n=50) and 60 years and over (n=47). Unpaired t-tests showed that although the younger group tended to have more analgesics than the older one the difference was not significant (t=1.95, NS). There were no differences in analgesic provision according to gender (t=0.69 NS).

To summarise then, over 64 hours commencing at midnight after surgery, patients in this sample received a variety of anaesthetic and analgesic drugs given in various combinations and via various routes. Examination of analgesics which were administered either intramuscularly or orally indicated that certain time related patterns appeared. The number of doses of intramuscular opioids given gradually decreased over 64 hours, and a circadian variation in the number of doses was superimposed on this decline. More detailed analysis showed that peak administration times occurred twice a day, the most pronounced between 8am - 12 noon, and another between 8pm - 12 midnight. The deepest trough occurred between 12 midnight - 8am and there was a less pronounced trough from 12 noon - 8pm. There was no such obvious circadian pattern for the oral analgesics, though their frequency of administration increased gradually over the 64 hours. Peaks and troughs of intramuscular analgesic administration tended to occur at the same times, regardless of whether novel analgesia was given. Finally, patients received no more than a quarter of the maximum possible dose of intramuscular analgesics to which they were entitled during the first 48 hours after midnight following surgery. This was not influenced by age, gender or whether or not they received novel analgesia.

7.10 Numbers of nursing staff

7.10.1 Numbers and types of staff on various shifts

The numbers of nursing staff on each shift from the night immediately following surgery to the late shift on the third post-operative day were recorded. The staff were divided into four groups; registered nurses, enrolled nurses, learner nurses and nursing auxiliaries for each of the nine shifts.

Enrolled nurses were employed only on night shifts while the proportion of learner nurses was considerably lower at night than during either of the day shifts. A staffing index consisting of the mean number of each grade on duty per shift was then calculated (see Table 63).

Table 63: Staffing index for each grade of staff on duty for each type of shift

Grade	**Night**	**Early**	**Late**
RGN	1.23	1.65	1.3
SEN	0.54	0.0	0.0
Learner	0.43	3.2	2.13
Auxiliary	0.89	0.56	0.56
Totals	**3.09**	**5.41**	**3.99**

It may be seen that generally there were two qualified nurses on night and early shifts and one on late shifts. While few learner nurses worked nights, there were about three on each early and two on each late shift. As has already been mentioned, no enrolled nurses worked on day shifts.

7.10.2 Nursing staff and analgesic provision

It is evident from results presented that fewest staff (qualified and learners) were on duty at night, and fewest doses of analgesics were given at night. Similarly, both highest numbers of analgesic doses and nursing staff coincided on early shifts. Late shifts were intermediate for both variables.

It is inappropriate to try to produce statistical associations between staffing levels and analgesic provision using these data, since even if they produced significant findings, these could not be considered to have a cause and effect relationship. The fact remains, however, that fewest doses of analgesics were given at night, when staffing levels were at their lowest. Future research might usefully examine this in more detail, taking into account the inter-relationships between staffing and patients' sleep (including the use of hypnotics) and pain (including the use of analgesics).

7.11 Summary of findings

7.11.1 Sleep in hospital

1. Patients reported a mean reduction in their total night-time sleep of one hour in hospital compared with sleep at home.

2. Patients reported considerable disturbance to their sleep on the night prior to interview (ie their third post-operative night). Eighty-one patients woke up at least once, while over one-quarter were disturbed four or more times.

3. On the third post-operative night pain was the most commonly reported cause of night-time disturbance (n=41) with noise coming second (n=27). Almost three-quarters of the sample reported that pain had interfered with their sleep in some way. Noise (n=25) and pain (n=23) were reported as the worst problems generally affecting sleep in hospital.

4. For patients whose sleep was disturbed, analgesics helped more of them to get back to sleep than any other action taken.

7.11.2 Post-operative pain

5. Ninety-eight of the 100 patients experienced post-operative pain, and they described it in a wide variety of ways. Most common were general descriptions, including discomfort (n=18); moderate to severe pain (n=35); pain on movement, breathing or coughing (n=36); and pain on cessation of non-standard analgesics (n=11).

6. Although for the majority of patients pain was directly associated with the site of surgery (n=81), backache was the second most common (n=21) and pain due to flatulence (n=9) was the third .

7. Virtually half the patients (n=49) reported that pain was worse at night, three felt it was worse during the day and the remainder perceived no difference.

8. One third of the sample (n=33) said they would be more likely to tell nurses about their pain at night than during the day. The main reasons given were that they felt generally worse, the pain felt worse and that they wanted to sleep. Seventeen patients said that they would be more likely to tell nurses about their pain during the day. Reasons included there being more nurses on duty during the day, and that nurses had less time at night.

9. An inexplicable negative correlation was found between pain at the time of interview (as scored on a VAS) and the length of time since they received analgesics, ie the less the pain, the greater the length of time.

10. Patients were divided into two main groups - those who had been offered their last analgesic (n=47) and those who had requested it (n=38).

11. While about one third of the sample (n=35) had gained complete relief from their last analgesic, about half (n=49) gained only partial relief. The latter group described their pain relief commonly as having taken the edge off the pain (n=12), or in more operational terms ie it allowed them to sleep (n=11), it allowed movement, or they were pain free so long as they did not move (n=9). Only one person gained no pain relief from the analgesic they received.

12. About one-fifth (n=19) of the patients reported that they had had difficulty in asking nurses for a painkiller at some point. Reasons commonly included not realising they could have more analgesics, not wanting to make a fuss and not wanting to bother busy nurses. Forty-seven of the patients said they preferred the nurses to ask them if they were in pain, rather than having to take the initiative to ask nurses for pain relief.

13. Nearly forty per cent of patients (n=39) reported that they had been in pain but had not told nursing staff. Reasons included not wanting to be a nuisance, accepting pain as inevitable, not realising they could tell nurses and preferring not to take painkillers.

14. When patients were asked to use a visual analogue scale to show how bad their pain would have to be before they told a nurse, there were significant differences between scores for day and night. Forty-nine patients scored pain lower for night than day while 38 scored pain higher for night.

7.11.3 Coping with post-operative pain

15. Patients had their own methods of coping with their pain, including supporting their wound (n=25), deep breathing and relaxation (n=24), distraction (n=16) and mobilising (n=15).

16. Patients expressed considerable interest in using alternative therapies for controlling post-operative pain, with relaxation being the most favoured method. Forty-four patients felt that it would be helpful if nurses could suggest alternative methods to them. They offered a wide variety of suggestions for helping other patients to cope with their pain in hospital.

7.11.4 Patients' comments on relationships between pain and sleep

17. Over one-third (n=36) felt that tiredness affected post-operative pain, for the most part making it worse. One third (n=32) felt that a good night's sleep reduced the intensity of the pain. A much greater number felt that sleep helped them to cope more effectively with their pain (n=77), and even more (n=92) felt that sleep had a positive effect on recovery.

7.11.5 Patterns of analgesic administration

18. A diurnal fluctuation in the number of doses of intramuscularly administered opioid drugs was observed. Fewest doses were given between midnight and 8am, most

doses were given between 8am and 4pm and an intermediate number was given between 4pm and midnight.

19. Closer examination of the circadian pattern of intramuscular opioid administration showed that the highest numbers of doses were given from 8am-12pm and 8pm-12am. Lowest numbers of doses were given from 12am-4am.

20. There was no such diurnal fluctuation seen in the pattern of provision of oral analgesics.

21. Patients who received novel analgesia were given one-fifth of the maximum possible dose of intramuscular opioids during the first two post-operative days, while those receiving intramuscular doses only were given one-quarter of the possible maximum.

7.11.6 Ward staffing levels

22. Highest staffing levels occurred on early shifts, when highest numbers of doses of intramuscular opioid analgesics were given, lowest staffing levels occurred at night when least doses were given, while late shifts were intermediate for both staffing levels and analgesic provision.

7.12 Limitations of the study

1. The sample of patients was limited to those in a particular hospital undergoing abdominal surgery under the care of a specific group of nurses and surgeons. Results, therefore, cannot be generalised to all patients in all hospitals and to all staff.

2. Information gained from a single interview three days after surgery cannot be as accurate or detailed as information obtained from a series of interviews or observations throughout that post-operative period.

3. While there is no reason to doubt patients' reports of their pain and sleep, it is possible that in some cases the effects of stress, pain, anaesthetic and opioid drugs may have influenced their memory of some events during the immediate post-operative period.

4. The use of the pain VAS to produce responses to hypothetical questions is unorthodox, and the validity of such an approach is unknown.

5. No instruments for assessing the affective or evaluative components of pain were used, therefore a limited view of patients' pain, ie the sensory qualities only were assessed.

6. Information about the timing and doses of intravenous, epidural and interpleural analgesics/anaesthetics was not available. Comparisons of data pertaining to patients who had/had not received any of the above are therefore based on the assumption that they were given for approximately 48 hours following surgery.

7. It is an underlying assumption of this study that sleep has an important role in healing processes. While this theory is supported by a large body of evidence, it is not universally accepted.

7.13 Conclusions

The seven aims of the study (see section 6.1) were met. First, the patients provided descriptive information about their experiences of pain and pain control during the first three days following surgery. These reports varied, but for the most part were general descriptions of the severity and site of the pain. Over one-third reported moderate to severe pain, and although most specified the site of surgery as the source, backache and pain due to flatulence were also relatively common. Second, certain differences between day and night-time pain and pain control were identified. Virtually half of the patients felt that pain was worse at night, while only three felt it was worse during the day. One-third were more likely to tell nurses about their pain at night. Third, this sample of patients showed considerable interest in using supplementary methods of pain control, in particular relaxation. This section of findings confirms the results of earlier research, in that post-operative pain remains a problem for patients. It has also shown that pain poses specific difficulties for patients at night. Alternative methods of pain control might be particularly useful to patients at night.

The fourth aim was to assess the extent of sleep disruption due to pain and the findings were similar to those found in the first study. Pain was the most common cause of disturbed sleep, while the provision of analgesics helped more patients to get back to sleep than anything else. Fifth, patients had clear ideas about the relationships between sleep and pain, the main ones being that tiredness worsened post-operative pain, and that a good sleep reduced pain intensity and helped them to cope with pain. Pain at night, therefore, had an adverse effect on sleep and this lack of sleep was perceived by patients as worsening pain, indicating detrimental interactions between pain and sleeplessness.

Sixth, patterns of analgesic provision varied according to the time of day. Fewest doses of intramuscular opioid analgesics were given between midnight and 4am, while two peaks of provision were observed, one between 8am and midday, and the other between 4pm and midnight. Between one-fifth and one-quarter of the maximum possible dose was given over the first and second post-operative days. Finally, staffing levels varied according to shift, and high staffing levels were associated with the most frequent administration of analgesics, while low staffing levels were associated with least frequent administration. Evidently least analgesics were provided during the night when staffing levels were lowest, although cause and effect inferences cannot be drawn.

Clearly then, sleep, pain and the provision of analgesics are closely interlinked and must be considered together in the planning of night-time care. The findings from this third study are discussed in more detail, together with the findings from the first two studies in Chapter 8.

CHAPTER 8

DISCUSSION AND RECOMMENDATIONS

8.1 Introduction

The initial aim of the research presented in this thesis was to describe changes in patients' sleep as a result of admission to surgical wards and, specifically, to identify the main factors disturbing sleep. The emergence of pain as the major disrupter of patients' sleep prompted the subsequent aim of discovering more about post-operative pain at night, in particular day-night differences in pain, pain control, and the provision of analgesics. Patients' own strategies for controlling pain and their beliefs about the relationships between sleep and pain were also examined. Some of the findings, particularly those relating to sleep, confirmed those of previous research, while others, particularly those relating to pain, revealed new issues.

Familiar themes which emerged from the analysis of the research which focused on sleep were those of environmental factors such as noise, uncomfortable ambient temperatures and dissatisfaction with hospital beds as major causes of disturbed sleep in surgical wards. This all confirms the findings of earlier research (Falk and Woods 1973; Hinks 1974; Bentley et al 1977; Royal Commission 1978; Ogilvie 1980; Soutar and Wilson 1986; NHS Management Consultancy Services 1987). Since these observations are not new, and their implications are self-evident, they will not be discussed in detail in this chapter. They do, however, both reinforce and add detail to a longstanding awareness of the difficulties of promoting sleep in hospital.

New findings have emerged which merit discussion, in particular the significance of pain as a disrupter of sleep in the post-operative patient. Day- and night-time experiences of pain differed, with many patients reporting that pain was worse at night. It was interesting to note that analgesic provision was found to be lower at night than during the day. It emerged that the majority of patients had experienced varying degrees of pain and pain relief and that some patients had their own strategies for managing pain, commonly using wound support, relaxation, distraction and mobilisation. Many showed interest in using alternative methods of pain control complementary to pharmacological methods.

This discussion is divided into three sections, beginning with patients' experiences of night-time pain and the associated patterns of analgesic provision. Any attempt to improve patients' sleep and pain control depends on nurses' ability to assess these accurately and take appropriate action. Issues surrounding the assessment of these highly subjective phenomena are, therefore, considered next. Third, the conclusion that there is a need to integrate pain and sleep in terms of nurses' knowledge, assessment skills and care is discussed. The chapter finishes with recommendations for nursing practice, education, management and research.

8.2 Pain and analgesic provision

The significance of pain as a disrupter of sleep was one of the most important findings from this research, and was the starting point for closer investigation of diurnal variations in pain and pain relief. Pain exerted a major influence on sleep; it was the most frequently cited cause of waking during the night in both Study 1 and Study 3. In keeping with this was the finding that the commonest action which had helped patients to get back to sleep at night was the provision of analgesics. There is little doubt that pain was the major problem interfering with these patients' sleep.

8.2.1 Pain relief and analgesic provision

While the emphasis of the first study was on sleep, and the second focused on analgesic provision, the issues of pain relief and analgesic provision were addressed in most detail in the last of the three studies. Patients were asked about the pain relief gained from the last analgesic they had received prior to interview. The extent of this relief was extremely varied. One third of the patients gained complete relief and almost half gained partial relief. Only one person obtained no relief at all from their analgesia. Patients' additional descriptions also reflected this wide range of analgesic effect. This information shows clearly the highly individual response to analgesic drugs. It is important therefore to assess the effectiveness of analgesic drugs for each patient, as well as monitoring their pain.

One-third of the patients described their pain relief in functional terms, in allowing movement or sleep. Obviously these two functions not only have a theoretically important role in the enhancement of recovery, but are also desirable to the patients themselves in terms of their own comfort.

Of the patients in Study 3, those who had received analgesics were roughly divided into two groups. Almost half had been offered their last analgesic, while over one-third had requested it. It is reassuring that such a substantial proportion felt able to ask for painkillers, but it is not known how much pain they were in at the time of their request. Consequently it is not known whether or not patients left it until they were in severe pain before they felt able to ask for relief.

The major finding concerning post-operative analgesic drugs was that they were not given uniformly over time after surgery. The results of the second study indicated that over the first five days after surgery, only about half as many doses of analgesic were given at night compared with the daytime. Three-quarters of those patients reported that their sleep had been disturbed by pain. So, even if analgesic need was reduced at night, it appears that patients were still experiencing pain severe enough to disturb their sleep. This may in part be explained by the findings of Donovan et al (1983) who found that for some patients mild pain disturbed sleep, while for others, moderate to severe pain did not.

This phenomenon was addressed in more detail in the third study. The time period studied was a 64 hour period from midnight following surgery, and for intramuscularly administered opioid drugs a diurnal pattern of provision emerged. Fewest doses were given during the night, between 12 midnight-4am. This supported findings from the second study, as well as other research (Burns et al 1990). The latter study implied a decreased need for analgesics during the night, since the patients in the study were self-administering opioids. This suggested that there was a reduction in pain during the night, so that a reduction in analgesic intake would also be expected at night.

This diurnal variation was not significant for oral analgesics, although again, fewest doses were given during the night. It is likely that oral analgesics were given most frequently during drug rounds, which would tend to mask any circadian pattern of administration.

The times of peak administration of intramuscular analgesics occurred in the morning between 8am and 12 noon and late evening, between 8pm and 12 midnight. This, again, confirms earlier findings of Burns et al (1990) who found that peak post-operative morphine requirements occurred around 9am and 8pm. There is no immediately obvious physiological explanation for this 24-hour variation. Levels of plasma cortisol and beta-endorphin fluctuate in a circadian manner, with peak levels around 4am-10am hours and troughs occurring at 10pm-3am hours. The anti-inflammatory property of cortisol and the analgesic property of beta-endorphin might be expected to produce lowest levels of endogenous pain relief round about midnight. If this is not the case, there must be an alternative explanation.

It is possible that increased morphine requirements first thing in the morning and mid-evening are associated with patterns of ward activity. Burns et al (1989) suggested that "increased requirements around 0900 hours could be associated with the morning ward round and routine nursing duties, and the early evening demands by increased ward activity around visiting time". Another explanation might be that patients self-medicate with more morphine in anticipation of certain events. The 9am peak in morphine requirements might be due to expectation of pain due to mobilisation, physiotherapy and so on. The evening peak might be in order to gain as pain-free a night as possible.

Twenty-four hour analgesic provision, then, did not appear to be overtly related to need, since considerably less was given during the night. Pain during the night, however, was inferred from patients' day-time reports of factors disturbing their sleep and further research into pain undertaken actually during the night might produce a clearer picture.

The second study indicated that only a small proportion of the maximum possible dose of prescribed analgesics was given during the 48 hours from midnight following surgery. Similar results were found in the third study. Patients in this sample received between one-fifth and one-quarter of the maximum possible prescribed dose of analgesics to which they were entitled. In conjunction with the findings that many patients felt their pain was worse at night, that pain was the most common factor disturbing sleep and that fewest doses of analgesics were given during the night, it appears that patients tended not to receive adequate analgesic cover throughout the night.

Given the difficulties of assessing pain at night, it might be preferable to give patients continuous intravenous infusions of analgesics, or failing that, analgesics at fixed times throughout the night rather than on demand. De Conno et al (1989) compared on demand analgesia with fixed analgesia for a sample of 35 patients following abdominal surgery. They found that patients who received fixed analgesia had significantly better pain control, more sleep and spent more time standing or sitting rather than lying down over the first post-operative week. While these patients received fixed analgesia throughout the day and night, a trial of fixed analgesic provision at night only, with on demand provision during the day would be of value. The introduction of this type of regime might improve patients' experiences of sleep and night-time pain, particularly where continuous analgesic administration is unavailable.

It is difficult to know whether ward staffing levels had any influence on the patterns of analgesic administration for this sample. Other authors have suggested that the number of nurses on duty might influence how nurses assess (Kuhn 1990) and treat pain (Cartwright 1985). Certainly fewest doses of analgesics were given when staffing levels were lowest, but it is not possible to infer a cause and effect relationship.

Post-operative pain has been the subject of interest for many researchers (Cohen 1980; Sofaer 1984; Donovan et al 1987; Melzack et al 1987; Seers 1987; Carr 1990; Kuhn et al 1990; Owen et al 1990) in recent years, though the emphasis has been on day-time care. Without exception, these researchers showed that post-operative patients experienced variable and often poor pain relief, although the situation at night has not been thoroughly explored. In spite of all this research, post-operative pain management does not appear to have improved substantially over the last 10 years. Assessment and control remain problematic and patients still rely primarily on medication as a means of obtaining pain relief. The second study, however, suggested that the provision of analgesic medication was not related to whether pain disturbed patients' sleep.

The responsibility for pain management is shared by nurses and doctors. Cohen (1980) reported that nurses tend to under-medicate, while Marks and Sachar (1973) concluded that physicians under-prescribe. They suggested that effective doses and duration of action of narcotic drugs were overestimated by doctors, as were the dangers of addiction. While nurses may share these beliefs, the provision of analgesia depends on individual nurses' assessments of pain. Indeed, for nurses, the crux of solving the problem of controlling pain at night is probably in making accurate assessments of pain.

8.2.2 Day and night-time experiences of pain

Key findings which emerged from the three studies were not only the differences regarding day and night-time provision of analgesics but also the associated experiences of pain. While only three patients in Study 3 felt that their experience of pain had been worse during the day, almost half the sample reported that it was worse at night. Carr (1990) found time related fluctuations in the pain scores of 21 surgical patients, with peaks in the morning and at mid-day. The time periods considered, however, were from 8am to 8pm, so no information was available regarding pain at night. There is very little available research into the 24-hour fluctuations of post-operative pain. Burns et al (1989) reported diurnal fluctuations in analgesic intake among post-operative patients using intravenous PCA. This patient-controlled administration may be considered a reflection of pain intensity. They found peak analgesic intakes occurred around 9am and 8pm. This does not help directly to explain why so many patients felt that pain was worse at night, since it appears from the study by Burns et al (1989) that less analgesia was required at night than during the morning and evening. It does suggest, however, that analgesics administered by nursing staff were not provided in a way which was explicitly related to patients' experiences of pain.

Attitudes towards telling nursing staff about pain also varied according to time of day, with one-third of the patients being more likely to tell nursing staff at night, and fewer than one-fifth more likely to tell nurses during the day. Of those who were more likely to tell the nurses at night, most felt that their pain was worse at night. The two most common reasons for being more likely to tell nurses about pain at night were that patients felt worse at night, and that they needed to sleep.

There appears to be a circular problem here. If patients are unable to sleep at night, the time drags and there is nothing to distract from the pain. Conversely, if patients are in pain or are anxious, it is likely that they will be unable to sleep. According to one patient (79): "There's nothing worse than having pain and watching the clock go round". Another patient (11) said, "The pain is magnified at night because you don't sleep well". The problem of sleeplessness worsening pain, and pain disturbing sleep is not an easy one for nurses to deal with.

It could be argued that some of the responsibility for optimising pain control lies with patients themselves. Almost one-fifth of this sample, however, reported that they had experienced some difficulty in asking nursing staff for analgesics at some point during their hospital stay. The main reasons that were given will be familiar to many nurses. They included being unaware that they could have more analgesics, not wanting to make a fuss and not wanting to bother busy nurses. They may be reluctant to request pain-killers, thinking it a sign of weakness, or believing that pain should be endured as an expected consequence of surgery. Seers (1989) quoted a patient who said "the nurses convey that it's a bit naughty to take a painkiller". Many patients seem unwilling to bother nurses whom they perceive to be busy. This was shown to be the case by Ley (1976). Owen et al (1990) monitored 259 surgical patients and found that they did not have the "necessary knowledge about pain relief to contribute effectively in their own pain management".

It is obvious that many patients do not like to ask (even after being encouraged to do so by nurses) since almost half of the patients in the third study preferred that nurses should offer them painkillers rather than them having to ask. This was also the case in Carr's study (1990) of surgical patients. Evidence of patients' reluctance came from many patients who had been in pain but had not told nursing staff. They gave familiar reasons; not wanting to be a nuisance, accepting pain as inevitable, not realising they could tell nurses about their pain and preferring not to take painkillers. It is probable that there were differences between patients and nurses in their respective expectations of who should initiate pain relief. Seers (1987) found that while fewer than half of the patients in her study expected nurses to know when they required analgesia, over two-thirds of the nurses thought that patients would ask for a painkiller if they needed one. These attitudes suggest that patients seem not to accept that adequate pain relief is their right; they need to understand that pain relief is important in their recovery and they may need to be convinced that there is nothing wrong with requesting analgesics.

Although there was not a clear pattern of when or whether patients were more likely to ask for analgesics, considerable numbers felt that pain either seemed or actually was worse at night; also many were more likely to report their pain at night. Pain therefore appeared to be a particular problem at night for many patients, and so is an area of clinical practice which could usefully be pursued further in terms of assessment and treatment. Many patients were clearly inhibited about telling nurses when they were in pain. Some patient education about the adverse effects of post-operative pain might improve this situation, as well as offering reassurance that it is perfectly acceptable to request analgesics.

Further information about day-night differences from visual analogue scales indicated more complications. The hypothetical questions in the third study about how bad pain would have to be before patients would get a nurse indicated significant differences between day and night. These questions were not entirely successful, however, since although there was a clear difference between scores for daytime and night-time, they appear to have been answered in two slightly different ways with roughly half the sample in each group. It appears that some patients scored higher for night than day, while others did the opposite. This was not related to whether they felt that pain was worse at night, as elicited from a question earlier in the interview. Perhaps this finding is spurious because it is possible that one group of patients generally considered pain worse at a lesser intensity at night, therefore pain was scored lower on the VAS for night than day. The other group of patients scored night-time pain as higher because they felt the pain seemed worse then. The two groups, therefore, may have been different simply in how they described the same phenomenon. This hypothesis gains credence from the finding that there were no other differences found between the two groups in terms of age, gender, living alone, previous surgery, site of surgery or pre-operative pain.

In conclusion, there are certain differences between patients' day-night experiences of pain and attitudes towards asking for pain relief. These differences have not been reported in any detail in earlier research and merit closer attention if night-time pain assessment and control are to be improved. The exact nature of post-operative pain at night compared with during the day is not clear, and further descriptive research would be useful for clarification.

8.2.3 Approaches to post-operative pain management

Patients' reported methods of coping with post-operative pain were for the most part more problem-focused than emotion-focused (as described in section 2.6.1). They tended to use practical methods of managing the pain itself, rather than their emotional response to pain. Although patients' reports of how they coped were strongly biased towards descriptions of practical strategies, this does not mean that they were not using emotion-focused strategies, simply that they may not have reported them. The four main ways in which they coped with their pain were by supporting their wounds while moving or coughing, distraction, mobilisation and deep breathing or relaxation. Nurses can teach all of these strategies, although more research has been completed into the effectiveness of relaxation techniques for post-operative patients than the other strategies.

Wound support is a straightforward way of reducing pain by minimising local movement at the site of surgery. Some patients had not been instructed in this method, but used it successfully anyway, while others had been shown how to do it by physiotherapists and sometimes nurses. Such teaching did not appear to be the specific responsibilty of any particular type of staff.

Distraction was another form of pain control used by patients. It has been defined by McCaffery (1983 p129) as "a kind of sensory shielding, a protecting of one's self from the pain sensation by focusing on and increasing the clarity of sensations unrelated to pain". The patient's attention is focussed on stimuli other than pain, tending to increase the ability to tolerate pain or to decrease its intensity. These effects are achieved by preventing pain from being the centre of the sufferer's attention. Simple devices such as listening to music or the radio, watching television, reading or simply watching the goings-on of a busy hospital ward can be used. Nurses are familiar with the phenomenon of a patient in pain perking up when visitors arrive, becoming apparently more cheerful until the visitors leave, when they revert back to an appearance of being in pain. Frequently these patients are not believed when they then complain of pain, but it is likely that they were using distraction (in the form of visitors) to alleviate pain which returned as soon as the distraction ceased. Patients may be distracted from their pain in many ways, for example by reading, watching television, talking to nurses or one another, or simply observing what is going on around them.

Another method of coping with post-operative pain was by mobilising. This may have functioned as a form of distraction, as mentioned earlier. The role of mobilisation in reducing pain from surgery is not clear, though Hickmott et al (1990) suggested that early mobilisation could reduce post-operative backache.

Relaxation is probably the most important part of many of the techniques used to promote sleep and reduce pain. While it was the second most common way in which patients coped with their pain, it was the alternative therapy in which most patients expressed interest. Titlebaum (1988) reviewed the literature on relaxation and concluded that it should be considered as a therapy when the nursing goals are (amongst others) to increase a sense of control, promote sleep and reduce pain or the perception of pain.

The success of different types of relaxation was examined by Hyman et al (1989) in their meta-analysis of 48 experimental studies. These included Benson's relaxation technique, Jacobson's progressive muscle relaxation, rhythmic breathing, imagery, meditation, autogenic training, hypnosis and yoga. They found that all but Benson's technique were effective, particularly for chronic problems such as hypertension, headache and insomnia.

Relaxation therapy has been used with some success in the treatment of surgical pain. In 1982, Wells studied cholecystectomy patients who had used relaxation as a method of post-operative pain management. She found that less distress was reported. Flaherty and Fitzpatrick (1978) used relaxation to aid the first post-operative attempt to get out of bed following herniorrhaphy, haemorrhoidectomy or cholecystectomy. They found that it produced a significant reduction in the amount of analgesia required, incisional pain and body distress, and decreased respiratory rate. In 1981 Wilson studied 70 surgical patients, comparing relaxation with information giving. He found that relaxation was associated with less pain and a shorter stay in hospital, and that it was of benefit to less-frightened patients more than those who were very frightened. Miller (1987) used a deep breathing relaxation technique with a small sample of 15 post-operative patients with considerable success. She found a significant decrease in systolic and diastolic blood pressures, pulse rate, respiratory rate and pain perception. Levin et al (1987) assessed the effectiveness of two relaxation techniques using a four group intervention study of 40 patients. Their findings were not consistent with the studies already mentioned, rhythmic breathing having no significant effect on pain. Benson's relaxation technique produced a significant reduction in pain scores compared with the attention/distraction group, but not the normal control group. The small size of the sample and the variability of different coping styles may have contributed to this result.

There were several ways, then, in which patients were managing their pain. These methods would be better recognised as functional for patients and complementary to the provision of analgesics in the management of pain. Nurses could promote these non-pharmacological methods by, for example, teaching patients to support their wound while moving or coughing, encouraging mobility and either distracting patients or helping them to distract themselves from their pain.

Patients did show some considerable interest in the use of alternative therapies for pain control, with almost half agreeing that it would be helpful if nurses were able to suggest such techniques to them. Those who were not in favour gave a range of reasons, though many of these implied that nurses already had enough to do, rather than actually being against the use of alternative therapies themselves.

Further systematic evaluation of the relative effectiveness and appropriateness of alternative pain control methods would be very useful. Overall, relaxation may well be the most helpful of these pain reduction techniques. Its success, however, appears to be closely linked to individual patient characteristics, including coping styles. Further research into the use of relaxation relative to such individual factors would be of value in developing the use of this technique for post-operative patients.

8.3 Assessment of sleep and pain

The crux of the problem of providing patients with effective and efficient nursing care of sleep and pain lies in making accurate and timely assessments of each of these phenomena. These would, of course, need to be followed up with appropriate action. Little has been reported in the research literature about the assessment of sleep, although much attention has been paid to the assessment of pain. Viewing assessment of the two as integrated has been almost entirely neglected, and, as will be argued later, is essential if patients' overall night-time experience is to be as comfortable as possible.

8.3.1 Assessment of sleep

It is difficult to say how hospital patients' sleep could most effectively be assessed in routine clinical practice. While there are assessment instruments available such as the St. Mary's Hospital Sleep Questionnaire (Ellis et al 1981), these have mainly been used for research rather than clinical purposes. It is not necessarily the case that research instruments are appropriate for clinical nurses, since thay may be too long and detailed for such general use. Little research is available which has evaluated the practicability and efficacy of apparently suitable approaches.

A factor analysis of findings from a study using the St. Mary's Hospital Questionnaire identified patients' priorities for sleep (Leigh et al 1988). The aspects of subjectively perceived sleep considered by the 222 hospital patients to be of greatest importance were the process of going to sleep and the quality of sleep. Nurses' assessments might therefore usefully focus on these attributes. Nursing records of normal sleep patterns, pre-sleep routines, medications and specific hospital-related problems could also provide a basis for consideration of patients' sleep. The first study indicated that nurses' recordings of patients' sleep both on admission and in the nursing notes were very brief. They contained very little useful information, either about normal sleep patterns and practices, or sleep in hospital, confirming the findings of Georgopoulos and Jackson (1970). Other researchers have found that nurses have "grossly misjudged and consistently overestimated" sleep time when compared with parallel polygraphic recordings (Aurell and Elmqvist 1985). It is probable that these omissions and inaccuracies were due to a lack of systematic assessment of patients' sleep.

Since patients are the only people who know how restful and refreshing or otherwise their sleep has been, nurses can only assess the subjective experience of sleep by asking them about it. Many researchers have shown that nurses have difficulty in communicating effectively with patients (Faulkner 1980; Maguire 1980; Macleod Clark 1982). They have shown that nurses' questioning techniques are often poor, with nurses tending to ask closed or leading questions rather than open ones. The question "did you sleep well?" is liable to evoke a less detailed response than "how did you sleep last night?". The latter creates an opening for patients to discuss whether they slept well and whether they had pain or any other difficulties. Pausing and giving patients time also allows patients to give a more informative response.

The development of sleep assessment techniques might benefit from clinical research involving multivariate statistical analysis of factors affecting sleep. Discriminant and other types of multivariate analysis could usefully be applied to many clinical situations where large numbers of interactive variables influence the topic of interest. Since discriminant analysis is used to calculate which combination of variables best predicts into which of two (or more) outcome groups patients will fall, it could be of use in many situations where two or more distinct outcomes are anticipated. In Study 1, discriminant analysis was used to identify the group of factors which best predicted how patients felt about their sleep in hospital. Although in general patients slept better in small wards (as shown by the Royal Commission 1978 and Ogilvie 1980), those living alone were likely to sleep better in large wards than those who lived with others. Those who did not sleep so well in large wards may have been those who had had to adjust to sleeping alone when they were used to sharing a bed. Unfortunately, patients were not asked specifically about this.

These findings were drawn from a relatively small sample of patients on surgical wards at two hospitals. A replication of this study involving larger numbers and taking more patient factors into consideration might prove useful. Multivariate analysis could be used to identify at risk patients more effectively if a larger sample from a wider range of settings were used. The use of discriminant analysis was a novel method of identifying factors which might help nurses to predict which patients are likely to sleep badly. In the longer term such a technique could make a substantial contribution to nurses' methods of assessment.

In order to improve the sleep of surgical patients, its importance to the well-being of patients must first be fully recognised by nurses. Measures to improve sleep, in particular by reducing noise levels and improving pain control could be tailored to specific wards with little practical difficulty. Evaluating the effectiveness of such measures, however, depends on the development of systematic assessments of sleep.

8.3.2 Assessment of pain

It is highly likely that the inadequacies of post-operative pain control indicated by the research presented here are due, to a considerable extent, to the inadequacies of assessing pain. Patients' reports of pain have implications for assessment, as discussed below. Although how nurses assess pain was not the focus of this research it is an issue of direct relevance to the findings.

Patients in Study 3 described the nature of post-operative pain in very varied ways. Many general descriptions were offered (eg discomfort, moderate pain) and numerous descriptions were of factors or actions which made their pain worse. Obviously general enquiries about pain do not provide patients with a valid and reliable way of reporting their pain. McCaffery's assertion that pain is what patients say it is depends on the patients' willingness and ability to communicate their pain verbally. The need for the development and implementation of systematic methods of pain assessment methods is clear. Some of these types of patient response could be used to help develop nursing assessment of pain and the most commonly occurring of these factors are discussed next. It is obvious to nurses which patients have recently stopped receiving intravenous analgesics, which have stitches, clips, intravenous cannuale and drains *in situ*, and it would probably automatically be assumed that these patients were likely to have some pain or discomfort.

It is much less easy to tell which patients suffer pain on movement, deep breathing or coughing (reported by more than one-third of patients in Study 3). Dodd (1986) found that of 22 post-operative patients, most received adequate pain relief at rest, but that this was not sufficient to allow patients to move comfortably. According to the Commission on the Provision of Surgical Services (1990 p7):

> "Patients may have less pain after surgery if they lie very still in bed. Therefore, pain is easily underestimated. It is important that the severity of the pain during movement, breathing and coughing is assessed".

Dodson (1982) showed that deep breathing and coughing were avoided by post-operative patients, increasing the risk of developing respiratory tract infection. Similarly, Fordham (1982) studied 14 patients undergoing hernia repair and found that pain and fear of pain inhibited exercise and deep breathing.

If one of the aims of post-operative analgesia is to avoid complications due to impaired mobility and breathing, then asking patients whether they can perform these actions without being inhibited by pain might be a useful addition to pain assessment. It might be even better to actually get the patient to move or cough, so that any impairment can be observed. This behavioural approach has been used in the assessment of chronic pain. For example, the Oswestry Low Back Pain Disability Questionnaire (Fairbank 1980) included a series of questions about what pain prevented respondents from doing. While this needs to be tested as a means of assessing post-operative pain, it might prove a useful adjunct to other methods. It may be of particular use at night, when patients should still be encouraged to take deep breaths and cough if they are awake, and would need to change their position in bed every 2-4 hours in order to avoid the development of pressure sores. Other methods of pain assessment, such as the use of pain scales at night can produce considerable disruption by the necessity of turning on lights, hunting for patients' spectacles and so on.

While the vast majority of the patients in the third study experienced pain after surgery, this was not always confined to the site of operation. Over one fifth of the patients experienced backache and almost one-tenth of the sample experienced pain due to flatulence. A wide variety of other types and sites of pain were experienced, each by one or two patients.

In 1936, Nygaard found that among 602 patients 7.8% experienced backache following general anaesthetic. Brown and Elman (1961) reported a higher incidence; 19% of 325 patients reported backache after surgery. Rafferty (1988) investigated the effect of an inflatable lumbar support during surgery in 100 patients. She noted that the incidence of backache was only 18% compared with 28% in a control group. Similarly, Hickmott et al (1990) found that lumbar supports reduced the incidence of post-operative backache from 46% to 21% for 114 patients. In addition, risk factors have been identified. Rafferty (1988) suggested that those undergoing surgery of 60 minutes or longer were at greater risk of backache, while Hickmott et al (1990) suggested a limit of 40 minutes or more. The latter authors also suggested that previous back pain was a risk factor, and they claimed that early mobilisation reduced the severity of back pain. Knowing these risk factors can help nurses to identify which patients are most likely to suffer this post-operative complication, so that care may be taken to position patients and provide them with physical supports and analgesics if appropriate, as well as laying particular emphasis on early mobilisation.

Pain may cause paralytic ileus, as mentioned earlier, allowing gas to accumulate in the bowel causing distension and further pain. Since several patients made unsolicited comments to the effect that the pain due to wind was more severe than the pain from the surgical wound, it is obviously a considerable cause for concern. Kuhn et al (1990) found similarly that almost all of a group of 51 hysterectomy patients complained of wind pain, with half of them considering it worse than the wound pain. Unfortunately, there is little information available on ways that nurses might help to alleviate this type of discomfort, although the passing of flatus tubes may help in some cases.

The main point here is that post-operative pain is not necessarily confined to the site of operation and that patients may also experience backache, pain due to flatulence and a variety of other pains. Nurses may well be able to alleviate some of these if they are aware of them. Nursing assessment of pain in post-operative patients should not, therefore, be restricted to the site of surgery, but should be a more comprehensive consideration.

The inadequacy of pain assessment has been explored extensively in the research literature. It is not relevant to this thesis, however, to discuss the problematic areas of pain assessment in great detail. Methods of assessment have been developed and refined considerably in recent years, but shortcomings in nurses' assessments of patients' pain persist.

In 1978 Oberst reviewed research concerning nursing assessment of pain, and she identified three major shortcomings as follows:

1. Nurses' pain assessments were not standardised.

2. Nurses used some combination of observable pain behaviours and verbal expression as pain indices.

3. Nurses' assessments were not necessarily congruent with patients' pain relief needs.

Nurses' assessments of pain are complex, and the associated nursing care is therefore fraught with problems. Like sleep, pain is an entirely subjective experience which is extremely difficult to assess. Researchers have examined various aspects of the difficulty, including how nurses assess pain, nurse-patient agreement concerning pain needs, and characteristics of both nurse and patient which affect assessment.

In general it seems that nurses use a combination of indices when making assessments, including verbal reports, behavioural and physiological signs. Jacox and Stewart (1973) and Oberst (1978) reported that nurses in non-clinical settings (for example using vignettes) inferred more pain from nonverbal than verbal communication. In clinical settings, Jacox (1979) found that nurses reported that physiological signs and behaviours were easier to use than verbal reports in pain assessment. Similarly, Saxey (1986) found that 69% of nurses in her sample reported that they used nonverbal methods such as facial expression and bodily movement as being the criteria most indicative of pain. Only 31% chose the patients' verbal report as the major assessment method. Even though all pain research points to the conclusion that only the patient can say what his/her pain is like, it seems that nurses remain unconvinced by this.

Often there is a mismatch between nurses' and patients' ratings of pain. Teske, Daut and Cleeland (1983) examined the relationship between patients' reports and nurses' inferences. They found that inter-nurse agreement was high, while there was little correspondence between nurse and patient ratings. Seers (1987) also found that nurses consistently underestimated the levels of patients' pain, with disagreement occuring in 77% of 221 cases. This confirmed the findings of Johnston (1976) and Hunt et al (1977). The reasons for these disagreements are probably many and complex, being influenced by both nurse and patient attributes.

Several studies have shown that nurses have different aims from one another (table 62). Weis et al (1983) found that of 70 nurses (only half of a sample of 142 responded) just 22% aimed for total pain relief. Cohen (1980) Sofaer (1984) and Kuhn et al (1990) also found a wide variety of aims.

Many of the factors which influence patients' expressions of pain also influence nurses' inferences of pain. For example, female nurses may therefore be more sympathetic than male nurses towards male patients in pain because of social expectations. Nurses from higher socioeconomic groups have been shown to infer less pain than those from lower classes (Jacox 1979). Culture, beliefs and values all affect nurses' perceptions of others' pain (Davitz and Davitz 1981).

Professional training appears to have an important effect on nurses' attitudes towards pain, in terms of basic knowledge (related physiology, pharmacology and psychology) as well as beliefs. As discussed earlier, it seems that nurse training produces unrealistic fears of the addictive and respiratory depressive properties of analgesics, as well as a belief that pain control is doctors' responsibility (see Seers 1988).

It is worth noting that there is a considerable amount of research which demonstrates no relationship between certain attributes of nurses and their pain inferences. Personal attributes such as educational preparation, clinical specialty, job satisfaction, employment position (Dudley and Holm 1984) and age (Mason 1981) have no apparent connection with nurses' pain inferences.

Some characteristics of the patients' pain appear to influence nurses' inferences. These include factors such as diagnosis, physical pathology, and duration of the pain (Oberst 1978; Dudley and Holm 1984; Taylor et al 1984; Halfens et al 1990). It appeared that greater pain was inferred where there was obvious physical pathology, and where pain was acute rather than chronic.

Evidently then, there are many factors which colour nurses' appraisals of post-operative pain and pain control, preventing them from simply accepting what patients say about their pain, and treating them accordingly.

Observing and talking to patients may be supplemented by more formalised methods of assessing pain. Various instruments have been devised, for example the McGill Pain Questionnaire (Melzack 1975), and the London Hospital pain observation chart (Raiman 1986 p417). These instruments are quite complicated to use in clinical situations, requiring a considerable amount of effort from the patient to either complete them or provide the necessary information for the nurses to complete them. Simpler pain rating instruments are available, some of the more successful ones being verbal rating scales and visual analogue scales. Simple pain assessment instruments have been used with considerable success in clinical situations. It is worth remembering, however, that even with the simplest of such instruments, considerable effort may be needed on the part of the patient to use them at night.

It is unlikely that pain control for the post-operative patient will be substantially improved until systematic methods of assessment are validated and then fully integrated into practice. This depends not only on nurses really believing that patients are the only authority on their pain, but also on the development of systems of pain assessment which are appropriate for use at night as well as during the day. Research evaluating the effectiveness of various methods in various combinations is needed.

8.4 The relationships between sleep and pain

The research in this thesis has concentrated on post-operative patients' experiences of sleep, pain and analgesic provision at night. Although findings from the three studies were wide ranging, the major issue which arose was that of the interactive aspects of pain, sleep and recovery. These interrelationships are discussed and their implications for nursing considered.

To reiterate, there were several ways in which pain and sleep appeared to be linked. Pain was a major cause of sleep disturbance following surgery and analgesic provision was considerably less frequent at night than during the day. Pain disrupted sleep in several ways, by preventing patients from getting off to sleep, waking patients during the night and preventing them from getting back to sleep. Sleep consequently became shorter and more fragmented. Further, inability to sleep at night appeared to worsen patients' experience of pain at that time. About one third of the sample felt that tiredness worsened post-operative pain and about one-third felt that a good night's sleep reduced the intensity of the pain. This latter property of sleep corroborated the findings of Donovan et al (1987). Over three-quarters felt better able to cope with pain after a good sleep, and sleep was also considered to be a way of escaping from pain.

Almost all patients believed that sleep had a positive effect on recovery. The notion that beliefs can affect health was discussed in the review of the literature (see 2.6.1). Research has shown that the placebo effect and the power of suggestion can produce biological changes. It is possible to speculate, then, that if patients believe that sleep is essential to a speedy recovery, their recovery could be impeded, or at least their state of mind might be more negative if they are unable to sleep adequately. It seems, therefore, that there are three aspects of sleep of apparent importance to post-operative patients; the possible effects of patients' beliefs about sleep on their health, as well as the physical and mental restoration associated with sleep. It is therefore important to help patients to sleep as well as they possibly can while in hospital in order to optimize their recovery and well-being.

The interactions between sleep and pain are of a kind consistent with a holistic view of patients. This is a perspective which proposes that the characteristics of individuals and their environments are interrelated and, to a certain extent, inseparable. "The whole is always greater than the part being studied, and that part can never completely explain the whole" (Burns and Grove 1987, p5). While there is a plethora of influences from many different sources which influence both pain and sleep, it is the interrelationship of these two phenomena which are of interest here. This interrelatedness is subject to many external influences, not least nurses' actions, which in turn depend on their knowledge and beliefs.

While patients had definite views on the relationships between pain and sleep, it does not appear that nurses have an integrated view of these phenomena. Relationships between nursing knowledge, beliefs and assessment of pain and sleep are therefore considered here with particular attention given to the specific problems encountered at night. Some suggestions are made as to how drawing these aspects of nursing together might be used towards the improvement of post-operative patients' night-time experiences. These are proposed in terms of a closer integration of nursing research, knowledge, assessment and care of pain and sleep.

8.4.1 Nursing knowledge and beliefs about pain and sleep

The knowledge used by nurses, while inceasingly becoming research-based, has evolved from a variety of sources. These include common sense, belief, intuition and past experiences (Gortner 1980). While there is little information available which describes nurses' knowledge of the various aspects of sleep, there is a considerable body of research which has examined their knowledge of pain and related issues. There are several possible reasons for this discrepancy. One may be that there is a lack of understanding of the role of sleep in recovery, so that its importance is not generally recognized. Another could be differences in how individuals relate to others' experiences of pain and sleep. The majority of nurses must have experienced sleep deprivation, (particularly if they have worked night shifts) therefore there may be an assumption that this phenomenon is commonplace and problems easily dealt with. On the other hand, it is unlikely that many nurses will have experienced severe pain of the kind which may exist after surgery, and their understanding of this may be much more limited. It is possible that while nurses may empathize with sleep difficulties, they have more difficulty empathizing with pain of a magnitude they have never experienced themselves.

Sleep upsets may also be perceived as less unpleasant and less of a problem than unrelieved pain, therefore meriting less attention, both by clinicians and researchers. The possibilities for nursing intervention may also contribute to the difference in emphasis between these two phenomena. There may be little that nurses feel able to do to help patients sleep, while the provision of analgesics and other comfort measures may produce (or appear to produce) profound effects on the sufferer. Whatever the reasons, there is much written about nurses' assessment and treatment of pain, and far less about their assessment and treatment of sleep problems.

Researchers have repeatedly emphasised that in hospitals noise and pain are two main causes of sleep disturbance and recommendations have been made for improvement. Specific recommendations for nursing, and the expansion of knowledge in this area are scarce. Conversely, researchers have addressed many clinically important aspects of pain and much is known about nurses' knowledge deficits. The Commission on the Provision of Surgical Services Report on Pain After Surgery (1990, p3) identified four main areas of misconception:

1. The doctor and nurse believe they, rather than the patient, are the authority on the patient's pain.

2. Comparable physical stimuli produce comparable severity of pain in different people and, similarly, equal doses of analgesics will produce equal outcome for all people.

3. Physical signs, physiological or behavioural, accompany pain and can be used to verify its existence and severity.

4. Post-operative pain cannot be prevented.

They suggested that not only knowledge of the pharmacology of pain but also knowledge of its sociocultural, psychological and physiological aspects are essential to effective assessment and relief.

In general it appears that pain is treated as one distinct entity and sleep is treated as another, and the interdependent nature of the two does not appear to be acknowledged. Most nursing textbooks do not appear to take a holistic view of the nursing care of these phenomena, with information about pain and sleep tending to be presented separately. Indeed, not all textbooks present information which is research-based. Often pain receives considerable attention, while sleep receives little (eg Watson and Royle 1987; Boore, Champion and Ferguson 1987), although there is considerable variation in emphasis. Pain is frequently discussed in one section of a book and sleep in another, with only a little overlap (eg Narrow and Buschle 1987; Roper, Logan and Tierney 1990). Currently, then, nursing decisions about care are likely to be based on discrete rather than integrated sources of knowledge about pain and sleep.

Nurses' knowledge of pain and sleep may not only be inadequate, it may also be inaccurate. While several researchers have investigated knowledge of pain, there is very little literature about knowledge of sleep. In general, nurses overestimate the risk of addiction to opioid drugs (Cartwright 1985; Saxey 1986; Watt-Watson 1987; McCaffery 1990). In practice, the risk of addiction is very low. Porter and Jick (1980) found an actual addiction rate of less than 1% among patients treated with narcotics. Cohen (1980) discovered other misconceptions. She found that nurses wrongly attributed respiratory changes on the first post-operative day to the effects of analgesics rather than uncontrolled pain. This general lack of knowledge of the side-effects of controlled drugs is not confined to nurses; Weis et al (1983) reported that both nurses and doctors had limited understanding of narcotic analgesics. Lander (1990) suggested that not only lack of knowledge, but also overconfidence in clinical skills contribute to poor pain management. She asserted that health professionals "possess a strong belief in the accuracy of their judgements about pain intensity and rely on their assessments more than the patients' statements".

The knowledge and beliefs that nurses hold about pain and sleep presumably exert a considerable influence on their practice. This may result in inadequate assessment and/or treatment of sleep and pain.

8.4.2 Nursing assessment of sleep and pain

Accurate and timely assessments of sleep and pain, both separately and together, appear to be crucial to the planning of night-time care of post-operative patients. It is important to take into consideration the effects of pain on sleep and vice versa. Given that these are subjective phenomena, it is likely that pain, sleep or both will not be assessed accurately and consequently insufficient attention and/or care given. It is highly probable that the assessment of pain occurs most frequently when particular patients are asked whether they want anything (an analgesic) for their pain. The same patient's sleep may be dealt with by a different nurse at a different time by asking if a hypnotic is required. Consequently there is a considerable likelihood that sleep and/or pain may be inadequately assessed. This may then result in uncontrolled pain or lack of sleep (or both) causing problems for the patient.

It is possible to speculate from the research presented here that considering pain and sleep together when planning night-time care would achieve an increase in sleep and a decrease in pain more effectively than by considering them separately.

The practical difficulties of achieving maximum sleep with minimum pain are considerable, and include the successful integration of research-based nursing knowledge in clinical practice, in particular the assessment and nursing care of sleep and pain. Although there has been considerable research into nurses' preferred methods of assessment and their frequent inadequacy, little information is available on the specific difficulties encountered at night. Even though all the relevant pain research points to McCaffrey's conclusion that pain is what the patient says it is, it seems that nurses do not appear to act on verbal reports. If facial expression and body postures are generally used as the basis for the provision of pain control measures, problems of assessment are likely to be greater at night. Obviously in darkness nurses cannot observe patients easily, so that relying on what patients say becomes even more important. In order for this to take place, however, patients' inhibitions about reporting pain must be overcome.

8.4.3 Integration of the nursing management of sleep and pain

It may be seen that there is a series of events which influence patients' experiences of sleep and pain at night which are crucial in forming the overall night-time experience of post-operative patients. What nurses know about pain and sleep, from sources such as research, common sense, beliefs, intuition and past experiences affects how they assess and care for patients. The way in which this appears to take place is shown diagrammatically in figure 23. It may be seen that there is generally little overlap between sleep and pain in the areas of research, knowledge, assessment and nursing care of sleep and pain. Understanding of the interdependence of sleep and pain is highly likely to be absent, allowing inadequate assessment and care of the total experience of night-time pain and sleep. The occurrence of either night-time pain or sleeplessness would then allow negative interactive effects between pain and sleep to occur, i.e. pain decreasing sleep or sleeplessness worsening pain, and sleeplessness reducing the ability to cope with pain, as proposed in this thesis. This highly simplified representation does not address all the complexities involved in the relationships between research, knowledge, patient assessment, nursing action and patients' experiences of night-time care following surgery, but does convey the essence of the problem.

It is argued that the integration of pain and sleep in terms of research, knowledge, assessment and nursing care could improve patients' night-time experiences after surgery. Figure 24 shows such a hypothetical situation which has been derived from the findings of the research presented here. Research should continue to examine the interactions between pain and sleep, the information available to nurses should make clear the interrelatedness of these two phenomena and this knowledge should then be used in the assessment and care of post-operative patients. Assessing sleep and pain together should permit the planning of nursing care to aim to produce the best possible sleep with the least possible pain. This integration should reduce the possibility of the previously mentioned negative effects occurring between pain and sleep. The theoretical inverse relationship between sleep and pain, with one tending to decrease as the other increases may be moved in the direction of maximum sleep and minimum pain. Good pain control together with

Figure 23: Pain and sleep considered separately

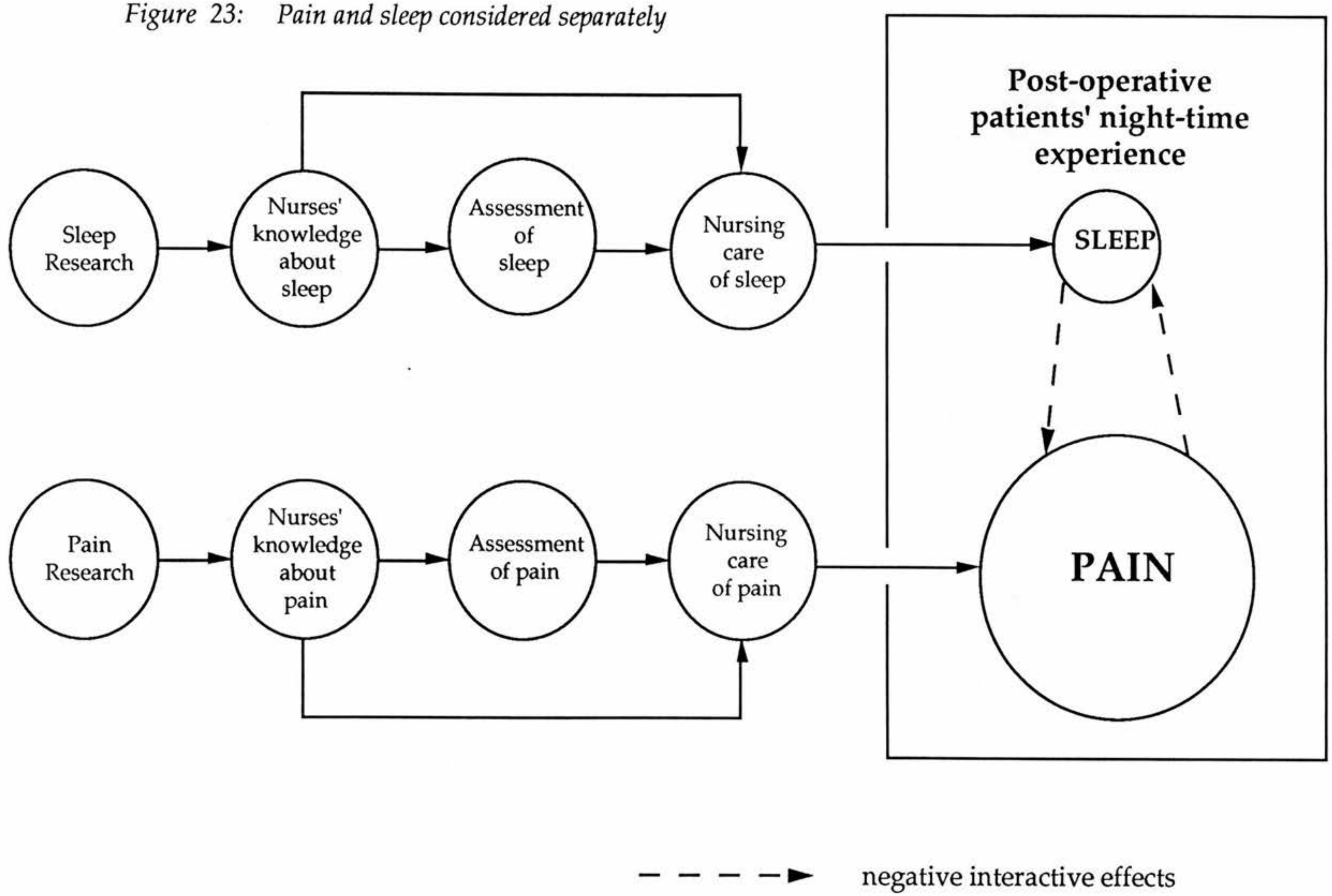
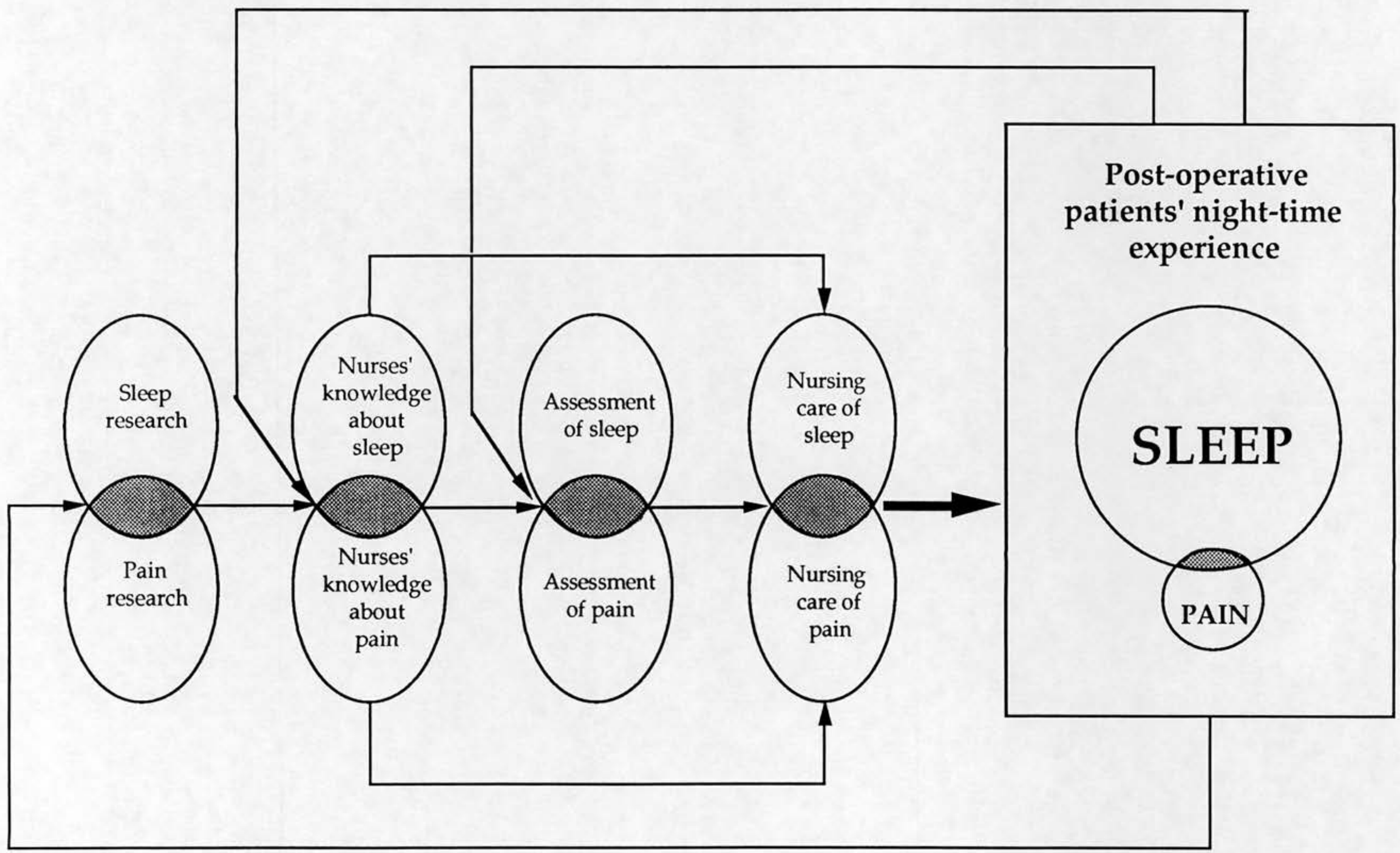


Figure 24: Pain and sleep considered together



the best possible conditions for sleeping mean that the night-time experience of post-operative patients can be made as agreeable as possible. This approach to night-time care could ultimately produce more comfortable, well-rested patients who recover more rapidly from their surgery than they otherwise might have done.

8.5 Recommendations

Various recommendations intended to improve the promotion of sleep and pain relief by nurses in surgical wards have been derived from the research presented here. These are grouped under the headings of practice, education, management and research.

8.5.1 Practice

1. Nursing assessment of patients on admission should include information about usual sleep so that the patients most likely to sleep poorly in hospital may be identified. Information regarding their normal duration and subjective quality of sleep, whether or not they live alone, normally take hypnotics and/or analgesics should all be taken into consideration. Patients considered likely to have poor sleep could then be allocated to the more comfortable beds and side-wards.

2. Systematic monitoring of patients' sleep should allow records of each night's sleep in hospital to be expanded. Nurses could give patients clear opportunities to say how they had slept, and if they had not slept well, record the reason why not. Difficulties with sleep could be incorporated into care plans and possible solutions to problems addressed either at night, or during the day where appropriate.

3. Careful consideration of routine practices such as early morning rounds of tea, clinical observations, and medications are needed. These practices should only be adhered to when they are genuinely in the interests of

patients. Individual assessment of the needs of each patient should lead to the reduction of routine disturbances to a minimum.

4. Hypnotic drugs proved effective in improving subjective reports of sleep for this group. It may be that more explanation and choice about whether to take such drugs might encourage those reluctant to take 'sleeping pills' to reconsider if they were having difficulties in sleeping.

5. Noise reduction at night would certainly be beneficial to many patients, since even noises which do not actually wake them can disrupt the normal cycle of sleep stages. This may take different forms on different wards, with more attention to the problems being needed on Nightingale wards. Where it is not already the case, the wearing of soft-soled shoes could be incorporated into hospital policy for all hospital staff who work on the wards at night.

6. It is important to assess pain carefully at night if patients are to kept as pain-free as possible. This is an aspect of clinical nursing care which requires development. Various methods of pain assessment using visual, verbal and analogue scales are available, and can be used as appropriate. In addition, asking post-operative patients to move, cough or take a deep breath could help nurses to make a more objective assessment of pain. Not only should pain due to surgery be considered, but also any other pain, such as backache, wind pains, headache, sore throat and so on. Appropriate action may then be taken.

7. Closer attention should be paid to pain control, since pain was the major cause of disturbed sleep for this sample. It is not possible to know whether prescribing practices should be reviewed, or if nurses usefully could pay more attention to the analgesic needs of patients or both. It would be helpful to provide analgesics in amounts or frequencies sufficient to prevent sleep from being disturbed, perhaps giving them at

fixed times throughout the night. For those in severe pain, continuous administration of analgesics via intravenous infusion pumps could prevent the troughs in blood levels of analgesic drugs associated with increased pain.

8. Patients' own methods of managing their pain might successfully be exploited. Patients appear to find strategies such as wound support, distraction and relaxation helpful. Not all patients are likely to want to use such techniques, so the needs of each individual should be carefully considered.

9. Pain relief should also be carefully monitored. The degree of relief gained from a dose of analgesic is extremely variable, and may be total or it may not have any effect on the pain whatsoever.

10. Patient education would be helpful. Making patients aware of the possible adverse effects of post-operative pain and the importance of pain control might reduce any inhibitions patients might have about reporting their pain to nursing staff.

8.5.2 Education

11. It is important that nurses understand the nature of sleep and its significance to health and recovery from illness or trauma. Therefore, a basic knowledge of the physiology and function of sleep and the problems relating to patients' sleep should be an important subject within the basic nurse education curriculum. Similarly, a basic knowledge of the ill-effects of post-operative pain together with an understanding of related pharmacology and psychology should provide a sound basis for practice.

12. Nurse education for post-operative night-time care should be informed by research. The findings from research into various aspects of night-time care, in particular relating to pain and sleep, should be integrated.

13. Both student nurses and those who are qualified would benefit from teaching aimed at improving skills in assessment of patients' sleep.

14. The various possible ways of assessing the pain of post-operative patients and understanding of the difficulties inherent in making such assessments should be included in the nursing curriculum.

15. Different methods of controlling the pain of post-operative patients should be understood. This should include knowledge of standard techniques such as the intermittent administration of opioids, as well as newer methods such as interpleural and intravenous and patient controlled analgesia. In addition knowledge of some alternative therapies such as relaxation and distraction would be useful.

8.5.3 Management

16. Findings from the first study support the current trend of building new hospitals with wards divided into smaller bays, for example, four, six or eight bedded bays in order to provide an environment conducive to sleep.

17. The evidence from the first study suggests that horsehair mattresses are detrimental to sleep. This being the case, horsehair mattresses should be phased out (where this is financially viable) from any wards that still use them.

18. Ward managers should be as flexible as is realistically possible in their ward organisation, allowing bedtimes, wake-up times, tea and drug rounds to disrupt patients' sleep as little as possible. Noise at night could be reduced by requirements that quiet shoes are worn by nursing staff, noisy equipment is only used when absolutely necessary and so on, depending on the ward.

8.5.4 Research

19. Given the limitations of these studies and their concern with specific groups of patients and clinical areas, it would be useful to repeat the work with larger samples from a greater diversity of clinical areas, to discover more precisely the risk factors for poor sleep in hospital.

20. The use of multivariate statistical analysis could prove particularly appropriate for the study of clinical phenomena such as pain and sleep, where many variables influence results. These techniques could have a valuable role in the identification of factors predictive of preferred outcomes of nursing care.

21. This study corroborates previous research findings, in that noise was a major problem. It would therefore be valuable for future research to evaluate the effect of strategies aimed at reducing noise on patients' sleep.

22. The precise nature of the day-night differences in the perception of post-operative pain are not clear. Further examination of this might produce information useful for the development of night-time pain assessment instruments.

23. A study of the value of asking patients to move, cough or take a deep breath as a way of assessing their pain might aid the development of pain assessment at night.

24. Care should be taken in the use of the pain visual analogue scale when registering responses to hypothetical questions. Further research into the use of the PPI and pain VAS, both together and separately might advance techniques of assessing post-operative pain at night.

25. Evaluations of alternative methods of pain control, in particular relaxation techniques would be useful. Existing

research findings are not conclusive, because varying plans of investigation have included different types of surgery, differences in alternative techniques and different outcome measures. Particular attention needs to be given to patients' individual coping styles.

26. An evaluation of the comparative effectiveness of fixed, on demand and patient-controlled analgesia would be useful, in order to indicate which methods best achieve pain control throughout the night. This might provide a useful interim measure while more individualised approaches to the assessment and control of night-time pain are being developed.

Concluding comment

Pain-free refreshing sleep is a very welcome experience, especially to those fatigued by illness. If nurses' awareness of the interrelationships between night-time pain and sleep disturbance could be heightened, patients' nights in hospital might ultimately be less unpleasant. Under ideal circumstances, nurses working in practice, management, education and research would be able to take forward the recommendations appropriate to their particular fields. Improvements in the nursing care of pain and sleep at ward level might then gradually be achieved. Creating the situation where patients experience maximum sleep and minimum pain at night should allow them, in the words of T. S. Eliot, to "sleep, [and] prepare for life".

References

Adam K. (1977) Body weight correlates with REM sleep. **British Medical Journal**, 1, (6064) 813-814.

Adam K. (1984) Are poor sleepers turned into good sleepers by hypnotic drugs? In Hindmarch I. Ott H. & Roth T. (Eds.) **Sleep, Benzodiazepines and Performance**, Springer-Verlag, Berlin pp.44-45.

Adam K. (1987) Total and percentage REM sleep correlate with body weight in 36 middle-aged people. **Sleep**, 10, (1) 69-77.

Adam K. Oswald I. (1983) Protein synthesis, bodily renewal and the sleep-wake cycle. **Clinical Science**, 65, 561-567.

Adam K. Oswald I. (1984) Sleep helps healing. **British Medical Journal**, 289 (6456), 1400-1401.

Adam K. Tomeny M. Oswald I. (1986) Physiological and Psychological differences between good and poor sleepers. **Journal of Psychiatric Research**, 20 (4) 301-316.

Adamson L. Hunter W. M. Ogunremi O. O. Oswald I. Percy-Robb I. W. (1974) Growth hormone release during sleep after daytime execise. **Journal of Endocrinology**, 62, 473-478.

Akerstedt T. Froberg J. E. (1979) Sleep and stressor exposure in relation to circadian rhythms in catecholamine secretion. **Biological Psychology**, 8, 869-880.

Akerstedt T. & Gillberg M. (1981) The circadian variation of experimentally displaced sleep. **Sleep**, 4, 159-170.

Aschoff J. (1965) Circadian rhythms in man: a self sustained oscillator with an inherent frequency underlies human 24-hour periodicity. **Science**, 148, 1427-1432.

Aurell J. Elmqvist D. (1985) Sleep in the surgical intensive care unit: continuous polygraphic recording of sleep in nine patients receiving post-operative care. **British Medical Journal**, 290, 1029-1032.

Bach S. Noreng M. F. Tjellden N. U. (1988) Phantom limb pains in amputees during the first 12 months following limb amputation, after pre-operative lumbar blockade. **Pain**, 33, (3) 279-301.

Bailey H. (1981) **Sleep and the hospital patient.** Research Report 1, Department of Nursing and Community Health Studies, The Polytechnic of the South Bank, London.

Baekeland F. Lasky R. (1966) Exercise and sleep patterns in college athletes. **Perceptual and Motor Skills,** 23, 1203-1207.

Barbason H. Van Cantfort J. Houbrechts N. (1974) Correlation between tissular and division functions in the rat liver of young rats. **Cell Tissue Kinetics,** 7, 319-326.

Beecher H. K. (1956) Relationship of significance of wound to pain experiences. **Journal of the American Medical Association,** 161, 1609-1613.

Belville J. W. Forrest W. H. Miller E. Brown B.W. (1971) Influence of age on pain relief from analgesics. **Journal of the Americal Medical Association,** 217, (13) 1835-1841.

Bentley S. Murphy F. Dudley H. (1977) Perceived noise in surgical wards and an intensive care area: An objective analysis. **British Medical Journal,** 2, (6101) 1503-1506.

Billing G. Moos R. H. (1981) The role of coping responses and social resources in attenuating the stress of life events. **Journal of Behavioural Medicine,** 4, (2) 139-157.

Bing H. I. (1936) Viscerocutaneous and cutaneovisceral thoracic reflexes. **Acta Medica Scandinavica,** 89, 57.

Bond M. R. Pearson I. B. (1969) Psychological aspects of pain in women with advanced cancer of the cervix. **Journal of Psychosomatic Research,** 13, 13-19.

Bonica J. J. (1987) Importance of effective pain control. **Acta Anaesthesiologica Scandinavica,** Supplementum 85, 1-16.

Bonica J. J. (1990) Chapter 25: Post-operative pain. In Bonica, J. J. (Ed.) **The Management of Pain,** Vol. 1 (2nd edn.). Lea and Febiger, Philadelphia.

Bonica J. J. Benedetti C. (1980) Post-operative pain. In Condon, R. E. DeCosse J. J. (Eds.) **Surgical Care: A physiologic approach to clinical management.** Lea and Febiger, Philadelphia, pp.394-414.

Bonke B. Schmitz P. I. M. Verhage F. Zwaveling A. (1986) Clinical study of so-called unconscious perception during general anaesthesia. **British Journal of Anaesthesia,** 58, 957-964.

Bonnet M. H. (1985) Effect of sleep disruption on sleep, performance and mood. **Sleep**, 8, (1) 11-19.

Boore J. R. P. Champion R. Ferguson M. C. (1987) **Nursing the Physically Ill Adult: A Textbook of Medical-Surgical Nursing**. Churchill Livingstone, Edinburgh.

Bourbonnais F. (1981) Pain assessment: Development of a tool for the nurse and the patient. **Journal of Advanced Nursing**, 6, (4) 277-282.

Brown E. M. Elman D. S. (1961) Post-operative backache. **Anesthesia and Analgesia**, 40, 683-685.

Brezinova V. Oswald I. (1972) Sleep after a night-time beverage. **British Medical Journal**, 2, (5811) 431-433.

Breughel M. A. (1971) Relationship of pre-operative anxiety to perception of post-operative pain. **Nursing Research**, 20, (1) 26.

Broughton R. Baron R. (1978) Sleep patterns in the intensive care unit and on the ward after acute myocardial infarction. **Electroencephalography and Clinical Neurophysiology**, 45, 348-360.

Bruguerolle B. (1987) Recent data in chronopharmacokinetics. **Pathologie Biologie (Paris)**, 35, (6) 925-934.

Burns N. Grove S. K. (1987) **The Practice of Nursing Research - Conduct, Critique and Utilization.** W. B. Saunders Company, Philadelphia.

Burns E. R. Scheving L. E. Fawcett D. F. Gibbs W. M. Galatzan R. E. (1976) Circadian influence on the frequencey of labeled mitosis method in the stratified squamous epithelium of the mouse oesophagous and tongue. **Anatomical Record**, 184, 265-273.

Burns J. W. Hodsman N. B. A. McLintock T. T. C. Gillies G. W. A. Kenney G. N. C. McArdle C. S. (1989) The influence of patient characteristics on the requirements for post-operative analgesia. **Anaesthesia, 44,** 2-6.

Butler, R. W. Damarin F. L. Beaulieu C. Schwabel A. I. Thorn B. E. (1989) Assessing cognitive coping strategies for acute post-surgical pain. **Journal of Consulting and Clinical Psychology**, 1, (1) 41-45.

Canavan T. (1984) The psychobiology of sleep. **Nursing** (Oxford), 2, (23) 682-683.

Cantor A. J. Fox E. A. N. (1956) **Psychosomatic Aspects of Surgery**. Grune and Stratton, New York.

Carli G. Montesano A. Rapezzi S. Paluffi G. (1987) Differential effects of persistent nociceptive stimulation on sleep stages. **Behavioural Brain Research**, 26, (2-3) 89-98.

Carr E. J. (1990) Post-operative pain: Patients' expectations and experiences. **Journal of Advanced Nursing**, 15, 89-100.

Carskadon M. Dement W. C. Mitler M. M. Guilleminault C. Zarcone V. P. Spiegel R. (1976) Self-reports versus sleep laboratory findings in 122 drug free subjects with complaints of chronic insomnia. **American Journal of Psychiatry**, 133, 1382-1388.

Cartwright P. D. (1985) Pain control after surgery: A survey of current practice. **Annals of the Royal College of Surgeons of England**, 67, (1) 13-16.

Carter D. E. (1984) Sleep and the low-dependency hospital patient. Paper presented at the Scottish RCN Research Society Conference, November 1984.

Chapman C. R. Casey K. L. Dubner R. Foley K. M. Gracely R. H. Reading A. E. (1985) Pain measurement: An overview. **Pain**, 22, 1-31.

Chapman C. R. Syrjala K. L. (1990) Measurement of Pain. In Bonica J. J. (Ed.) **The Management of Pain** Volume 1 (Second Edn.) Lea and Febiger, Philadelphia and London.

Clark E. Hodsman N. Kenney G. (1989) Short Report: Improved post-operative recovery with patient-controlled analgesia. **Nursing Times**, 85, (9) 54/56.

Clark P. R. F. Spear F. G. (1964) Reliability and sensitivity in the assessment of well-being. **Bulletin of the British Psychological Society**, 17, (55) 18A.

Clausen O. P. F. Thorud E. Bjerkness R. Elgjo K. (1979) Circadian rhythms in mouse epidermal basal cell proliferation: Variations in compartment size, flux and phase duration. **Cell Tissue Kinetics**, 12, 319-337.

Cohen F. L. (1980) Post-surgical pain relief: Patients' status and nurses' medication choices. **Pain**, 9, 265-274.

Commission on the provision of surgical services (1990) **Report of the Working Party on Pain after Surgery**. The Royal College of Surgeons of England and The College of Anaesthetists.

Committee on the Review of Medicines (1980) Systematic review of the benzodiazepines. **British Medical Journal**, 282, 910-912.

Cooper K. R. & Phillips B. A. (1982) Effect of short term sleep loss on breathing. **Journal of Applied Physiology**, 53, 855-858.

Copp L. A. (1985) Pain coping model and typology. **Image: The Journal of Nursing Scholarship.** XVII, (3) 69-71.

Copp L. A. (1990) Chapter 10 - The patient in pain: USA nursing research. In Bergman, R. (Ed.) **Nursing Research for Nursing Practice: An International Perspective.** Prentice Hall, New York.

Cornwall A. Dondieri D. C. (1988) The effect of experimentally induced anxiety on the experience of pain. **Pain**, 35, 105-113.

Cousins N. (1989) Belief becomes biology. **Advances**, 6, (3) 265-274.

Craig K. D. Prkachin K. M. (1983) Nonverbal Measures of Pain. In Melzack R. (Ed.) **Pain Measurement and Assessment.** Raven Press, New York.

Craig D. G. (1981) Post-operative recovery of pulmonary function. Anesthesia and Analgesia, 60, 46-52.

Craig K. D. Weiss S. M. (1971) Vicarious influences on pain threshold determinations. **Journal of Personality and Social Psychology**, 19, (1) 53-59.

Crisp A. H. & Stonehill E. (1971) Aspects of the relationship between psychiatric states, sleep, nocturnal motility and nutrition. **Journal of Psychosomatic Research**, 15, 501-509.

Czeisler C. A. Weitzman E. D. Moore-Ede M. C. Zimmerman J. C. & Knauer R. S. (1980) Human sleep: its duration and organisation depend on its circadian phase. **Science**, 210, 1264-1267.

Dalrymple D. G. Parbrook G. D. Steel D. F. (1972) The effect of personality on postoperative pain and vital capacity impairment. **British Journal of Anaesthesia**, 44, (8) 902.

Davitz J. R. Davitz L. J. (1981) **Inferences of patients' pain and psychological distress: Studies of nursing behaviours**. Springer Publishing Company, New York.

De Conno F. Ripamonti C. Gamba A. Prada A. Ventafridda V. (1989) Treatment of post-operative pain: Comparison between administration at fixed hours and 'on demand' with intramuscular analgesics. **European Journal of Surgical Oncology**, 15, (3) 242-246.

Dixon J. S. Bird H. A. (1981) Reproducibility along a 10cm vertical visual analogue scale. **Annals of the Rheumatic Diseases**, 40, 87-89.

Dodd J. (1986) Nursing evaluation of the efficacy of analgesic delivery in post-operative pain. **Australian Clinical Review**, 6, (23) 206-212.

Dodds E. J. (1980) Slept well? A study of ward activity and nurse-patient interaction at night. Unpublished MSc thesis, University of Surrey.

Dodson M. E. (1982) A review of methods for relief of postoperative pain. **Annals of the Royal College of Surgeons of England**, 64, 325-327.

Donovan M. Dillon P. McGuire L. (1987) Incidence and characteristics of pain in a sample of medical-surgical inpatients. **Pain**, 30, 69-78.

Douglas N. J. (1984) Control of breathing during sleep. **Clinical Science**, 67, 465-471.

Downie W. W. Leatham P. A. Rhind V. M. Wright V. Branco J. A. Anderson J. A. (1978) Studies with pain rating scales. **Annals of the Rheumatic Diseases**, 37, 378-381.

Dudley S. R. Holm R. (1984) Assessment of the pain experience in relation to selected nurse characteristics. Pain, 18, (2) 179-186.

Eliot T. S. (1948) Rhapsody on a Windy Night. In: **The Penguin Poets - Selected Poems T. S. Eliot.** Penguin, Harmondsworth, Middlesex

Ellis B. W. Dudley H. A. F. (1976) Some aspects of sleep research in surgical stress. **Journal of Psychosomatic Research**, 20, 303-308.

Ellis B. W. Johns M. W. Lancaster R. Raptopoulos P. Angelopoulos N. Priest R. G. (1981) The St. Mary's Hospital sleep questionnaire: A study of reliability. **Sleep**, 4 (1) 93-97.

Empson J. (1989) **Sleep and Dreaming.** Faber and Faber, London.

Evans C. Richardson P. H. (1988) Improved recovery and reduced post-operative stay after therapeutic suggestions during general anaesthesia. **The Lancet**, 2, (8609) 491-492.

Fabijan L. Gosselin M. (1982) How to recognise sleep deprivation in your ICU patients and what to do about it. **The Canadian Nurse**, April,20-23.

Fairbank J. C. T. Couper J. Davies J. B. O'Brien J. P. (1980) The Oswestry Low Back Pain Disability Questionnaire. **Physiotherapy**, 66, 271-273.

Falk S. A. Woods N. F. (1973) Hospital noise - levels and potential health hazards. **The New England Journal of Medicine**, 289, (15), 774-781.

Faulkner A. (1979) Monitoring nurse-patient conversation in a ward. **Nursing Times** Occasional Paper 75 (35) 95-96.

Felton G. Huss K. Payne E. A. Srsic K. (1981) Preoperative nursing intervention with the patient for surgery: Outcomes of three alternative approaches. **International Journal of Nursing Studies**, 13, 83-96.

Fielding J. W. Fagg S. L. Jones B. G. Ellis D. Hockey M. S. Minawa A. Brookes V. S. Craven J. L. Mason M. C. Timothy A. Waterhouse J. A. H. Wrigley P. F. M. (1983) An interim report of a prospective randomised controlled study of adjuvent chemotherapy in operable gastric cancer: British stomach cancer group. **World Journal of Surgery**, 7, 390-399.

Fisher L. B. (1968) The diurnal mitotic rhythm in the human epidermis. **British Journal of Dermatology**, 80, 75-80.

Flaherty G. G. Fitzpatrick J. J. (1978) Relaxation technique to increase comfort level of post-operative patients. **Nursing Research**, 27, (6) 352-355.

Floyd J. A. (1984) Interaction between personal sleep-wake rhythms and psychiatric hospital rest-activity schedule. **Nursing Research**, 33, (5) 255-259.

Folkman S. (1984) Personal control and stress and coping processes: A theoretical analysis. **Journal of Personality and Social Psychology**, 46, (4) 839-852.

Fontaine D. K. (1989) Measurement of nocturnal sleep patterns in trauma patients. Heart and Lung, 18, (4) 402-410.

Fordham M. (1982) The recovery of physical fitness. **International Journal of Nursing Studies**, 19, (4) 205-212.

Fordham M. (1988) Chapter 8: Pain In Wilson-Barnett J. Batehup L. (Eds.) **Patient Problems - A research base for nursing care.** Scutari Press, London.

Frankel B. L. Coursey R. D. Buchbinder R. & Snyder F. (1976) Recorded and reported sleep in chronic primary insomnia. **Archives of General Psychiatry**, 33, 615-623.

Freed D. (1975) Inadequate analgesia at night (letter). **The Lancet**, 1, (7905) 519-520.

Georgopolous B. S. Jackson M. (1970) Nursing Kardex behaviour in an experimental study of patient units with and without clinical nurse specialists. **Nursing Research**, 19, 196-218.

Gortner S. R. (1980) Nursing Research: Out of the past and into the future. **Nursing Research**, 29, (4) 204-207.

Graves D. A. Foster T. S. Batenhorst R. L. Bennett R. L. Baumann T. J. (1983) Patient controlled analgesia. **Annals of Internal Medicine**, 99, 360-366.

Gulevich G. Dement W. Johnson L. C. (1966) Psychiatric and EEG observations on a case of prolonged (264 hours) wakefulness. **Archives of General Psychiatry**, 15, 29-36.

Guyatt G. H. Townsend M. Berman L. B. Keller J. L. (1987) A comparison of Likert and visual analogue scales for measuring change in function. **Journal of Chronic Diseases**, 40, 1129-1133.

Guyton A. C. (1984) **Physiology of the Human Body.** Saunders College Publishing (Sixth Edn.), Philadelphia p.441.

Halfens R. Evers G. Abu-Saad H. (1990) Determinants of pain assessment by nurses. **International Journal of Nursing Studies**, 27, (1) 43-49.

Hardy J. D. Wolff H. G. Goodell H. (1952) **Pain sensations and reactions.** Williams and Wilkins, Baltimore, MD.

Harkins S.W Price D. D. Braith J. (1989) Effects of extraversion and neuroticism on experimental pain, clinical pain and illness behaviour. **Pain**, 36, 209-218.

Hartmann E. L. (1973) **The Functions of Sleep**. Yale University Press; New Haven and London.

Hauri P. (1968) Effects of evening activity on early night sleep. **Psychophysiology**, 4, 267-277.

Haywood S. C. Jefford R. E. Macgregor R. B. Stevenson K. Wooding Jones G. D. E. (1961) The patient's view of the hospital - an experimental study. **The Hospital**, 57, 644-650.

Hecker B. R. Albert L. (1988) Patient-controlled analgesia: A randomised, prospective comparison between two commercially available PCA pumps and conventional analgesic therapy for post-operative pain. **Pain**, 35, 115-120.

Hetta J. Rimon R. Almqvist M. (1985) Mood alterations and sleep. **Annals of Clinical Research**, 15, (5) 252-256.

Hickmott K. C. Healy T. E. J. Roberts S. P. Faragher E. B. (1990) Back pain following general anaesthesia and surgery: Evaluation of risk factors and the effect of an inflatable lumbar support. **British Journal of Surgery**, 77, 571-575.

Hilton B. A. (1976) Quantity and quality of patients' sleep and sleep disturbing factors in a respiratory intensive care unit. **Journal of Advanced Nursing**, 1, 453-468.

Hilton B. A. (1985) Noise in acute patient care areas. **Research in Nursing and Health**, 8, (3) 283-291.

Hinks M. D. (1974) The most cruel absence of care. King's Fund Project Paper No. 3, King's Fund, London.

Holgate R. (1988) In the small hours. **Nursing Times**, 84, (21) 34.

Horne J. A. (1976) Recovery sleep following different visual conditions during total sleep deprivation in man. **Biological Psychology**, 4, 107-118.

Horne J. A. (1983) Human sleep and tissue restitution: some qualifications and doubts. **Clinical Science**, 65, 569-578.

Horne J. A. (1985) Sleep function with particular reference to sleep deprivation. **Annals of Clinical Research**, 17, (5) 199-208.

Horne J. A. (1986) Human slow wave sleep. **European Neurology**, 25, Supplement 2, 18-21.

Horne J. A. (1988) The substance of sleep. **New Scientist**, 1594, 60-62.

Horne J. A. & Ostberg O. (1976) A self-assessment questionnaire to dtermine morningness-eveningness in human circadian rhythm. **International Journal of Chronobiology**, 4, 97-110.

Horne J. A. Wilkinson S. (1984) Chronic sleep reduction: Daytime vigilance performance and EEG measures of sleepiness, with particular reference to 'practice' effects. **Psychophysiology**, 21, (6) 69-78.

Hunt J. M. Stollar T. D. Littlejohns D. W. Twycross R. G. Vere D. W. (1977) Patients with protracted pain: A survey conducted at the London Hospital. **Journal of Medical Ethics**, 3, (2) 61-73.

Huskisson E. C. (1974) Measurement of pain. **The Lancet**, 2 (7889) 1127-1131.

Huskisson E. C. (1982) Measurement of pain. **Journal of Rheumatology**, 9, 768-769.

Hyman R. B. Feldman H. R. Harris R. B. Levin R. F. Malloy G. B. (1989) The effects of relaxation training on clinical symptoms: A meta-analysis. **Nursing Research**, 38, (4) 216-220.

Ioffe S. Jansen A. H. & Chernick V. (1984) Hypercapnia alters sleep state pattern. **Sleep**, 7, (3) 219-222.

Jacox A. K. (1979) Assessing pain. **American Journal of Nursing**, 79, 895-900.

Jacox A. K. Stewart M. (1973) **Psychological contingencies of the pain experience.** University of Iowa College of Nursing, Iowa City, USA.

Johns M. W. (1984) Chapter 1: Normal sleep. In Priest R. G. (Ed.) **Sleep - an international monograph**. Update Books.

Johns M. W. Large M. A. Masterton J. P. Dudley H. A. F. (1974) Sleep and delirium after open heart surgery. **British Journal of Surgery**, 61, 377-381.

Johnson M. (1976) Communication of patients' feelings in hospital. In Bennett A. E. (Ed.) **Communication between doctors and patients.** Oxford University Press, Oxford.

Johnson J. E. (1988) Bedtime routines: Do they influence the sleep of elderly women? **Journal of Applied Gerontology**, 7, (1) 97-110.

Johnston M. (1976) Communication of patients' feelings in hospital. In Bennett A. E. (Ed.) **Communication Between Doctors and Patients.** Oxford University Press, Oxford. pp.31-43.

Jones J. Hoggart B. Withey J. Donaghue K. & Ellis B. W. (1979) What the patients say: a study of reactions to an intensive care unit. **Intensive Care Medicine**, 5, 89-92.

Joyce C. R. B. Zutshi D. W. Hrubes V. Mason R. M. (1975) Comparison of fixed interval and visual analogue scales for rating chronic pain. **European Journal of Clinical Pharmacology**, 8, (6) 415-420.

Kales A. Tan T. L. Kollar E. J. Naitoh P. Preston T. A. Malstrom E. J. (1970) Sleep patterns following 205 hours of sleep deprivation. **Psychosomatic Medicine,** 32, 189-200.

Karacan I. Green J. R. Taylor W. J. et al. (1974) Sleep in post myocardial infarction patients. In Eliot R. S. (Ed.) **Contemporary problems in cardiology: stress and the heart**. Futura Publications, pp.163-195.

Karacan I. Thornby J. I. Anch M. Booth G. H. Williams R. L. & Sallis P. J. (1976) Dose-related sleep disturbances induced by coffee and caffeine. **Clinical Pharmacology and Therapeutics**, 20, 682-689.

Karacan I. Thornby J. I. Anch A. M. & William R. L. (1978) The effects of high ambient temperature on sleep in young men. **Sleep Research,** 7, 171.

Karacan I. Wolff S. M. Williams R. L. Hursch C. J. Webb W. B. (1968) The effect of fever on sleep and dream patterns. **Psychosomatics,** 9, 331-339.

Katz R. (1977) Informed consent: Is it bad medicine? **Western Journal of Medicine,** 126, 426-428.

Kavey N. B. Altschuler K. Z. (1979) Sleep in herniorrhaphy patients. **The American Journal of Surgery,** 138, 682-687.

Kay D. C. Eisenstein R. B. Jasinski D. R. (1969) Morphine effects on human REM state, waking state and NREM sleep. **Psychopharmacology** (Berlin), 14, 404-410.

Keefe F. J. Crisson J. Urban B. J. Williams D. A. (1990) Analyzing low back pain: The relative contribution of pain coping strategies. **Pain,** 40, 293-301.

Keele K. D. (1948) The pain chart. **The Lancet,** 2, 6-8.

Keeri-Szanto M. Heaman S. (1972) Post-operative demand analgesia. **Surgery, Gynaecology and Obstetrics,** 134, 647-651.

Kemp J. (1984) Nursing at night. **Journal of Advanced Nursing,** 9, 217-223.

Kendel J. Schmidt-Kessen W. (1973) The influence of room temperature on night-time sleep in man (Polygraphic night-sleep recordings in the climate chamber). In Koella W. P. Levin P. (Eds.) **Sleep**. Karger, Basel pp.423-425.

Kessler S. (1976) Genetic factors in narcolepsy. In: Guilleminault C. Dement W. C. Passavant P. (Eds.) **Narcolepsy**. Spectrum Publications, New York.

Kirk K. (1972) Mitotic activiy and cell degeneration in the mouse thymus over a period of 24 hours. **Zeitschrift fur Zellforschung und Mikroskopische Anatomie**, 129, 188-195.

Kleiman R. L. Lipman A. G. Hare B. D. Macdonald S. D. (1987) PCA vs. regular IM injections for severe post-operative pain. **American Journal of Nursing**, 1491-1492.

Knight C. L. Mehta M. (1978) Perioperative care. Postoperative pain relief. **British Journal of Hospital Medicine**, 19, (5) 462-469.

Knill R. L. Moote C. A. Skinner M. I. Rose E. A. (1990) Anesthesia with abdominal surgery leads to intense REM sleep during the first post-operative week. **Anesthesiology**, 73, 52-61.

Koninck J. De, Gagnon P. & Lallier S. (1983) Sleep positions in the young adult and their relationship with the subjective quality of sleep. **Sleep**, 6 (1) 52-59.

Korner A. (1965) Growth hormone control of biosynthesis of protein and ribonucleic acid. **Recent Progress in Hormone Research**, 21, 205-236.

Koskenvuo M. Partinen M. Kaprio J. (1985) Snoring and disease. **Annals of Clinical Research**, 17 (5) 247-251.

Kremer E. Atkinson J. H. Ignelzi R. J. (1981) Measurement of pain: Patient preference does not confound pain measurement. **Pain**, 10, (2) 241-248.

Kreuger J. M. Pappenheimer J. R. Kanowsky M. L. (1978) Sleep-promoting factor S purification and properties. **Proceedings of the National Academy of Sciences**, 75, 5235-5238.

Kuhn S. Cooke K. Collins M. Jones J. M. Mucklow J. C. (1990) Perceptions of pain relief after surgery. **British Medical Journal**, 300, 1687-1690.

Lander J. (1990) Clinical judgments in pain management. **Pain**, 42, 15-22.

Lange M. P. Dahn M. S. Jacobs L. A. (1988) Patient-controlled analgesia versus intermittent analgesia dosing. **Heart and Lung**, 17, (5) 495-498.

Langley G. B. Shepheard H. (1984) Problems associated with pain measurement in arthritis: Comparison of the visual analogue and verbal rating scales. **Clinical and Experimental Rheumatology**, 2, 231-234.

Lasagna L. (1960) The clinical measurement of pain. **Annals of the New York Academy of Sciences**, 86, 26-37.

Lazarus R. S. Launier R. (1978) Stress related transactions between person and environment. In Pervin L. A. Lewis M. (Eds.) **Perspectives in Interactional Psychology**. Plenum Press, New York.

Lee K. A. Kieckhefer G. M. (1989) Technical notes - Measuring human responses using visual analogue scales. **Western Journal of Nursing Research**, 11, (1) 128-132.

Leibeskind J. C. Melzack R. (1987) The International Pain Foundation: Meeting a need for education in pain management. **Pain**, 30, 1-2.

Leigh T. J. Bird H. A. Hindmarch I. Constable P. D. L. Wright V. (1988) Factor analysis of the St. Mary's Hospital Sleep Questionnaire. **Sleep**, 11, (5) 448-453.

Levere T. E. Davis N. (1977) Arousal from sleep: The physiological and subjective effects of a 15 dB(A) reduction in aircraft flyover noise. **Aviation, Space and Environmental Medicine**, 48, 607-611.

Levin R. F. Malloy G. B. Hyman R. B. (1987) Nursing management of post-operative pain: Use of relaxation techniques with female cholecystectomy patients. **Journal of Advanced Nursing**, 12, 463-472.

Levine J. D. Gordon N. C. Fields H. L. Howard L. (1978) The mechanism of placebo analgesia. **The Lancet**, 2, 654-657.

Ley P. (1976) Towards better doctor-patient communications. In Bennett A. E. (Ed.) **Communication Between Doctors and Patients.** Oxford University Press, Oxford.

Linton S. J. Melin L. Stjernlöf K. (1985) The effects of applied relaxation and operant activity training on chronic pain. **Behavioural Psychotherapy**, 13, 87-100.

Lorig K. (1984) Measurement of pain (letter). **Nursing Research**, 33, 376.

Luce G. G. Segal J. (1969) **Insomnia: The Guide for Troubled Sleepers.** Doubleday, New York.

Lucente F. & Fleck S. (1972) A study of hospitalisation anxiety in 408 medical and surgical patients. **Psychosomatic Medicine**, 34, 304-312.

MacLeod Clark J. (1983) Nurse-patient communication in surgical wards. In Wilson-Barnett J. (Ed.) **Nursing Research: ten studies in patient care.** John Wiley & Sons, Chichester.

Maguire P. Tait A. Brooke M. Sellwood R. (1980) Emotional aspects of mastectomy: A conspiracy of pretence. **Nursing Mirror**, 150, (2) 17-19.

Marks R. M. Sachar E. J. (1973) Undertreatment of medical patients with narcotic analgesics. **Annals of Internal Medicine**, 78, 173-181.

Marlowe S. Engstrom R. White P. F. (1989) Epidural patient-controlled analgesia (PCA): An alternative to continuous epidural infusions. **Pain**, 37, 97-101.

Martinez-Urrutia A. (1975) Anxiety and pain in surgical patients. **Journal of Consulting and Clinical Psychology**, 43, (4) 437-442.

Mason D. J. (1981) An investigation of the influence of selected factors on nurses' inferences of patient suffering. **International Journal of Nursing Studies**, 18, (4) 251-259.

Mauer A. M. (1965) Diurnal variation of proliferative activity in human bone marrow. **Blood**, 26, 1-7.

Maxwell C. (1978) Sensitivity and accuracy of the visual analogue scale: A psycho-physical classroom experiment. **British Journal of Clinical Pharmacology**, 6, 15-24.

McCaffery M. (1972) **Nursing Management of the Patient with Pain**. J. B. Lippincott, Philadelphia. p.8.

McCaffery M. (1983) **Nursing the Patient in Pain** (2nd edn.). Harpur & Row, London.

McCaffery M. Ferrell B. O'Neil-Page E. Lester M. Ferrell B. (1990) Nurses' knowledge of opioid drugs and psychological dependence. **Cancer Nursing**, 13, (1) 21-27.

MacFadyen U. M. Oswald I. Lewis S. A. (1973) Starvation and slow-wave sleep. **Journal of Applied Physiology**, 35, (3) 391-394.

McGhie A. & Russell S. (1962) The subjective assessment of normal sleep patterns. **Journal of Mental Science**, 108, 642-654.

McGuire D. B. (1988) Measuring pain. In Frank-Stromberg M. (Ed.) **Instruments for Clinical Nursing**. Appleton and Lange, California USA pp. 333-356.

McLintock T. T. C. Aitken H. Downie C. F. A. Kenney G. N. C. (1990) Post-operative analgesic requirements in patients exposed to positive intra-operative suggestions. **British Medical Journal**, 301, (6755) 788-790.

Megirian D. Ryan A. T. Sherrey J. H. (1980) An electrophysiological analysis of sleep and respiration of rats breathing different gas mixtures: Diaphragmatic muscle function. **Electroencephalography and Clinical Neurophysiology**, 50, 303-313.

Meinhart N. T. McCaffery M. (1983) **Pain: A nursing approach to assessment and analysis.** Appleton-Century-Crofts, Norwalk, USA.

Melzack R. (1975) The McGill pain questionnaire: Major properties and scoring methods. **Pain**, 1, 277-299.

Melzack R. (1983) Concepts of pain measurement. In: Melzack R. (Ed.) **Pain measurement and assessment.** Raven Press, New York.

Melzack R. Abbott F. V. Zackon W. Mulder D. Davis M. W. L. (1987) Pain on a surgical ward: a survey of the duration and intensity of pain and the effectiveness of medication. **Pain**, 29, 67-72.

Melzack R. Casey K. L. (1968) Sensory, motivational and central control determinants of pain. A new conceptual model. In Kenshalo D. R. (Ed.) **The Skin Senses**. Charles C. Thomas, Springfield pp.423-439.

Melzack R. Wall P. D. (1965) Pain mechanisms: A new theory. **Science**, 150, (3699) 971-979.

Miller K. (1987) Deep breathing relaxation - a pain management technique. **AORN Journal**, 45, (2) 484-488.

Modig J. (1952) Thromboembolism and blood loss: Continuous epidural block vs. general anaesthesia with controlled ventilation. **Regional Anaesthesie**, 7, S84.

Modig J. (1976) Respiration and circulation after total hip replacement surgery. **Acta Anaesthesiologica Scandinavica**, 20, 225.

Moja E. A. Antinoro E. Cesa-Bianchi M. Gessa G. L. (1984) Increase in stage 4 sleep after ingestion of a tryptophan-free diet in humans. **Pharmacological Research Communications**, 16, (9) 909-914.

Monroe L. J. (1967) Psychological and phyiological differences between good and poor sleepers. **Journal of Abnormal Psychology**, 72, 255-264.

Moore A. K. Vilderman S. Lubenskyi W. McCans J. Fox G. S. (1990) Differences in epidural morphine requirements between elderly and young patients after abdominal surgery. **Anesthesia and Analgesia**, 70, 316-320.

Moore-Ede M. C. (1983) The circadian timing system in mammals: two pacemakers preside over many oscillators. **Federation Proceedings**, 42, 2802-2808.

Moote C. A. Knill R. L. Skinner M. I. Rose E. A. (1989) Morphine disrupts nocturnal sleep in a dose-dependent fashion. **Anesthesia and Analgesia**, Supplement 69, 200.

Morgan K. (1987) **Sleep and Ageing**, Croom Helm, London & Sydney, p.12.

Morgan H. White B. (1983) Sleep deprivation. **Nursing Mirror**, 5 October, NICG Journal, S8-S11.

Murphy F. Bentley S. Ellis B. W. Dudley H. (1977) Sleep deprivation in patients undergoing operation: A factor in the stress of surgery. **British Medical Journal**, 2, (6101) 1521-1522.

Murray J. Dunn G. Williams P. Tarnapolsky A. (1981) Factors affecting the consumption of psychotropic drugs. **Psychological Medicine**, 11, 551-560.

Muzet A. Libert J-P Candas V. (1984) Ambient temperature and human sleep. **Experientia**, 40, 425-429.

Muzet A. Erhart J. (1978) Amplitude des modifications cardiovasculaires provoquées par le bruit au cours du sommeil. **Coeur et Medecine Interne** (Paris), 17, 49-56.

Muzet A. Erhart J. Eschenlauer R. Lienhard J. P. (1981) Habituation and age differences of cardiovascular responses to noise during sleep. In Koella W. P. (Ed.) **Sleep**. Fifth European Congress of Sleep Research. Karger, Basel, pp.212-215.

Myco F. (1983) **Nursing care of the hemiplegic stroke patient.** Harper and Row, London.

Narrow B. W. Buschle K. B. (1987) **Fundamentals of Nursing Practice** (Second Edn.). Wiley, New York.

NHS Management Consultancy Services (1987) **Study of night nursing services.** Report No. 2/87. Department of Health and Social Security, London.

Nimmo W. S. Duthie D. J. R. (1987) Pain relief after surgery. **Anaesthesia and Intensive Care**, 15, 68-71.

Nisbett R. E. Schachter S. (1966) The cognitive manipulation of pain. **Journal of Experimental Social Psychology**, 2, 227-236.

Nygaard K. K. (1936) Routine spinal anaesthesia in a provincial hospital with a comparative study of post-operative complications following spinal and ether anaesthesia. **Acta Chirurgica Scandinavica**, 78, 379-396.

Oberst M. T. (1978) Nurses' inferences of suffering: The effects of nurse-patients similarity and verbalisations of distress. In Nelson M. J. (Ed.) **Clinical Perspectives in Nursing Research**. Teachers College Press, New York, pp.38-60.

Ogilvie A. J. (1980) Sources and levels of noise on the ward at night. **Nursing Times**, July 31, 1363-1366.

Orr W. C. & Stahl M. L. (1977) Sleep disturbances after open heart surgery. **American Journal of Cardiology**, 39, 196-201.

Oswald I. (1980) Sleep studies in clinical pharmacology. **British Journal of Clinical Pharmacology**, 10, 317-326.

Oswald I. (1984) Chapter 2: Good, poor and disordered sleep. In Priest R. G. (Ed.) **Sleep - an international monograph**. Update Books.

Otto E. (1973) Physiological analysis of human sleep disturbance induced by noise and increased room temperature. In Koella W. P. Levin P. (Eds.) **Sleep**. Karger, Basel pp. 414-418.

Owen H. McMillan V. Rogowski D. (1990) Post-operative pain therapy: A survey of patients' expectations and their experiences. **Pain**, 41, 303-307.

Pappenheimer J. R. (1977) Sleep and respiration of rats during hypoxia. **Journal of Physiology** (London), 266, 191-207.

Parbrook G. D. Dalrymple D. G. Steel D. F. (1983) Personality assessment and post-operative pain and complications. **Journal of Psychosomatic Research**, 17, 277-285.

Partinen M. Kaprio J. Koskenvuo M. & Langinvainio H. (1983) Genetic and environmental determination of human sleep. **Sleep,** 6, (3) 179-185.

Pearson R. E. (1961) Response to suggestions given under general anaesthesia. **American Journal of Clinical Hypnosis,** 4, 106-114.

Petre-Quadens O. Schlag J. D. (Eds) (1974) **Basic Sleep Mechanisms.** Academic Press, New York.

Petursson H. Lader M. H. (1984) **Dependence on tranquillisers**. Maudsley Monograph Vol. 28. Oxford University Press, Oxford.

Pollman L. Hildebrandt G. (1987) Circadian profiles and circaseptan periodicity in the frequency of administration of analgesic drugs after oral surgery. **Functional Neurology,** 2, (2) 231-237.

Porter J. Jick H. (1980) Addiction rare in patients treated with narcotics. **New England Journal of Medicine,** 302, 123.

Rafferty A. M. (1988) Post-operative backache. **Nursing Times,** 84, (46) 32-35.

Raiman J. (1986) Towards understanding pain and planning for relief. **Nursing,** 11, 411-423.

Rannels S. R. Jefferson L. S. (1980) Effect of glucocorticoids on muscle protein turnover in perfused rat hemicorpus. **American Journal of Physiology,** 238, E564-E572.

Reading A. E. (1980) A comparison of pain rating scales. **Journal of Psychosomatic Research,** 24, 119.

Reading A. E. (1984) Testing pain mechanisms through persons in pain. In Wall P. D. Melzack R. (Eds.) **Textbook of Pain**. Churchill Livingstone, Edinburgh.

Rechtschaffen A. Gilliland M. A. Bergman B. M. & Winter J. B. (1983) Physiological correlates of prolonged sleep deprivation in rats. **Science,** 221, 182-184.

Rechtschaffen A. & Kales A. (1968) **A manual of standardised terminology, techniques and scoring system for sleep stages of human subjects.** US Dept of Health, Education and Welfare, Bethesda, Maryland.

Reeve D. R. E. (1975) A study of mitotic activity and the diurnal variation of the epithelial cells in wounded rectal mucous membrane. **Journal of Anatomy**, 119, 333-345.

Reeve D. R. E. (1977) Some observations on the diurnal variation of mitosis in the stratified squamous epithelium of wounded tympanic membrane. **Cell Tissue Research**, 182, 253-263.

Reinberg A. Lévi F. (1987) Clinical chronopharmacology with special reference to NSAIDS. **Scandinavian Journal of Rheumatology**, Supplement 65, 118-122.

Revill S. I. Robinson J. O. Rosen M. Hogg M. I. J. (1976) The reliability of a linear analogue for evaluating pain. **Anesthesia**, 31, (11) 1191-1198.

Reynolds C. F. Kupfer D. J. Taska L. S. Hoch C. C. Sewitch D. E. Spiker D. J. (1985) Sleep of healthy seniors: a revisit. **Sleep**, 8, 20-29.

Roffwarg H. P. Muzio J. N. Dement W. C. (1966) Ontogenic development of the human sleep-dream cycle. **Science**, 152, 603-619.

Roper N. Logan W. W. Tierney A. J. (1990) **The Elements of Nursing** (Third Edn.). Churchill Livingstone, Edinburgh.

Rosen M. (1984) Patient controlled analgesia. **British Medical Journal**, 289, 640-641.

Rosenstiel A. K. Keefe F. J. (1983) The use of coping strategies in chronic low back pain patients: Relationship to patient characteristics and current adjustment. **Pain**, 17, 33-44.

Roth B. Nevsimalova S. Rechtschaffen A. (1972) Hypersomnia with 'sleep drunkenness'. **Archives of General Psychiatry**, 26, 456-462.

Royal Commission on the National Health Service (1978) **Patients' attitudes to the hospital service.** Research Paper No. 5, HMSO, London.

Ryan A. T. & Megirian D. (1982) Sleep-wake patterns of intact and carotid sinus nerve sectioned rats during hypoxia. **Sleep**, 5, 1-10.

Saetren H. (1972) The diurnal variation of the first mitotic wave reeased among rat kidney tubule cells by partial nephrectomy. **Acta Pathologica et Microbiologica Scandinavica**, Section A, 80, 736-742.

Saxey S. (1986) The nurses' response to post-operative pain. **Nursing**, 10, 377-381.

Schiffman P. L. Trontell M. C. Mazar M. F. & Edelman N. H. (1983) Sleep deprivation decreases ventilatory reponse to CO_2 but not load compensation. **Chest**, 84, 695-698.

Scott J. Huskisson E. C. (1976) Graphic representation of pain. **Pain**, 2, 175-184.

Scott J. Huskisson E. C. (1979) Accuracy of subjective measurements made with or without previous score: An important source of error in serial measurement of subjective states. **Annals of the Rheumatic Diseases**, 38, 558-559.

Scott L. E. Clum G. A. Peoples J. B. (1983) Pre-operative predictors of post-operative pain. **Pain**, 15, (3) 283-293.

Scott N. B. Mogensen T. Bigler D. Kehlet H. (1989) Comparison of the effects of continuous intrapleural vs epidural administration of 0.5% bupivacaine on pain, metabolic response and pulmonary function following cholecystectomy. **Acta Anaesthesiologica Scandinavica**, 33, (7) 535-539.

Seers C. J. (1987) Pain, anxiety and recovery in patients undergoing surgery. PhD thesis, University of London.

Seers C. J. (1988) Factors affecting pain assessment. **The Professional Nurse**, 3, (6) 201-206.

Seers C. J. (1989) Patients' perceptions of acute pain. In Wilson-Barnett J. Robinson S. (Eds.) **Directions in Nursing Research**. Scutari Press, London.

Seltzer J. L. Larijani G. E. Goldberg M. E. Marr A. T. (1987) Intrapleural bupivacaine - a kinetic and dynamic evaluation. **Anesthesiology**, 67, (5) 798-800.

Selye H. (1950) **The Physiology and Pathology of Exposure to Stress.** Asta, Montreal.

Shapiro C. M. Bortz R. D. Bartel P. R. Jooste P. L. (1975) Sleep patterns after graded exercise. **Journal of Applied Physiology**, 39, 187-190.

Shapiro C. M. Verschoor G. V. (1979) Sleep patterns after a marathon. **South African Journal of Science**, 75, 415-416.

Shaver J. Giblin E. Heitkemper M. Paulsen V. (1989) Sleep and its restorative function. **Communicating Nursing Research**, 22, 80.

Simmons D. J. Cohen M. (1980) Post-fracture linear bone growth in rats: A diurnal rhythm. **Clinical Orthopaedics**, 149, 240-248.

Sofaer B. (1984) The effect of focused education for nursing teams on post-operative pain of patients. PhD thesis, University of Edinburgh.

Soutar R. L. Wilson J. A. (1986) Does hospital noise disturb patients? **British Medical Journal**, 292, (6516) 305.

SPSSX Inc. (1983) **SPSSX User's Guide.** McGraw-Hill Book Company, New York.

Sriwatanakul K. Weis O. F. Alloza J. L. Kelvie W. Weintraub M. Lasagna L. (1983) Analysis of narcotic analgesic usage in the treatment of post-operative pain. **Journal of the American Medical Association**, 250, 926-929.

Stead W. (1985) One awake, all awake! **Nursing Mirror**, 160, 16, 20-21.

Stepanova S. I. (1974) Effects of transmeridianal flights on the human body. **Kosmicheskaia Biologiia I Aviakosmicheskaia Meditsina** (Moskva), 8, 3-12.

Steriade M. & Hobson J. A. (1976) Neuronal activity during the sleep-waking cycle. **Progress in Neurobiology**, 6, 155-376.

Stewart M. L. (1977) Measurement of clinical pain. In Jacox A. K. (Ed.) **Pain: A Source Book for Nurses and Other Health Professionals.** Little, Brown & Co., Boston.

Storlie F. (1978) Pointers for assessing pain. **Nursing (US)**, 8, (5) 37-39.

Strian F. Lautenbacher S. Galfe G. Holzl R (1989) Diurnal variations in pain perception and thermal sensitivity. **Pain**, 36, 125-131.

Stromskag K. E. Steen P. A. (1988) Comparison of interpleural and epidural anesthesia for extracorporeal shock wave lithotripsy. **Anesthesia and Analgesia**, 67, (2) 1181-1183.

Taenzer P. (1983) Post-operative pain: Relationship among measures of pain, mood and narcotic requirements. In Melzack R. (Ed.) **Pain Measurement and Assessment**. Raven Press, New York.

Taenzer P. Melzack R. Jeans M. E. (1986) Influence of psychological factors on post-operative pain, mood and analgesic requirements. **Pain**, 24, 331-342.

Tamsen A. Hartvig P. Fagerlund C. Dahlstrom B. Bondesson U. (1982) Patient-controlled analgesic therapy. **Acta Anaesthesiologica Scandinavica**, Suppl. 74, 157-160.

Taylor A. G. Skelton J. A. Butcher J. (1984) Duration of pain condition and physical pathology as determinants of nurses' assessments of patients in pain. **Nursing Research**, 33, 4-8.

Teske K. Daut R. L. Cleeland C. S. (1983) Relationship between nurses' observations and patients' self-reports of pain. **Pain**, 16, 289-296.

Titlebaum H. M. (1988) Relaxation. **Holistic Nurse Practitioner**, 2, (3) 17-25.

Trinder J. Montgomery I. & Paxton S. J. (1988) The effect of exercise on sleep: the negative view. **Acta Physiologica Scandinavica**, 133, suppl. 574, 14-20.

US Environmental Protection Agency (1974) **Information on levels of environmental noise requisite to protect public health and welfare with an adequate margin of safety.** Report No. 550-9-74-004. EPA, Washington, DC.

Valk I. M. & Van Den Bosch J. S. G. (1978) Intra daily variation of the human ulnar length and short term growth - a longitudinal study in eleven boys. **Growth**, 42, 107-111.

Vertes R. P. (1986) A life-sustaining function for REM sleep: A theory. **Neuroscience and Behavioural Reviews**, 10, 371-376.

Vitiello M. V. Prinz P. N. & Halter J. B. (1983) Sodium restricted diet increases night-time plasma norepinephrine and impairs sleep patterns in man. **Journal of Clinical Endocrinology and Metabolism**, 56 (3) 553-556.

Vuori I. Urponen H. Hasan J. Partinen M. (1988) Epidemiology of exercise effects on sleep. **Acta Physiologica Scandinavica**, 133, Supplementum 133, 3-7.

Walker J. M. Floyd T. C. Fein G. Cavness R. Lualhati R. Feinberg I. (1978) Effects of exercise on sleep. **Journal of Applied Physiology**, 44, 945-951.

Walker B. B. (1972) The post-surgery heart patient: Amount of uninterrupted time for sleep and rest during the first, second and third post-operative days in a teaching hospital. **Nursing Research**, 21, 2, 164-169.

Walker J. Campbell S. (1988) Pain assessment and the nursing process. **Senior Nurse**, 8, (5) 28-31.

Watson J. E. Royle J. R. (1987) **Watson's Medical-Surgical Nursing and Related Physiology** (Third Edn.). Baillière Tindall, London.

Watt-Watson J. (1987) Nurses' knowledge of pain issues: A survey. **Journal of Pain and Symptom Management**, 2, (4) 207-211.

Webb W. B. (1965) Sleep characteristics of human subjects. **Bulletin of the British Psychological Society**, 18, 1-10.

Webb W. B. (1982) Sleep in older persons: sleep structures or 50 to 60 year old men and women. **Journal of Gerontology**, 37, 581-586.

Webb W. (1988) An objective behavioral model of sleep. Sleep, 11, 488-496.

Webb W. B. Agnew H. W. (1971) Stage 4 sleep: influence of time-course variables. **Science**, 174, 1354-1356.

Webb W. B. Swinburne H. (1971) An observational study of sleep of the aged. **Perception and Motor Skills**, 32, 895-898.

Wehr T. A. Wirz-Justice A. Goodwin F. K. Duncan W & Gillin J. C. (1979) Phase advance of the circadian sleep-wake cycle as an anti-depressant. **Science**, 206, 710-713.

Weis O. F. Sriwatanakul K. Alloza J. L. Weintraub M. Lasagna L. (1983) Attitude of patients, housestaff and nurses toward post-operative analgesic care. **Anesthesia and Analgesia**, 62, 70-74.

Weitzman E. D. Kripke D. F. Golmacher D. McGregor P. & Nogire C. (1970) Acute reversal of the sleep-waking cycle in man. **Archives of Neurology**, 22, 483-489.

Weitzman E. D. Zimmerman J. C. Czeisler C. A. Ronda J. (1983) Cortisol secretion is inhibited during sleep in normal man. **Journal of Clinical Endocrinology and Metabolism**, 56, 352-358.

Wells N. (1982) The effect of relaxation on post-operative muscle tension and pain. **Nursing Research**, 31, (4) 236-238.

Wever R. A. (1979) **The circadian system of man: Results of experiments under temporal isolation.** Springer-Verlag, New York.

Wever R. A. (1984) Properties of human sleep-wake cycles: parameters of internally synchronised free-running rhythms. **Sleep**, 7, 27-51.

Wewers M. E. Lowe N. K. (1990) A critical review of visual analogue scales in the measurement of clinical phenomena. **Research in Nursing and Health**, 13, 227-236.

White D. P. Douglas N. J. Pickett C. K. Zwillich C. W. & Weil J. V. (1983) Sleep deprivation and the control of ventilation. **American Journal of Respiratory Disorders**, 128, 984-986.

White P. F. (1987) Mishaps with patient-controlled analgesia (PCA). **Anesthesiology**, 66, 81-83.

White P. F. (1988) Use of patient-controlled analgesia for management of acute pain. **Journal of the American Medical Association**, 259, (2) 243-247.

Wilkinson R. T. Campbell K. B. (1984) Effects of traffic noise on quality of sleep: Assessment by EEG, subjective report or performance next day. **Journal of the Acoustical Society of America**, 75, (2) 468-475.

Williams D. L. McLean A. W. Cairns J. (1983) Dose-response effects of ethanol on the sleep of young women. **Journal of Studies on Alcohol**, 44, 515-523.

Williams R. L. Karacan I. Hursch C. J. (1974) **EEG of Human Sleep**. John Wiley and Sons, New York 1974, 51-64.

Wilmore D. W. Long J. M. Mason A. D. Pruitt B. A. (1976) Stress in surgical patients as a neurophysiologic reflex response. **Surgery, Gynaecology and Obstetrics**, 142, 257-269.

Wilson J. F. (1981) Behavioural preparation for surgery: Benefit or harm? **Journal of Behavioural Medicine**, 4, (1) 79-102.

Winget C. M. Deroshia C. W. Markley C. L. & Holley D. C. (1984) A review of human physiological and performance changes associated with desynchronosis of biological rhythms. **Aviation Space and Environmental Medicine**, 55, (12) 1085-1096.

Woodforde J. M. Merskey H. (1972) Some relationships between subjective measures of pain. **Journal of Psychosomatic Research**, 16, 173-178.

Woods N. (1972) Patterns of sleep in post-cardiotomy patients. **Nursing Research**, 21, 347-352.

Woolf C. J. (1983) Evidence for a central component of post-injury pain hypersensitivity. **Nature**, 306, 686-688.

Woolf C. J. Wall P. D. (1986) Morphine sensitive and morphine insensitive actions of C-fibre input on the rat spinal cord. **Neuroscience Letters**, 64, 221-225.

World Health Organization (1980) **Noise**. WHO, Geneva.

Yogman M. W. Zeisel S. H. (1984) Diet and sleep patterns in newborn infants. **New England Journal of Medicine**, 310 (14) 928-929.

Zacharias M. Pfeifer M. V. Herbison P. (1990) Comparison of two methods of intravenous administration of morphine for post-operative pain relief. **Anaesthesia and Intensive Care**, 18, 205-209.

Zborowski M. (1952) Cultural component in response to pain. **Journal of Social Issues**, 8, (4) 16-30.

Zepelin H. (1973) A survey of age differences in sleep patterns and dream recall among well-educated men and women. **Sleep Research**, 2, 81.

Zepelin H. McDonald C. S. & Zammit G. K. (1984) Effects of age on auditory awakening thresholds. **Journal of Gerontology**, 39, (3) 294-300.

Zulley J. (1980) Timing of sleep within the circadian temperature cycle. **Sleep Research**, 9, 282.

Zulley J. Schulz H. (1980) Sleep and body temperature in free-running sleep-wake cycles. In Popoviciu L. Asgian B. Badin G. (Eds.) **Sleep**. Karger, Basel.

Appendix 1

Sleep Assessment Interview Schedule

(Study 1)

Subject No. ☐☐☐

I'd like to ask you some questions about your sleep.

The first half ask about your normal sleep at home and the second half are about your sleep in hospital. Your answers should help us to pinpoint the sorts of problems people might have sleeping in hospital so that the nurses will be better able to help patients to sleep.

Date ______________________ ☐

Pre/post intervention ______________________ ☐

Hospital no. ______________________

Age ______________________ ☐☐

Sex ______________________ ☐

Live alone? ______________________ ☐

Ward ______________________ ☐

Ward design ______________________ ☐

Take night ______________________ ☐

Date of admission ______________________ ☐☐

Date of surgery ______________________ ☐☐

Reason for admission ______________________ ☐

Primary diagnosis ______________________ ☐☐☐☐

____

Secondary diagnoses ______________________ ☐☐☐☐

______________________ ☐☐☐☐

Hypnotics (home)________________________________ ☐

(hospital)________________________________ ☐

given last night? ________________________________ ☐

Analgesics (home)________________________________ ☐

(hospital)________________________________ ☐

given last night?________________________________ ☐

Other drugs (home) ________________________________ ☐

____

(hospital)________________________________ ☐

____

Type of bed/mattress ________________________________ ☐

Nursing notes:

Sleep at home ________________________________

____

____

quality ☐
quantity ☐
medication ☐
pre-sleep routines ☐

Sleep last night ________________________________

____

____

quality ☐
quantity ☐
medication ☐
pre-sleep routines ☐

Part I - Sleep at Home

1. At what time do you usually settle down ready to go to sleep at home?

   ______________________________ ☐☐☐☐

2. When you are at home, are there certain things you do routinely to help you relax and get ready to go to sleep?

   Do you have a hot drink?
   What do you have? ______________________ ☐

   Do you have an alcoholic drink? ☐ ☐
   Do you smoke a cigarette? ☐ ☐
   Do you take a hot bath? ☐ ☐
   Do you read? ☐ ☐
   Do you watch television? ☐ ☐
   Do you listen to the radio? ☐ ☐

   Anything else?

   ______________________________ ☐☐

   ____

3. Do you ever take tablets to help you sleep?

   Yes ☐ No ☐ ☐

   If yes, what are they called? ______________________

   hypnotics ☐
   analgesics ☐
   other ☐

   How often do you take them? ______________________ ☐

4. How many cigarettes do you usually smoke each day?

   ______________________________ ☐☐

5. Do you drink alcohol at all?

____ ☐

6. About how long does it usually take you to get to sleep at home, after settling down in bed?

____ ☐☐☐

7. How often do you usually wake up during the night when you're at home?

____ ☐☐

8. What causes you to wake up during the night when you're at home?

____ ☐☐

9. How many hours sleep do you usually have each night at home?

____ ☐☐☐☐

10. What time do you usually wake up in the morning at home?

____ ☐☐☐☐

11. Do you usually wake up naturally? (Without an alarm, etc.)

Yes ☐ No ☐

If no, what usually wakes you up at home?

____ ☐☐

12. Do you usually take a nap during the day when you're at home?

Yes ☐ No ☐

How long do you spend asleep? ________________ ☐☐☐

Do you usually fall asleep before getting into bed?

Yes ☐ No ☐ ☐

Part II - Sleep in Hospital

13. Last night were you able to go through the same routines that help you to relax and get ready to sleep at home?

Yes ☐ No ☐ ☐

If no, why not? ______________________________ ☐

14. (Smokers) How many cigarettes did you smoke yesterday?

____ ☐☐

15. Did you take any tablets last night to help you to sleep?

Yes ☐ No ☐

If so, what were they? ________________________ ☐

hypnotics ☐
analgesics ☐
other ☐

Were these offered or requested? ______________ ☐

Did you ask for them to be prescribed? __________ ☐

16. What time did you settle down ready to go to sleep last night?

____ ☐☐☐☐

17. How long did it take you to fall asleep last night after you had settled down?

______________________________________ ☐☐☐

18. How many times did you wake during last night?

______________________________________ ☐☐

19. If your sleep was disturbed last night, please describe the cause or causes:

Strange surroundings	☐	☐
Pain	☐	☐
Went to toilet	☐	☐
Worry	☐	☐
Bad dreams	☐	☐
Noise	☐	☐

What was the noise? ________________________ ☐

Too hot	☐	☐
Too cold	☐	☐
Uncomfortable bed	☐	☐
Uncomfortable in bed	☐	☐

Anything else

____

______________________________________ ☐☐

Did you tell the nurses? ________________________ ☐

20. If your sleep was disturbed on previous nights, please describe the cause or causes:

Strange surroundings	☐	☐
Pain	☐	☐
Went to toilet	☐	☐
Worry	☐	☐
Bad dreams	☐	☐
Noise	☐	☐
What was the noise? ______________________		☐
Too hot	☐	☐
Too cold	☐	☐
Uncomfortable bed	☐	☐
Uncomfortable in bed	☐	☐

Anything else

____

______________________________________ ☐☐

Did you tell the nurses? ______________________ ☐

21. Did anything or anyone help you get back to sleep?

Yes ☐ No ☐

If yes, please describe what helped:

____

____

______________________________________ ☐☐

22. Overall, how many hours sleep do you think you got last night?

______________________________________ ☐☐☐☐

23. Did you wake up naturally this morning?

Yes ☐ No ☐

If not, what woke you up? ____________________

____

____ ☐☐

24. What time did you finally wake up this morning?

____ ☐☐☐☐

25. Did you have a nap during the day yesterday?

Yes ☐ No ☐

How long did you spend asleep? ______________ ☐☐☐

Did you fall asleep before getting into bed last night?

Yes ☐ No ☐ ☐

26. Please tell me how last night's sleep compares with how you normally sleep at home. Was it:

Far better? ☐
Better? ☐
The same? ☐
Worse? ☐
Far worse? ☐

27. Do you think that anything could be done to help you sleep better while you're in hospital?

____ ☐☐

____

____

____

____

Appendix 2

Diagnoses of patients (Study 1)

(as recorded in nursing documentation)

Abdominal pain	Bilateral inferior ethmoidectomy - endonasal sinus surgery
Abdominal pain - hiatus hernia	Bilateral leg ulcers
Abdominal pain + jaundice	Biopsy of 2 neck lumps
Abdomino-perineal resection	Bleeding per rectum
Above knee amputation (ischaemic ulcers right foot)	Bronchoscopy, bone scan, ? metastases
Above knee amputation left leg	Cancer - bladder
Amputation infected 2nd left toe	Cancer - cervix
Amputation left toe	Cancer - cervix, rectovaginal fistula, stoma
Amputation necrotic toe right foot	Cancer - neck (exploration)
Anaemia	Cancer - pharynx and oesophagus
Angioplasty of femoral artery	Cancer - tongue
Anterior resection	Carotid endarterectomy
Aortic bifurcation graft	Cerebral infarction
Aortic occlusion	Chest pain, Mallory-Weiss tear
Aortic occlusion (no surgery)	Cholecystectomy
Aorto-bifemoral graft	Cholecystectomy and reconstruction of pylorus
Aorto-bifemoral graft for ischaemia	Chronic obstructive airways disease
Aorto-iliac bypass grafts	COAD, cor pulmonale
Appendicitis	Colectomy
Ascending aortic aneurysm	Colectomy, cancer bowel
Ascites, urinary retention	Colonoscopy, bowel polyps
Asthma	Colostomy for rectovaginal fistula
Barium enema	Colotomy + excision of rectal polyp
Below knee amputation - femoral occlusion	Coronary bypass graft

Crohn's disease	Excision of pilonidal sinus
Curettage of para-rectal sinus	Exploration of left part of neck
CVA	Faecal impaction
Dacron graft - aneurysm (PVD)	Femoral aneurysm
Deep vein thrombosis	Femoral crossover graft (PVD)
Diabetic PVD - excision of necrotic left foot	Femoral embolectomy
Diabetic ulcer right foot - amputation of great toe	Femoral embolectomy
Dissection of adhesions (due to diverticulitis)	Femoral embolectomy, fasciotomy
Diverticular disease	Femoral-femoral crossover graft
Dizziness - ? cause	Femoral occlusion left leg, below knee amputation
Drainage of appendix abscess	Femoral vein graft
Drainage of cervical node abscess	Femorapopliteal bypass
Drainage of pancreatic cyst	Femorapopliteal bypass graft
Dysphagia, oesophagoscopy, tracheostomy	For barium enema
Dysphagia - trache	Gallstones
Endolaryngeal microsurgery	Gastroentorostomy
Endolaryngeal microsurgery, antroscopy, right nasal polypectomy	Graft to abdominal aortic aneurysm
Epigastric pain	Graft to stenosed right iliac artery
Epigastric pain - ? mesenteric angina	Haematemesis + melaena
Epistaxis	Haemorrhoidectomy
Evacuation of groin haematoma + repair of common femoral artery	Hemicolectomy, volvulus
Excision of lesion from floor of mouth (ca) + left radical neck dissection	Hemiparesis
Excision of lesion in left sartorius muscle	Hepatic cancer, jaundice; repositioning of external Stent drain
Excision of lesion - sartorius	Hernia repair
Excision of melanoma of leg, skin graft	Hiatus hernia
Excision of necrotic area of foot	Hypercalcaemia + hypokalaemia
Excision of oral tumour	Hypopharyngeal mass

Incarcerated inguinal hernia	Mastectomy
Incisional hernia repair	Mastoidectomy
Inguinal hernia repair	Myringoplasty
Intermittent claudication both legs - femoropopliteal bypass graft	Nasal polypectomy
Intermittent claudication left leg	Nephrectomy
Intermittent claudication right leg	Obstruction of bile duct
Investigations of numbness - hands, legs, face	Obstructive jaundice
Ischaemic right arm	Oesophagoscopy
Ischaemic right foot, angioplasty of left femoral artery	Oversewing of DU truncal vagotomy and gastrojejunostomy
Ischaemic right foot, excision of aneurysm + dacron graft; amputation of right great toe	Oversewing of perforated duodenal ulcer
Ischaemic right leg	Oral tumour, excision of lesion
Ischaemic right lower limb - above knee amputation	Pancreatitis, cholelithiasis
Ischaemic toes	Pararectal sinus
Jaundice	Parathyroidectomy
Jaundice and abdominal pain	Parotidectomy
Left CVA	Perforated DU - Polya gastrectomy
Left femoral embolectomy	Perforated peptic ulcer
Left femoral embolectomy, fasciotomy	Perforated ulcer
Left hemiparesis	Pharyngeal sympathectomy
Left inguinal hernia repair	Pneumonia
Left nephrectomy	Polya gastrectomy
Left radical neck dissection, right neck node biopsy	Profundoplasty + vein patch
Left-sided pain, weight loss	Pulmonary embolism
Ligation varicose veins right leg	PUO
Lymphoedema + cellulitis right arm	Pyrexia
Mallory-Weiss tear	Radiation proditis
Mass in hypopharynx, oesophagoscopy	Radiation proditis - cancer cervix
	Radical mastoidectomy

Radical neck dissection	Subacute obstruction
Recurrent epistaxis	Swollen haematoma left leg
Removal of thyroglossal cyst	Temporal bone resection, radical neck dissection, tracheostomy
Renal colic	TIA
Repair of abdominal aortic aneurysm	Tonsil dissection
Repair of bilateral inguinal hernia	Total laryngectomy
Repair of incisional hernia	Transient ischaemic attacks
Repair of inguinal hernia	Vagotomy for gastric ulcer
Repair of ruptured aortic aneurysm	Vagotomy - Nissan fundoplication
Resection of cancerous lesion of tongue	Varicose ulcer
Resuturing of skin flap around neck	Venous ulcers of ankles
Right femoropopliteal biograft bypass + profundoplasty	Vertigo
Right femoral popliteal bypass graft for claudication	Wound sinus
Right iliac fossa pain	Y graft to iliac arteries
Right inguinal hernia repair	
Right nasal polypectomy	
Right parotidectomy, cancer	
Roux-en-Y	
Ruptured aortic abdominal aneurysm	
Ruptured aortic aneurysm	
Sarcoidosis	
Septorhinoplasty	
Simple mastectomy	
Sinus due to suture (post hernia repair)	
Stridor - tracheostomy for cancer	
Stripping and ligation of varicose veins	
Stripping left varicose veins	
Stripping of bilateral varicose veins	
Subacute abdominal obstruction	

Appendix 3

Categories of Analgesics (Study 1)

None	
Mild	: Aspirin Hydrocortisone Ibuprofen Naproxen Paracetomol Piroxicam
Intermediate	: Buprenorphine Codeine Codis Co-codamol Codydramol Distalgesic Dihydrocodeine Mefenamic acid Nefopam Nalbuphine Pentazocine
Major	: Chief's powders (a 'cocktail' of controlled drugs) Diamorphine Dipipanone hydrochloride Fentanyl Morphine sulphate Papaveretum Pethidine

Appendix 4

Categories of Home Pre-Sleep Routines

Eating and Drinking	
Caffeinated drink	60
Non-caffeinated drink	15
Snack	19
	94
Alcohol and Cigarettes	
Alcoholic drink	30
Cigarette	22
	52
General Relaxation	
Bath/shower/wash	9
Read	78
Watched TV	48
Radio	12
Knitting	2
	149
Other	
Prepare for a.m.	4
Walk dog	1
Lock up, etc.	1
Pleasant thoughts	1
Playing bowls	1
	8
Total	**303**

Appendix 5

Categories of Reasons Why Patients Did Not Perform Their Pre-Sleep Routines in Hospital (Study 1)

Too Unwell		**Inappropriate/Inadequate Facilities**	
Felt too ill	5	No preferred drink	3
Too tired	6	Rotten tea	1
Sickness	1	No snack	2
	12	Smoke in TV room	1
		No ward TV	1
Pain	**4**	No choice of TV channel	5
Distractions		Uncomfortable headphones	1
Strange surroundings	2	Nothing to read	1
Unable to concentrate	18	Nightlights too bright	1
Too much going on	5		**16**
	25		
Treatment		**Social Drugs**	
NBM/clear fluids	10	No smoking	13
Reduced mobility	9	No alcohol	18
Different hypnotic	1		**31**
Different drug regime	1		
	21		
Noise		**Other**	
TV noise	1	Couldn't reach light	1
Too noisy	4	Read longer - not tired	3
	5	Bad eyesight	1
Ward Routine		Didn't want drink	1
Settled in bed too early	13	Didn't like to have light on	1
Nurses put lights out	6	Watched late night TV	1
Told to put light out	1		**8**
Evening drink too early	26		
TV off at 10 p.m.	1		
No-one to help to bath	4		
Missed drink	1		
	52	**Total**	**174**

Appendix 6

Categories of Causes of Night-Time Awakening at Home (Study 1)

Anxiety and Worry	
Worry	9
Afraid to sleep in	3
	12
Go to toilet	**75**
Pain or discomfort	
Pain	15
Cramps	2
	17
Breathing difficulties	**6**
Noise	
Street noise	3
Door banging	1
Dog barking	1
Neighbours	2
Spouse	4
Dog	1
	12
Other	
Thirst	4
Cigarette	1
Nosebleeds	1
Nightmares	3
Drug side-effects	1
Old routine	1
To turn over	1
Had enough sleep	2
	14
Total	**136**

Appendix 7

Categories of Causes of Night-Time awakening in Hospital

	Previous Night	All Nights
Anxiety and worry	**7**	**73**
Go to toilet	**67**	**93**
Pain or Discomfort		
Tracheostomy tube uncomfortable	1	0
Uncomfortable position	1	0
Indigestion	1	0
Leg cramps	1	1
Pain	40	127
Uncomfortable in bed	15	42
Nausea	0	2
	59	**172**
Breathing difficulties	**3**	**0**
Environmental temperature		
Too hot	21	91
Too cold	4	31
Draughty	1	0
	26	**122**
Lighting		
Light (Outside)	2	2
Nightlights	3	3
	5	**5**
Bad Dreams	**5**	**28**

(Cont. over)

'Bed Problems'	Previous Night	All Nights
Uncomfortable bed	9	61
Draw sheet	1	7
Sweaty mattress	2	24
Sweaty pillows	2	9
Pillows too hard/soft	1	3
Bed too small/high	1	6
	16	**110**
Treatment		
Bed tilted	0	2
Observations	3	2
Nursing procedures	5	0
Physiotherapy	0	1
For blood sample	1	0
Effect of laxative	1	0
To take hypnotic	2	0
	12	**5**
Noise		
Traffic	6	6
Ambulance	4	8
'Rowdies'	7	12
Rattling windows	1	10
Doors banging	1	5
Ventilation/heating	2	2
Tap dripping	1	1
Noisy sheets	0	1
Screens	0	3
Plastic pillowcases	1	4
Bedpans and sluice	1	7
Telephone	0	2
TV noisy	0	1
IVI alarms	1	4

(Cont. over)

Noise (cont.)	**Previous Night**	**All Nights**
ET suction	0	2
Squeaky door	0	1
Blood fridge	0	2
Toilet seat fell off	0	1
Patients shouting, etc.	20	44
Patients snoring, etc.	4	10
Admissions	4	6
Theatre patients	1	3
Cleaners/hoover	0	2
Buzzers	0	1
Patient fighting nurse	0	1
Footsteps	7	15
Voices	2	1
Nurses talking	17	33
Beds being moved	0	1
People in corridor	0	3
Dressing trolley	1	2
Washing dishes	0	1
	88	**195**
Other		
Other patients	0	1
Wanted cigarette	0	1
Thirst	4	1
Had enough sleep	2	0
Hypnotic wore off	2	0
Strange surroundings	9	85
Don't know	17	4
Watched satellite TV	2	0
Floor shaking	0	1
	36	**93**
Totals	**324**	**896**

Appendix 8

Categories of Causes of Morning Wakening at Home and in Hospital

Home:		**Nursing/Medical Care**	
Woke up naturally	**145**	Woken for nursing observations	15
Physical causes		Woken for drug administration	8
Pain	8	Blood test	2
Needed to go to toilet	1	Nurse sitting patient up	1
Thirst	1	Nurse draining T-tube	1
	10		**27**
Member of Household		**General Ward Activity**	
Family	13	Woken by tea trolley	15
Pet	2	Lights being switched on	3
	15	Nurses walking/talking	25
Noise		Domestic staff	3
Alarm clock	18	Nurses opening blinds/windows	5
Street noise	6	Paper boy	2
Postman	4	Nurse tidying locker	1
Various	2	Noise from other patients	2
	30	Breakfast	2
Total	**200**	Patient being admitted	1
		Toilet seat fell off	1
			60
Hospital:		**Other**	
Woke up naturally	**82**	Daylight	3
Physical causes		Birds singing	1
Pain	9	Don't know	4
Needed to go to toilet	8	Not applicable (not asleep)	1
Felt cold	2		**9**
Smell from colostomy	1		
Wanted cigarette	1		
Nausea	1		
	22	**Total**	**200**

Appendix 9

Categories of Suggestion for Improving Sleep in Hospital

No suggestions	**57**	Stop doors banging	3
		Nurses wash hands off main ward	1
		Staff should wear soft-soled shoes	6
Pain control		Ill patients near door of 4-bay	1
Stronger/epidural/IV analgesia	15	TV too loud	1
Encourage to take analgesia	1	Nurses station off main ward	3
More gradual change from strong to weak analgesia	1		**65**
	17		
Hypnotic Drugs			
Hypnotic/stronger hypnotic drugs	9		
Ensure patient takes hypnotic	1	**Light**	
Prescribe hypnotics and let patients decide when to take them	2	Be able to keep reading light on	2
		Dimmer nightlights	2
		Darker wards at night	4
	12	Provide eyeshades	1
Noise Reduction			**9**
Measures to reduce noise	14		
Ill patients and those requiring noisy equipment on separate wards	5		
Admit patients to 4-bays	1		
Disposable instead of metal bedpans	3	**Beds**	
Repair floors so trolleys quieter	4	Remove plastic from mattresses	9
Quieter night staff	5	Harder/softer pillows	3
Provide earplugs	3	More comfortable beds	24
Remove plastic pillow covers (noisy)	1	Remove plastic from pillows	8
		More bed covers	1
Quieten dressing trolleys	2	Provide hammocks	1
Carpeting where practical	2	Prefer duvet	6
Double glazing	5	Hi-lo beds	7
Soundproof cubicles	1	More eggshell mattresses	4
Nurse call button	1		**63**
Quieter IVI alarms	3		

Appendix 9 (cont)

Other Routines		**Environment**	
Later to bed	1	Smaller wards	13
Wake later in morning	4	Single rooms	8
Evening drug round earlier	1	More fresh air	6
Don't wake to give hypnotics	1	Ban smoking	4
Don't wake to take temperature	1	Cooler wards	2
		Warmer wards	2
Help to bath at night	1	More and nearer toilets	3
	9	Heating which could be rapidly adjusted	2
		Lightswitch and buzzer closer	1
			41
Other			
More research	1		
Relieve boredom during the day	1	**Eating and Drinking**	
Provision for friend to stay	1	Hot drink later at night	11
Don't 'board out' patients	1	Allow alcoholic drinks	12
Consider individual needs	9	Allow to smoke	5
TV in cubicle	1	Provide better tea	1
Better communication with doctors, less anxiety	2	Provision of hot drinks during night	2
Own TV	2	Provide late evening snack	2
More exercise during day	1		**33**
More information before admission	1		
	20	**Nurses**	
		Employ more nursing staff	8
		Improve nurses' pay	1
		Talk to nurses more	1
		More attention from nurses	1
		More frequent checks by nurses during night	2
		More time to get nurses' attention when they go round	2
			15

Total number of suggestions: **284**

Appendix 10

Analgesic Provision Schedule

(Studies 2 and 3)

Continuous IV analgesia given Yes ☐ No ☐ ☐

Time commenced ________________ ☐☐☐☐

Drug ________________ ☐

Dose per hour ________________ ☐☐

Time discontinued or dose changed ________________ ☐☐☐☐

Time commenced ________________ ☐☐☐☐

Drug ________________ ☐

Dose per hour ________________ ☐☐

Time discontinued or dose changed ________________ ☐☐☐☐

Time commenced ________________ ☐☐☐☐

Drug ________________ ☐

Dose per hour ________________ ☐☐

Time discontinued or dose changed ________________ ☐☐☐☐

Intermittent analgesics Yes ☐ ☐

No ☐

Analgesic 1: ____________________ Name ☐☐

Dose/range prescribed

____________________ ☐☐☐

Route ____________________ ☐

Fixed times/prn ____________________ ☐

Minimum time between doses

____________________ ☐

Duration of prescription

____________________ ☐☐

1st administration:	time	____________	☐☐☐☐
	dose	____________	☐☐☐
2nd administration:	time	____________	☐☐☐☐
	dose	____________	☐☐☐
3rd administration:	time	____________	☐☐☐☐
	dose	____________	☐☐☐
4th administration:	time	____________	☐☐☐☐
	dose	____________	☐☐☐
5th administration:	time	____________	☐☐☐☐
	dose	____________	☐☐☐
6th administration:	time	____________	☐☐☐☐
	dose	____________	☐☐☐
7th administration:	time	____________	☐☐☐☐
	dose	____________	☐☐☐
8th administration:	time	____________	☐☐☐☐
	dose	____________	☐☐☐
9th administration:	time	____________	☐☐☐☐
	dose	____________	☐☐☐
10th administration:	time	____________	☐☐☐☐

	dose ______________	☐☐☐
11th administration:	time ______________	☐☐☐☐
	dose ______________	☐☐☐
12th administration:	time ______________	☐☐☐☐
	dose ______________	☐☐☐
13th administration:	time ______________	☐☐☐☐
	dose ______________	☐☐☐
14th administration:	time ______________	☐☐☐☐
	dose ______________	☐☐☐
15th administration:	time ______________	☐☐☐☐
	dose ______________	☐☐☐
16th administration:	time ______________	☐☐☐☐
	dose ______________	☐☐☐
17th administration:	time ______________	☐☐☐☐
	dose ______________	☐☐☐
18th administration:	time ______________	☐☐☐☐
	dose ______________	☐☐☐

Analgesic 2: Name ______________________________ □□

Dose/range prescribed

______________________________________ □□□

Route ______________________________ □

Fixed times/prn ____________________ □

Minimum time between doses

______________________________________ □

Duration of prescription

______________________________________ □□

1st administration:	time	____________________	□□□□
	dose	____________________	□□□
2nd administration:	time	____________________	□□□□
	dose	____________________	□□□
3rd administration:	time	____________________	□□□□
	dose	____________________	□□□
4th administration:	time	____________________	□□□□
	dose	____________________	□□□
5th administration:	time	____________________	□□□□
	dose	____________________	□□□
6th administration:	time	____________________	□□□□
	dose	____________________	□□□
7th administration:	time	____________________	□□□□
	dose	____________________	□□□
8th administration:	time	____________________	□□□□
	dose	____________________	□□□
9th administration:	time	____________________	□□□□
	dose	____________________	□□□
10th administration:	time	____________________	□□□□
	dose	____________________	□□□
11th administration:	time	____________________	□□□□
	dose	____________________	□□□

12th administration:	time ____________	☐☐☐☐
	dose ____________	☐☐☐
13th administration:	time ____________	☐☐☐☐
	dose ____________	☐☐☐
14th administration:	time ____________	☐☐☐☐
	dose ____________	☐☐☐
15th administration:	time ____________	☐☐☐☐
	dose ____________	☐☐☐
16th administration:	time ____________	☐☐☐☐
	dose ____________	☐☐☐
17th administration:	time ____________	☐☐☐☐
	dose ____________	☐☐☐
18th administration:	time ____________	☐☐☐☐
	dose ____________	☐☐☐
19th administration:	time ____________	☐☐☐☐
	dose ____________	☐☐☐
20th administration:	time ____________	☐☐☐☐
	dose ____________	☐☐☐

Appendix 11

Post-Operative Pain and Sleep Schedule

(Study 3)

Code Number ______________________________ ☐☐☐

Hospital number ____________________________

Date of birth ______________________________

Age______________________________________ ☐☐

Sex ______________________________________ ☐

Live alone? _________________________________ ☐

Ward ____________________________________ ☐

Previous operations __________________________ ☐

____

Date of surgery ______________________________

Date of interview_____________________________

Type of operation _____________________________ ☐☐

I'd like to ask you some general questions about your experiences of pain and sleep since your operation and also about how pain might have affected your sleep. The answers that you give will be completely confidential.

1. Were you in any pain before your operation?

Yes ☐ ☐
No ☐

Comment ___________________________________ ☐

____

2. Have you had any pain or discomfort since your operation?

Yes ☐ ☐
No ☐

(If no pain, go to question 16)

Can you tell me a bit more about that?
(Prompt)

______________________________________ ☐☐

______________________________________ ☐☐

______________________________________ ☐☐

____

____

____

3. Do you have any pain just now? If yes, could you describe how it feels using these scales?

No Pain |————————————————————| **Worst possible pain**

0 No pain ☐
1 Mild ☐
2 Uncomfortable ☐ ☐
3 Distressing ☐
4 Horrible ☐
5 Excruciating ☐

Where is the pain? ______________________ ☐

4. I'm interested in whether pain seems any different during the night compared with during the day. Could you tell me if the pain you've had since your operation has seemed either better or worse during the night than during the day?

Better ☐
Worse ☐
Same ☐ ☐
Not sure ☐
N/A ☐

Could you tell me a bit more about that? _________ ☐

____ ☐

____ ☐

____

____

5. Do you know when you last received a painkiller?

____ ☐

Was it offered to you or did you request it?

Offered ☐
Requested ☐ ☐
Neither ☐
N/A ☐

6. Did it ease the pain?

Yes ☐
No ☐ ☐
Partly ☐
N/A ☐

Comment _________________________________

____

____

7. Have you ever found it difficult to ask the nurses for painkillers?

Yes ☐
No ☐ ☐
Don't know ☐
N/A ☐

When was that? ______________________ ☐

______________________ ☐

____

Why was it difficult? ______________________ ☐

______________________ ☐

____

____

8. Have the nurses offered you painkillers at times other than medicine rounds?

Yes ☐
No ☐ ☐
Not sure ☐
N/A ☐

If yes, when? ______________________ ☐

______________________ ☐

____

9. During the daytime, how bad would your pain have to be before you got a nurse? ☐☐☐

No Pain |——————————————| **Worst possible pain**

10. During the night, how bad would your pain have to be before you got a nurse? ☐☐☐

No Pain |————————————————| **Worst possible pain**

11. Has there ever been an instance when you've been in pain and you haven't told the nurse?

Yes ☐
No ☐ ☐
Not sure ☐
N/A ☐

If so, why was that?

____ ☐

____

____

12. Do you prefer to wait until the nurses ask you if you are in pain, rather than telling them?

Yes ☐
No ☐ ☐
Not sure ☐
N/A ☐

If yes, why is that?

____ ☐

____ ☐

____

13. Would you be more likely to tell the nurses about your pain during the night or during the day?

Night ☐
Day ☐ ☐
Neither ☐

Why is that? ______________________________ ☐

____

14. I've talked mostly about painkillers as a way of relieving your pain. Some people find other ways of coping with their pain, like concentrating on relaxing, or distracting themselves by watching TV. Have you tried any different ways of coping with your pain?

______________________________ ☐

______________________________ ☐

______________________________ ☐

____

____

15. In addition to taking painkillers, would you like to try any of these alternative methods of coping with your pain?

Relaxation ☐ ☐

Distraction ☐ ☐

Hypnosis ☐ ☐

Acupuncture ☐ ☐

Acupressure ☐ ☐

Hot/cold pads ☐ ☐

Other (specify) __________ ☐ ☐

16. Do you think it would be helpful if the nurses could suggest alternative methods of coping with your pain?

Yes ☐
No ☐ ☐
Not sure ☐

Comment ________________________________ ☐

____

____

17. Do you have any suggestions for ways of helping other patients to cope with pain that you think could be used in hospital?

Yes ☐ ☐
No ☐

If yes, what? ______________________________ ☐

____ ☐

I'd like to ask you a few questions about your sleep now.

18. Have you felt tired since your operation?

Yes ☐
No ☐ ☐
Not sure ☐

Comment ________________________________

19. How well do you usually sleep at home?

____ ☐

20. How long do you usually sleep for during the night?

____ ☐☐☐

21. About how long did you sleep for last night?

____ ☐☐☐

22. Did you wake up during last night?

How many times? __________________________ ☐☐

What made you wake up? ____________________ ☐☐

____ ☐☐

23. Did anything or anyone help you get back to sleep? For example, did you get more comfortable, have a hot drink or a painkiller?

Yes ☐ N/A ☐ ☐

No ☐ No help needed ☐

What helped? ______________________________ ☐

____ ☐

24. What is the worst problem you've had with sleeping in hospital?

____ ☐☐

____

25. Has pain interfered with your sleep in any way since your operation?

Yes ☐
No ☐ ☐
Not sure ☐
N/A ☐

If yes, in what way?

______________________________________ ☐

______________________________________ ☐

______________________________________ ☐

____

26. Does the pain seem any different when you're tired?

Yes ☐
No ☐ ☐
Not sure ☐
N/A ☐

If yes, in what way?
(Prompt)

______________________________________ ☐

____

____

27. There seem to be two different sides to pain; first how intense the pain is and, second, how much the pain bothers you. Do you think that a good night's sleep has any effect on how intense the pain is?

Yes ☐
No ☐ ☐
Don't know ☐

In what way?
(Prompt)

____________________ ☐

____________________ ☐

____

28. Do you think that getting enough sleep makes any difference to how you cope with pain?

Yes ☐
No ☐ ☐
Don't know ☐

If yes, in what way?
(Prompt)

____________________ ☐
____________________ ☐
____

29. Do you think that sleep has any effect on how people recover from operations?

Yes ☐
No ☐ ☐
Don't know ☐

If yes, in what way?
(Prompt)

____________________ ☐

____________________ ☐

____

Appendix 12

Ward Staffing Schedule (Study 3)

Post-op night: ____________________________________ ☐ ☐

____________________________________ ☐ ☐

Day 1: Early ____________________________________ ☐ ☐

____________________________________ ☐ ☐

Late ____________________________________ ☐ ☐

____________________________________ ☐ ☐

Night ____________________________________ ☐ ☐

____________________________________ ☐ ☐

Day 2: Early ____________________________________ ☐ ☐

____________________________________ ☐ ☐

Late ____________________________________ ☐ ☐

____________________________________ ☐ ☐

Night ____________________________________ ☐ ☐

____________________________________ ☐ ☐

Day 3: Early ____________________________________ ☐ ☐

____________________________________ ☐ ☐

Late ____________________________________ ☐ ☐

____________________________________ ☐ ☐

Appendix 13

Types of surgery (Study 3)

Type of Surgery	*No. of patients*
Abdoperineal resection and colostomy	1
Abdominal repair of rectal prolapse	1
Anterior resection	3
Appendicectomy	6
Appendicectomy and drainage of pelvic abcess	1
AP resection	1
Bilateral adrenalectomy and splenectomy	1
Bowel resections for Crohn's	1
Cholecystectomy	39
Cholecystectomy and excision of ampullary ca	1
Devine colostomy	1
Drainage of 600ml appendix abcess	1
Gastroenterostomy and truncal vagotomy	1
Hemicolectomy	1
Hepaticojejunostomy and cholecystectomy	1
Ileocaecal resection	1
Incisional hernia repair	4
Laparotomy and appendicectomy	1
Laparotomy and division of adhesions	1
Laparotomy and excision of insulinoma	1
Laparotomy and lymph node biopsy	1
Laparotomy and removal of gangrenous gall bladder	1
Laparotomy and revision of gastrectomy	1
Laparotomy and biopsy of pancreas, hepaticojejunostomy	1
Left hemicolectomy	1
Left hemicolectomy, hysterectomy and bilateral salpingo-oophorectomy	1
Left inguinal hernia repair	1
Pancreaticojejunostomy	1
Pan-proctocolectomy	1
Removal of mass and resection of jejunum	1
Repair of paraumbilical and incisional hernia	1
Repair of perforated gastric ulcer	2
Repair of ruptured bladder	1
Repair of strangulated umbilical hernia	1
Repair of ventral hernia	1
Resection of rectal polyps	1
Resection of terminal ileum	1
Reversal of colostomy	2
Right hemicolectomy	3
Right inguinal hernia repair	2
Sigmoid colectomy	3
Splenectomy	3
Vagotomy and pyloroplasty	1
Total	**100**

Appendix 14

Publications

n.b. Papers have been reproduced by kind permission of Nursing Times, Journal of Advanced Nursing and Surgical Nurse.

Vol. 84, No. 1

PATIENTS' SLEEP-WAKE RHYTHMS IN HOSPITAL

Part 1

José Closs, MPhil

SUMMARY: Admission to hospital is a disruptive experience for the majority of people. Nurses are expected to be sensitive to all the needs of the newly admitted patient, be they physical, emotional or social. Since lack of sleep may be detrimental to the physiological and psychological (and therefore social) state of the individual, an understanding of some of the mechanisms involved in both maintaining and disturbing the normal sleep-wake cycle might help nurses to maintain normal patterns in their patients.

This paper contains a brief review of the literature pertaining to the importance of the sleep-wake cycle, the functions of sleep with particular reference to healing, factors affecting normal sleep and, lastly, those factors which have been shown to disturb the normal sleep-wake rhythm during admission to hospital.

THE 24-hour sleep-wake cycle is fundamental to the normal functioning of all human beings, though the actual length of time spent asleep may vary enormously between individuals. Many researchers have attempted to find out why sleep is necessary and precisely what its functions are, but there still remains much controversy surrounding the subject.

There is, however, a huge body of evidence which supports the hypothesis that sleep aids healing and it has been suggested that there is 'an obligation on all who work in hospitals to reduce noise, to relieve patients' anxieties, and help them to sleep'[1]. Since nurses spend more time in close contact with hospital patients than other health care professionals, they are in the best position to fulfil this obligation.

Disruption of normal patterns of rest and activity, and in particular that of sleep, leads to numerous adverse physiological and psychological consequences. These could be particularly undesirable for hospital patients, who are subject to many additional stresses.

FUNCTIONS OF SLEEP

Perhaps a brief explanation of the various stages of sleep is appropriate at this point, since it has been suggested that different stages have different functions. Sleep has been divided into two distinct states on the basis of EEG (electroencephalogram) recordings: REM (rapid eye movement) sleep, during which dreaming occurs, and non-REM sleep. The latter is further subdivided into states 1, 2, 3 and 4 which are increasingly 'deep'. Stages 3 and 4 comprise the portion defined as slow wave sleep (SWS)[2]. All of these stages occur many times during a night's sleep in an approximately 100-minute repeating cycle, with some stage shifts accompanying body movements.

As yet there is no absolute consensus regarding the functions of sleep. It is generally considered that sleep is a restorative process, though it has also been suggested that it is merely 'an instinct, a genetic hangover from earlier days when immobility at night was the optimal survival strategy'[3]. Horne[4] proposes a combination of the two: 'At sleep onset two processes may work in parallel, that of obligatory and restorative sleep, oriented towards brain restitution, and that of the more facultative sleep drive. The former appears to necessitate only some of sleep, presumably the first few hours (wherein most SWS is found), and then declines, leaving the latter to maintain sleep for the required length.'

A later review by the same author[5] concluded that the 'obligatory' portion of sleep is essential only for the functioning of the brain, and that other organs may require only physical rest and feeding for restitution. However, according to Oswald[6] there are 'over 100 research reports showing that the protein synthesis and cell division for the revewal of tissues such as the skin, bone marrow, gastric mucosa, bone or brain take place predominantly during the time of the 24 hours devoted to rest and sleep'. Therefore it would appear vital that patients who have undergone any type of surgery or trauma should enjoy adequate sleep in order that their healing processes should not be retarded owing to inhibition of protein synthesis and cell division; and also to avoid psychological problems resulting from inadequate sleep which might hinder recovery.

Direct study of sleep and healing in hospital patients is extremely difficult, but there is considerable evidence from animal studies which demonstrates the importance of sleep for tissue renewal[7-15]. Several studies have shown that not only do more cells divide during normal sleep, but also that they take less than half the time they would during wakefulness[8,9,10].

Unfortunately, the evidence regarding humans is somewhat sparse. Valk and Van den Bosch[16] found that the rate of bone growth in boys increased during sleep, as did proliferative activity in human bone marrow[17]. In addition, the peak rate of human skin mitoses has been shown to occur at night. So even though there is relatively little evidence that anabolism occurs during sleep in humans, there are numerous animal studies which have produced findings supporting the theory that sleep coincides with restorative processes.

Circadian variations in the levels of anabolic and catabolic hormones also suggest that anabolic processes occur during the sleep period. In man, protein synthesis is inhibited by hormones such as cortisol, glucagon and catecholamines,

EDITOR'S NOTE: Not only is this an excellent literature review, it also relates a complex field of research to nursing. Many factors affecting sleep can be modified and the disturbances in hospital obviously need attention by staff.

which reach their highest levels during the day[18]. During sleep, energy expenditure in the tissues falls and the energy stored within the cells as adenosine triphosphate (ATP) rises to levels which become sufficiently high for protein synthesis to occur. Growth hormone, (GH) which stimulates protein and RNA synthesis and amino acid uptake, reaches peak secretion rates during slow wave sleep[19] and Adamson el al.[20] found that an increase in daytime exercise led to an increase in night-time secretions of GH. In addition, SWS is the sleep state which has the highest positive correlation with the length of prior wakefulness, and therefore appears to have restorative properties [15,21,22]. All of this evidence supports the assertion that sleep, and in particular SWS, is essential for tissue restoration.

The function of REM sleep is more difficult to explain. It seems possible that REM sleep is involved in learning and memory, but research has so far failed to provide convincing evidence to support these ideas. Individuals who take anti-depressant drugs on a long-term basis may sustain complete abolition of REM sleep without any appreciable ill effects[23], suggesting that REM sleep is not essential to normal functioning. Individuals who were sleep deprived for several nights showed that not all of the sleep that was missed was reclaimed[24,25,26], only about one-third of the total sleep loss being recovered, and this was mostly SWS, with about two-thirds of the REM. Stages 1 and 2 were never made up, thereby appearing to be dispensible constituents of sleep.

Total sleep deprivation has been shown to result in clear signs of central nervous system impairment and there is some evidence of physiological damage. Rechtschaffen et al.[27] deprived rats of sleep for 5-33 days and found that they suffered 'severe pathology and death' whereas control rats did not. The causes of death were not uniform, rendering the mechanism of sleep deprivation in causing such damage unclear.

Total sleep deprivation for 48 hours results in changes in central nervous system function, such as behavioural irritability, suspiciousness, speech slurring and minor visual misperceptions[4]. These may be accompanied by increased suggestibility and/or a reduction in motivation and willingness to perform tasks which could include mobilisation and other aspects of self-care. Such detrimental psychological effects of sleep deprivation in hospital patients have been observed, including symptoms such as lethargy, irritability and confusion; and later, delusions and paranoia.

Hartmann[28] assessed sleep requirements by interview and questionnaire and found that stress and illness were virtually always accompanied by an increased subjective sleep need. Studies of coronary care patients have shown generally disturbed sleep, but suggest increased total sleep time[29,30]. It is possible that this increase in duration of sleep is associated with a physical need for that sleep. These observations support the hypothesis that sleep aids healing, suggesting that conditions favourable to sleep should be encouraged in all areas where patients are suffering from infection and trauma, or are recovering following surgery.

FACTORS AFFECTING NORMAL SLEEP

There are many factors which may affect normal sleep, including age, gender, diet and ambient temperature to name but four. These influences should be taken into account when making nursing assessments of patients' sleep, since normal habits and needs vary enormously between individuals.

1. Age

Age in particular should be taken into account, since the changes in sleep patterns associated with ageing are well documented. The elderly tend to sleep less, spend more time in bed, have comparatively less stage 4 and REM sleep and have more shifts between sleep stages[31].

McGhie and Russell[32] found a significant increase in the proportion of patients over 65 years claiming to sleep for five hours or less. The elderly have increased amounts of wakefulness after sleep onset. Webb and Swinburne[33] attributed 38% of night-time awakening among the elderly to pain and physical discomforts such as bladder distension and urinary urgency. Nurses should be aware of such problems and attempty to alleviate discomfort as far as possible, as well as encouraging regular bowel and bladder habits.

Elderly people sustain an absolute and relative reduction in time spent in stage 4 sleep, which may even disappear in a quarter of those in their sixth decade of life. However, they have an increased total duration of stage 1 sleep and an increase in the number of shifts into stage 1.

The total sleep time (TST) is either reduced or unchanged in the elderly as compared with younger groups, though the time in bed tends to increase. This appears to be because they spend more time lying in bed at night without attempting to sleep as well as unsuccessfully trying to sleep, and lying in bed resting or napping during the day. Obviously these sleep patterns would be considered abnormal in a younger age group, but should cause no concern among the elderly, and wards with large proportions of elderly patients should adjust their routines in order to accommodate such sleep habits.

Zepelin et al.[34] studied subjects aged 18-71 years and found a significant decline in the intensity of noise required to arouse them from sleep with increasing age. This reduction was present in all sleep stages but greatest in stage 4. Since noise disturbs normal sleep stage progression and increases frequency of awakening, it may be that noise reduction in hospital is of particular importance in optimising the sleep of the elderly.

2. Gender

Gender should also be considered when assessing sleep. Men have more disturbances in sleep than women from early adulthood onward[35], frequently owing to nocturnal penile tumescence occurring during REM sleep. Wever[36] found that women sleep significantly longer than men, though it is well recognised that women complain of problems with sleeping more than men, and also consume more sleep-inducing drugs.

3. Anxiety and depression

Anxiety and depression frequently interfere with sleep, and each of these may be associated with admission to hospital. Anxiety results in an increase in plasma noradrenaline levels owing to increased activity of the sympathetic nervous system. This in turn results in sleep changes similar to those seen in normal aged adults (less stage 4 and REM, and more stage shifts and awakenings), who also undergo elevations of daytime and night time plasma noradrenaline[37].

Insomnia caused by depression has been associated with raised levels of monoamine oxidase which catabolises the neurotransmitters noradrenaline and 5-hydroxytryptamine (5-HT), each of which is involved in sleep onset and maintenance[38]. Depressed patients, therefore, tend to have difficulty falling asleep, and an increased number of awakenings during the night. Nurses should encourage depressed and anxious patients to discuss their feelings and, if possible assist them with underlying difficulties. Alerting medical staff to the apparent existence of anxiety and depression should ensure that the patient receives appropriate medical or psychological treatment.

4. Diet

There has been much research into the effects of diet on sleep. In recent years there has been controversy over the role of tryptophan (the amino acid precursor of 5-HT) of which milk, beef and beans are major sources. As yet there is no conclusive evidence that a high tryptophan diet enhances sleep. Yogman and Zeisel[39] found that newborn infants given a high tryptophan feed entered sleep significantly quicker than a control group given a high valine feed. The authors suggested that tryptophan's increased availability resulted in increased 5-HT synthesis which therefore facilitated sleep onset. This is in conflict with work by Moja et al.[40] who found that in a group of healthy adults a tryptophan-free diet caused a reduction in stage 4 sleep latency and an increase in stage 4 sleep during the first three hours of sleep.

Little information is available regarding the effects of other nutritional substances,though Vitiello et al.[37] found that for a group of 10 healthy adult males a low sodium diet decreased REM and SWS and increased wakefulness. Brezinova and Oswald[41] found that Horlicks apparently enhanced sleep by increasing its total duration and reducing periods of wakefulness. Unfortunately, the volunteers who had participated in the study were a self-selected group, that is they had responded to an advertisement asking for subjects willing to take night-time drinks. A link was noted between habitual bedtime practices and sleep; those who ate little or nothing before bedtime slept better after a dummy capsule than Horlicks, and those who normally had a bedtime drink slept better after Horlicks. Hot milky drinks are usually provided in hospital in the late evening, but it should be remembered that many people take an alcoholic 'nightcap' at home, and if they are normally heavy drinkers they will suffer from withdrawal symptoms in hospital if they are not permitted to drink.

Withdrawal from alcohol, as well as hypnotic drugs, will result in disturbed sleep. It should be noted that alcohol is not a good hypnotic drug, since although it accelerates sleep onset, it disturbs sleep patterns later on in the night, as well as causing possible awakenings in the early hours owing to a full bladder. Caffeinated drinks such as coffee, tea, drinking chocolate and Cola act as stimulants, frequently resulting in disturbed sleep when taken late at night.

The biochemical effects of diet on sleep are not all clear, but since adherence to routine habits appears to enhance sleep, nurses should allow patients to eat or drink as they would at home before bed-time, as far as is feasible.

5. Sleep position

Sleep positions have been associated with objective and subjective sleep quality. A comparison of sleep positions of good and poor sleepers showed that the poor sleepers spent more time on their backs with their heads straight, and changed position more frequently[42]. Snoring and sleep apnoea have been associated with subjects who slept flat on their backs. Since these are undesirable for the sleeper himself, and snoring may disturb others sleeping within earshot, nurses could perhaps encourage and assist poor sleepers to adopt alternative positions for sleeping.

Long periods of bedrest have been shown to disrupt other aspects of circadian rhythmicity. Winget et al.[43] found that after 56 days of bedrest the body temperature waveform remained the same but at a lower level, that is, a 'low-grade hypothermia' occurred. In addition, heart rate gradually increased. According to Selye[44], these phenomena are characteristic of acute stress, regardless of its cause.

6. Respiration

Total sleep deprivation appears to reduce the hypercapnic ventilatory response by 17-20%[45,46]. White et al.[47] found that total sleep deprivation reduced the hypoxic response by approximately 29%. Conversely, several studies have indicated that hypercapnia and hypoxaemia have adverse effects on sleep patterns in rats[48,49,50]. Both increase sleep onset latency, reduce total sleep time and increase the duration of episodes of wakefulness. In addition, Ioffe et al.[51] found that hypercapnia and hypoxaemia prolonged episodes of REM sleep.

Although these experiments involved animals, the suggestion that hypoxia and hypercapnia interfere with normal sleep patterns could be seen to have implications for nursing. Nurses should ensure that any patients with respiratory difficulties, such as post-operative patients or those with respiratory tract infections, receive adequate support and assistance, particularly regarding the administration of oxygen, posture, deep breathing and coughing.

7. Temperature

Temperature may also affect the normal sleep-wake cycle. Muzet et al.[52] found that 'even slight changes of the ambient temperature within the thermoneutral zone can induce modifications of sleep structure'. Kendel and Schmidt-Kessen[53] pointed out that unclothed and uncovered subjects awoke from cold at 26°C and below. Total sleep deprivation has been shown to reduce the mean daily body temperature and increase subjective feelings of cold[54]. Fever has been found to be associated with a greater number of awakenings, increased total waking time and reduced amounts of SWS and REM. Elevated ambient temperature produces similar results[55,56].

Haskell et al.[57] noted that although REM sleep latency was increased at both high and low temperatures, REM sleep was depressed to a greater extent by lower than higher temperatures, whereas the reverse was observed for SWS. The duration of the REM phase is shortened in artificially induced fever[58] as well as at high ambient temperature. Zulley and Schulz[59,60] found that duration of REM sleep is negatively correlated with body temperature and also that body temperature influences sleep duration. The higher the body temperature at sleep onset the longer the duration of sleep.

These findings suggest that active management of pyrexial patients, perhaps by giving antipyretic drugs such as aspirin (or paracetamol for children), might improve their sleep. In addition, room temperature should be carefully monitored in general wards so that it may be maintained at a comfortable level, and patients should be encouraged to request more or less bedclothes as required.

8. Genetics

Sleep requirements appear to have a genetic component. This was demonstrated by Partinen et al.[61] who studied the sleep of 2 238 monozygotic and 4 545 dizygotic twin pairs. Familial clustering of narcolepsy[62] and idiopathic insomnia[63] has also been observed. It may be worth noting any familial sleep difficulties when assessing a patient, since it is unlikely that any nursing intervention could remedy these.

Obviously, then, many different factors influence quality and quantity of sleep. Some are inherent within the individual, such as age sex and genetic make-up. Others are environmental, such as ambient temperature, sleep position and diet. Nurses may be able to reduce the impact of detrimental environmental factors on sleep and should attempt to create conditions as similar as possible to those of a patient's home environment. Factors which researchers have found important in disrupting the sleep of hospital in-patients are discussed in the next section:

EVIDENCE OF SLEEP DISTURBANCE IN HOSPITAL

Several researchers have provided objective evidence of the extent of sleep disruption suffered by hospital in-patients. Walker[64] in a study of cardiotomy patients, found that they were disturbed approximately 14 times each hour immediately post-operatively. This was corroborated by Woods[65], who documented as many as 56 interruptions of sleep on the first post-operative night, for a similar group of patients. Bonnet[66] investigated the effect of constant interruptions in a group of 11 healthy young adults, all of whom were woken up after each complete minute of EEG defined sleep for two consecutive nights. Their total sleep time was reduced by only one hour, but they received very small amounts of slow wave sleep (SWS) and REM. After 48 hours the subjects became increasingly sleepy and their performance declined in a manner comparable with 40-64 hours of total sleep deprivation.

It should not be assumed, however, that all reductions in sleep are deleterious. Horne and Wilkinson[67] found that in a group of eight-hour sleepers who had their sleep limited to six hours, no significant daytime effects were observed. This level of reduction was achieved easily, at the expense of REM and stage 2 sleep, with SWS not affected.

Next week: Part 2

José Closs is research associate, Nursing Research Unit, Department of Nursing Studies, University of Edinburgh

Vol. 84, No. 2

PATIENTS' SLEEP-WAKE RHYTHMS IN HOSPITAL

Part 2

José Closs, MPhil

MUCH of the work investigating sleep disturbances in hospital has concentrated on acute care areas. Fabijan and Gosselin[68] suggested that patients in intensive care units (ICU) show signs and symptoms of sleep deprivation within 48 hours of admission, and recommended various interventions to prevent its occurrence.

Morgan and White[69] studied the attitudes of ICU nurses towards their patients' sleep, and found that although they were aware of its importance, they did not differentiate between essential and non-essential nursing tasks and often disturbed patients unnecessarily.

Hilton's[70] descriptive study of nine ICU patients used 48-hour EEG recordings in order to evaluate sleep quantity and quality. She found a mean TST of 2.6 hours (excluding stage 1) of the first 24 hours and 3.9 of the second 24 hours of monitoring. A similar study by Aurell and Elmqvist[71] demonstrated a mean TST (excluding stage 1) of less than two hours out of 48. These two studies have findings consistent with other research[72,73,74].

Subjective methods have also been used in order to assess the causes and extent of sleep disruptions of less acutely ill patients[75,76,77,78,79,80,81]. The Royal Commission Survey[76] indicated that 27% of the 699 patients interviewed were generally disturbed during the night. Murphy et al.[77] studied the sleep of 93 surgical patients, using questionnaires. They found a striking reduction in mean sleep duration, both pre-and post-operatively when compared with each patient's normal sleep. They suggested that much of this deficit was a result of early awakening, though some was because of delay in getting to sleep. The patients recorded reduced sleep quality, increased awakening, and, for the first three post-operative days, attributed much of the disturbance to noise and pain.

Carter[78] studied sleep patterns in 50 low dependency patients using an interview schedule. Seventy-six per cent felt that they accrued sleep deficit over three nights compared with sleep at home. Forty-four of these sustained a four-hour deficit, and 18% more than a six-hour deficit.

Dodds[79] in her study of 100 patients in a variety of wards, found that 78% of them were woken at least once during the night in hospital. The commonest cause of this was noise from equipment, other patients, and nurses. Just over half (56%) felt that they were able to sleep for long enough, and although 71% of the group preferred to sleep at least until 07.00h., 90% of them were woken before this time. Stead[80] reiterated this point in his study of 78 surgical patients, emphasising the disruptive effect of hospital routines, recommending that 06.00h drug rounds should be kept to a minimum. Of Dodds'[79] sample, 34% thought that 'lights out' at 23.00h was too late in view of early awakening and some forced themselves to stay awake for the 22.00h drug round, which often included hypnotic drugs.

Interestingly, although 77% of the sample never took hypnotic drugs at home, 60% of them took hypnotics during their stay in hospital. Bailey[81] found that noise was the most important reason for patients opting to take hypnotic drugs while in hospital.

SUMMARY

It is evident from the available literature that, for a considerable proportion of patients, hospital admission causes disruption of the normal sleep-wake cycle, and the functions of sleep should be understood in order to comprehend the adverse effects of this disruption. Although REM sleep has no clear function, SWS appears to be associated with restorative processes such as secretion of GH, and peak rates of mitosis and cell replacement. Total sleep deprivation results in psychological disturbances such as reduced motivation, irritability, confusion and paranoia. All of these are potentially detrimental to recovery from illness or surgery.

Factors affecting sleep patterns tend to fall into two groups: those inherent within the individual, such as age, gender and genetic constitution, and those as a result of the immediate environment, such as diet, sleep position, and temperature. It may be possible for nurses to manipulate some aspects of the patient's environment in order to optimise quality and quantity of sleep.

In view of the increasing amount of evidence which suggests that sleep enhances healing processes, it may be of considerably greater importance than is generally appreciated, that certain patients receive an optimum quantity and quality of sleep, preferably following as closely as possible their normal 'home sleep' patterns. It could be expected that such a provision might promote and even hasten recovery. An evaluation of nursing interventions designed to achieve this would appear to be a worthwhile project. **NT**

REFERENCES

[1]Adam, K., Oswald, I. Sleep helps healing. *British Medical Journal* 1984; 289: 6456, 1400-1410.

[2]Rechtschaffen, A., Kales, A. *A Manual of Standardised Terminology, Techniques and Scoring System for Sleep Stages of Human Subjects.* Bethesda, Maryland: US Dept. of Health, Education and Welfare, 1968.

[3]Canavan, A. The psychobiology of sleep. *Nursing* 1984; 23: 628-683.

[4]Horne, J.A. Human sleep and tissue restitution: some qualifications and doubts. *Clinical Science* 1983; 65: 6,569-578.

[5]Horne, J.A. Sleep function with particular reference to sleep deprivation. *Annals of Clinical Research* 1985; 17 5: 199-208.

[6]Oswald I., Good, poor and disordered sleep. In: Priest, R.G. (ed), *Sleep: An international monograph,* Update Books 1984, 18-24.

[7]Bullough, W.S. The effects of experimentally induced rest and exercise on the epidermal mitotic activity of the adult male mouse, *Mus musculis. Proceedings of the Royal Society,* Series B 1948; 135: 233-242.

[8]Kirk, H. Mitotic activity and cell degeneration in the mouse thymus over a period of 24 hours. *Zietschrift fur Zellforschung und Microskopische Anatomie* 1972; 129: 188-95.

[9]Burns, E.R., Scheving, L.E., Fawcett, D.F., Gibbs, W.M., Galatazan, R.E. Circadian influence on the frequency of labeled mitosis method in the stratified sqaumous epithelium of the mouse oesophagus and tongue. *Anatemical Record* 1976; 184: 3, 265-273.

[0]Clausen, O.P.F., Thorud, E., Bjerkness, R., Elgjo, K. Circadian ryhthms in mouse epidermal basal cell proliferation. Variations in compartment size, flux and phase duration. *Cell Tissue Kinetics* 1979; 12: 319-337.

[11]Reeve, D.R.E. A study of mitotic activity and the diurnal variation of the epithelial cells in wounded rectal mucous membrane. *Journal of Anatomy* 1975; 119: 2, 333-345.

[12]Reeve, D.R.E. Some observations on the diurnal variation of mitosis in the stratified squamous epithelium of wounded tympanic membrane. *Cell and Tissue Research* 1977; 182: 2, 253-263.

[13]Saetren, H. The diurnal variation of the first mitotic wave released among rat kidney tubule cells by partial nephrectomy. *Acta Pathologica et Microbiologica Scandinavica,* Section A. 1972; 80: 736-742.

[14]Barbason, H., Van Cantfort, J., Houbrechts N. Correlation between tissular and division functions in the rat liver of young rats. *Cell Tissue Kinetics* 1974; 7: 319-326.

[15]Simmons, D.J., Cohen, M., Post-fracture linear bone growth in rats: a diurnal rhythm. *Clinical Orthopaedics* 1080; 149: 240-248.

[16]Valk I., M., Van den Bosch, J.S.G. Intra daily variation of the human ulnar length and short term growth — a longitudinal study in eleven

boys. *Growth* 1978; **42**: 107-111.
[17]Mauer, A.M. Diurnal variation of proliferative activity in human bone marrow. *Blood* 1965; **26**: 1-7.
[18]Rannels, S.R., Jefferson, L.S. Effect of glucocorticoids on muscle protein turnover in perfused rat hemicorpus. *American Journal of Physiology* 1980; **238**: 5, E564-572.
[19]Korner, A. Growth hormone control of biosynthesis of protein and ribonucleic acid. *Recent Progress in Hormone Research* 1965; **21**: 205-236.
[20]Adamson, L, Hunter, W.M., Ogunremi, O.O., Oswald, I., Percy-Robb, I. W. Growth hormone release during sleep after daytime exercise. *Journal of Endocrinology* 1974; **62**: 3, 473-478.
[21]Webb, W.B., Agnew, H.W. Stage 4 sleep: influence on time-course variables. *Science* 1971; **174**: 4016, 1354-1356.
[22]Akerstedt, T., Gillberg, M. The circadian variation of experimentally displaced sleep. *Sleep* 1981; **4**: 2, 159-170.
[23]Petre-Quadens, O., Schlag, J.D. *Basic Sleep Mechanisms.* New York: Academic Press 1974.
[24]Gulevich, G., Dement W., Johnson, L.C. Psychiatric and EEG observations on a case of prolonged (264 hours) wakefulness. *Archives of General Psychiatry* 1966; **15**: 29-36.
[25]Kales, A., Tan, T-L., Kollar, E.J., Naitoh, P., Preston, T.A., Malstrom, E.J. Sleep patterns following 205 hours of sleep deprivation. *Psychosomatic Medicine* 1970; **32**: 189-200.
[26]Horne, J.A. Recovery sleep following different visual conditions during total sleep deprivation in man. *Biological Psychology* 1976; **4**: 107-118.
[27]Rechtschaffen, A., Gilliland, M.A., Bergmann, B.M., Winter, J.B. Physiological correlates of prolonged sleep deprivation in rats. *Science* 1983; **221**: 4606, 182-184.
[28]Hartmann, E.L. *The Functions of Sleep.* New Haven and London: Yale University Press, 1973.
[29]Karacan, I., Green, J.R., Taylor, W.J. et al. Sleep in post myocardial infarction patients. In: Eliot, R.S. (ed), *Contemporary Probvlems in Cardiology. Stress and the heart.* Mt Kisco: Futura Publications, 1974, 163-195.
[30]Broughton, R., Baron, R. Sleep patterns in the intensive care unit and on the ward after acute myocardial infarction. *Electroencephalography and Clinical Neurophysiology* 1978; **45**: 348-360.
[31]Williams, R.L., Karacan, I., Mursch, C.J. *EEG of Human Sleep.* New York: John Wiley and Sons, 1974, 151-64.
[32]McGhie, A., Russell, S. The subjective assessment of normal sleep patterns. *Jornal of Mental Science* 1962; **108**: 642.
[33]Webb W. B., Swinburne, H. An observational study of sleep of the aged. *Perception and Motor Skills* 1971; **32**: 895-898.
[34]Zepelin, H., McDonald, C.S., Zammit, G.K. Effects of age on auditory awakening thresholds. *Journal of Gerontology* 1984; **39**; 3: 294-300.
[35]Webb, W.B. Sleep in in older persons: sleep structures of 50 to 60 year old men and women. *Journal of Gerontology* 1982; **37**: 5, 581-586.
[36]Wever, R.A. properties of human sleep-wake cycles: parameters of internally synchronised free-running rhythms. *Sleep* 1984; **7**: 1, 27-51.
[37]Vitiello, M.V., Prinz, P.N., Halter, J.B. Sodium-restricted diet increases night-time plasma norepinephrine and impairs sleep patterns in man. *Journal of Clinical Endocrinology and Metabolism* 1983; **56**: 3: 553-556.
[38]Colling, J. sleep disturbances in aging: A theoretic and empiric analysis. *Advances in Nursing Science* 1983; **6**: 36-44.
[39]Yogman, M.W., Zeisel, S.H. Diet and sleep patterns in newborn infants. *New England Journal of Medicine* 1984; **310**. 14, 928-929.
[40]Moja, E.A., Antonoro, E., Cesa-Bianchi, M.,Gessa, G. L. Increase in stage 4 sleep after ingestion of a tryptophan-free diet in humans. *Pharmacological Research Communications* 1984; **16**: 9, 909-914.
[41]Brezinova, V., Oswald, I. Sleep after a bedtime beverage. *British Medical Journal* 1972; **2**: 5811, 431-433.
[42]Koninck, J., De Gagnon P., Lallier, S. Sleep positions in the young adult and their relationship with the subjective quality of sleep. *Sleep* 1983; **6**: 1, 52-59.
[43]Winget, C.M., Deroshia, C.W., Markley, C. L., Holley, D.C. A review of human physiological and performance changes associated with desynchronisis of biological rhythms, *Aviation, Space and Environmental Medicine* 1984; **55**: 12. 1085-1096.
[44]Selye, H. *The Physiology and Pathology of Exposure to Stress.* Montreal: Asta, 1950.
[45]Cooper, K. R., Phillips, B. A. Effect of short-term sleep loss on breathing. *Journal of Applied Physiology* 1982; **53**: 4, 855-858.
[46]Schiffman, P. L. Trontell, M. C., Mazar, M. F., Edelman, N. H. Sleep deprivation decreases ventilatory response to CO but not load compensation. *Chest* 1983; **84**: 6, 695-698.
[47]White, D. P., Douglas, N. J., Pickett. C. K., Zwillich, C. W., Well, J. V. Sleep deprivation and the control of ventilation. *American Journal of Respiratory disorders* 1983; **128**: 984-986.
[48]Pappenheimer, J. R. Sleep and respiration of rats during hypoxia. *Journal of Physiology* (Lond) 1977; **266**: 1, 191-207.
[49]Megirian, D., Ryan, A. T., Sherrey, J. H. An electrophysiological analysis of sleep and respiration of rats breathing different gas mixtures: diaphragmatic muscle function. *Electroencephalography and Clinical Neurophysiology* 1980; **50**: 303-313.
[50]Ryan, A. T., Megirian, D. Sleep-wake patterns of intact and carotid sinus nerve sectioned rats during hypoxia. *Sleep* 1982; **5**: 4, 1-10.
[51]Ioffe, S., Jansen, A. H., Chernick, V. Hypercapnia alters sleep state pattern. *Sleep* 1984; **7**: 3, 219-222.
[52]Muzet, A., Libert, J-P., Candas, V. Ambient temperature and human sleep. *Experienta* 1984; **40**: 425-429.
[53]Kendel, J., Schmidt-Kessen, W. The influence of room temperature on night-time sleep in man (Polygraphic night-sleep recordings in the climate chamber). In: Koella, W. P., Levin, P. (eds) *Sleep* Basel: Karger, 1973 423-425.
[54]Horne, J. A. Sleep function with particular reference to sleep deprivation. *Annals of Clinical Research* 1985; **17**: 5; 199-208.
[55]Karacan, I., Thornby, J. I., Anch, A. M., Williams, R. L. The effects of high ambient temperature on sleep in young men. *Sleep Research* 1978; **7**: 171.
[56]Otto, E. Physiological analysis of human sleep-disturbances induced by noise and increased room temperature. In: Koella, W. P., Levin, P. (eds) *Sleep* Basel: Karger, 1973, 414-418.
[57]Haskell, E. H., Palca, J. W., Walker, J. M., Berger, R. J., Heller, H. C. The influence of ambient temperature on electrophysical sleep in humans. *Sleep Research* 1978; **7**: 170.
[58]Karacan, I., Wolff, S. M., Williams, R. L., Hursch, C. J., Webb, W. B. The effect of fever on sleep and dream patterns. *Psychosomatics* 1968; **9**: 331-339.
[59]Zulley, J. Timing of sleep within the circadian temperature cycle. *Sleep Research* 1980; **9**: 282.
[60]Zulley, J., Schulz, H. Sleep and body temperature in free-running sleep wake cycles. In: Popovitch, L., Asgian, B., Badiu, G. (eds) *Sleep* Basel: Karger, 1980, 341-344.
[61]Partinen, M., Kaprio, J., Koskenvuo, M., Putkonen, P., Langinvainio, H. Genetic and environmental determination of human sleep. *Sleep* 1983; **6**: 3, 179-185.
[62]Kessler, S. Genetic factors in narcolepsy. In: Guilleminault, C., Dement, W. C., Passouant, P. (eds) *Narcolepsy.* New York: Spectrum Publications, 1976, 285-302.
[63]Roth, B., Nevsimalova, S., Rechtschaffen, A. Hypersomnia with 'sleep drunkenness'. *Archives of General Phychiatry* 1972; **26**: 456-462.
[64]Walker, B. B. The postsurgery heart patient: amount of uninterrupted time for sleep and rest during the first, second and third postoperative days in a teaching hospital. *Nursing Research* 1972; **21**: 2, 164-169.
[65]Woods, N. Patterns of sleep in post-cardiotomy patients. *Nursing Research* 1972; **21**: 347-352.
[66]Bonnet, M. H. Effect of sleep disruption on sleep, performance and mood. *Sleep* 1985; **8**: 1, 11-19.
[67]Horne, J. A., Wilkinson, S. Chronic sleep reduction: daytime vigilance performance and EEG measures of sleepiness, with particular reference to 'practice' effects. *Psychophysiology* 1984; **21**: 6; 69-78.
[68]Fabijan, L., Gosselin, M. How to recognise sleep deprivation in your ICU patient and what to do about it. *The Canadian Nurse* 1982; **78**: 4, 20-23.
[69]Morgan, H., White, B. Sleep deprivation. *Nursing Mirror* 1983; **157**: 14, S8-S11.
[70]Hilton, B. A. Quantity and quality of patients' sleep and sleep disturbing factors in a respiratory intensive care unit. *Journal of Advanced Nursing* 1976; **1**: 6, 453-468.
[71]Aurell, J., Elmqvist, D. Sleep in the surgical intensive care unit: continuous polygraphic recording of sleep in nine patients receiving postoperative care. *British Medical Journal* 1985; **290**: 6474, 1029-1032.
[72]Orr, W.C., Stahl, M.L., Sleep disturbances after open heart surgery. *American Journal of Cardiology* 1977; **39**: 196-201.
[73]Johns, M. W., Large, A. A., Masterton, J. P., Dudley, H. A. F. Sleep and delirium after open heart surgery. *British Journal of Surgery* 1974; **61**: 5, 377-381.
[74]Ellis, B. W., Dudley, H. A. F. Some aspects of sleep research in surgical stress. *Journal of Psychosomatic Research* 1976; **20**: 303-308.
[75]Whitfield, S. Noise on the ward at night. *Nurging Times* 1975; **71**: 11, 408-412.
[76]*The Royal Commission on the National Health Service* (Chairman: Sir Alec Merrison), London: HMSO, Cmnd No. 7615, 1975.
[77]Murphy, F., Bentley, S., Ellis, B. W., Dudley, H. Sleep deprivation in patients undergoing operation: a factor in the stress of surgery. *British Medical Journal* 1977; **2**: 610, 1521-1522.
[78]Carter, D. E. *Sleep and the Low Dependency Hospital Patient.* Unpublished paper presented at the Scottish Rcn Research Society Conference, November 1984.
[79]Dodds, E. J. *Sleep Well? A study of ward activity and nurse-patient interaction at night.* Unpublished MSc thesis, University of Surrey, 1980.
[80]Stead, W. One awake, all awake! *Nursing Mirror* 1985; **160**: 16; 20-21.
[81]Bailey, H. *Sleep and the Hospital Patient.* Research Report 1, Department of Nursing and Community Health Studies. The Polytechnic of the South Bank, 1981.

● **This review of the literature has been prepared in planning a study of sleep disruption in hospital patients, a project which is part of the Nursing Research Unit's core programme of research at the University of Edinburgh. It is funded by the Scottish Home and Health Department, and directed by Dr Alison Tierney.**

Accepted September 1986

José Closs is research associate, Nursing Research Unit, Department of Nursing Studies, University of Edinburgh

A copy of this Occasional Paper, and of Part 1, which appeared in the issue of January 6, may be obtained from Ms Closs, Nursing Research Unit, Department of Nursing Studies, University of Edinburgh, 12 Buccleuch Place, Edingurgh, EH8 9LN, on receipt of a large stamped addressed envelope.

Journal of Advanced Nursing, 1988, **13**, 501–510

Assessment of sleep in hospital patients: a review of methods

S. José Closs BSc(Hons) MPhil RGN *Research Associate, Nursing Research Department, Department of Nursing Studies, University of Edinburgh, 12 Buccleuch Place, Edinburgh EH8 9LN*

Accepted for publication 12 August 1987

CLOSS S.J. (1988) *Journal of Advanced Nursing* **13**, 501–510
Assessment of sleep in hospital patients: a review of methods
Since sleep and healing appear to be associated, achieving the optimum quality of sleep among hospital patients should be a priority for both clinical nurses and researchers. This paper discusses various methods of sleep assessment which may be used by those intending to conduct research in this field.

INTRODUCTION

Relatively little of the sleep research which has been undertaken during the past few years has focused on hospital patient's sleep. Those research reports which have addressed this area indicate that difficulties in sleeping among patients on hospital wards and high dependency units have been underestimated (Walker 1972, Woods 1972, Hilton 1976, Aurell & Elmqvist 1985). Since there is a considerable amount of evidence which suggests that sleep contributes to both physiological and psychological restoration (Oswald 1984), it is important that attention should be paid to the problems of inpatients. The theory that sleep is associated with healing suggests that achieving optimum sleep quality is in the interest of all hospital inpatients, particularly those who have undergone trauma or surgery. Identifying and responding to the sleep needs of patients should, therefore, be a goal for nursing practice and a priority for nursing research.

In terms of research into sleep problems there are several approaches to the measurement of sleep and its correlates. An awareness of such techniques can help the nurse to appraise pertinent sleep literature and thereby promote good nursing practice and stimulate nurses to undertake relevant research. The two types of method commonly used include subjective assessments of sleep by the sleeper, and objective measurements of physiological and psychological factors associated with sleep. Ward nurses' assessments usually involve a combination of these approaches, being based on their own observations and the patients' own reports of the quality and/or quantity of their sleep. Research into the sleep of inpatients might include detailed subjective assessments and perhaps EEG recordings in preference to other methods, though much would depend on the type of patient. The availability of equipment and the technical skills of the researcher would also be crucial factors in the selection of a method.

In this review, the structure and function of sleep are considered briefly before methods of assessment are discussed, since a basic understanding of these factors is important when considering the pros and cons of the various ways of measuring sleep.

Structure of sleep

Sleep is a temporary loss of consciousness, and has been described as 'a recurrent healthy state . . . of inertia and unresponsiveness' (Oswald 1976). It is not simply a lack of wakefulness; the two states are interdependent and are maintained by highly integrated central nervous system activity associated with changes in the peripheral nervous system as well as the endocrine, cardiovascular, respiratory and muscular

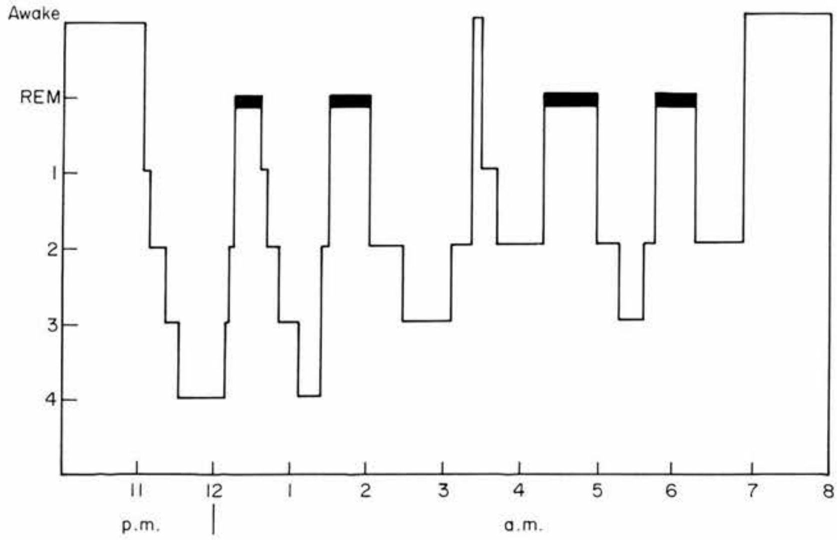


FIGURE 1 *Typical pattern of sleep stages in a healthy young adult.*

systems. According to contemporary EEG (electroencephalography) measurements, sleep has been divided into two distinct states: REM (rapid eye movement) and NREM (non-rapid eye movement). NREM is further subdivided into stages 1, 2, 3 and 4 which are increasingly 'deep'. Stages 3 and 4 comprise the portion known as SWS (slow wave sleep). These states are described in more detail later.

During a night's sleep, all of these stages may occur many times (though with advancing age stage 4 gradually diminishes). In healthy young adults there is usually progress from stage 1 through to stage 4. This is frequently followed by an episode of REM, this progression being repeated in approximately 90-minute cycles (Figure 1). Shifts from stage to stage tend to accompany body movements, and shifts to light sleep tend to occur suddenly, whereas shifts to deep sleep tend to be gradual.

Functions of sleep

Despite efforts by many researchers, the precise functions of sleep are not yet known. It has been suggested that sleep is merely 'an instinct, a genetic hangover from earlier days' (Canavan 1984), implying that sleep is not essential. Horne (1983), however, proposes that 'two processes may work in parallel, that of obligatory and restorative sleep, oriented towards brain restitution, and that of the more facultative sleep drive'. According to Oswald (1984) there are 'over 100 research reports showing that the protein synthesis and cell division for the renewal of tissues like the skin, bone marrow, gastric mucosa, bone or brain take place predominantly during the time of the 24 hours devoted to rest and sleep'. Growth hormone, which stimulates RNA and protein synthesis and amino acid uptake, reaches peak secretion rates during SWS (Korner 1965). In addition, SWS is the portion of sleep which has the greatest positive correlation with the length of prior wakefulness, suggesting that it has restorative properties (Webb & Agnew 1971, Czeisler *et al.* 1980, Akerstedt & Gillberg 1981).

The psychological effects of sleep deprivation, such as lethargy, irritability and confusion (Horne 1983) might adversely effect the recovery of hospital patients. Self-care could be impaired by lack of motivation and uncooperativeness.

Since there is a considerable body of literature which supports the assertion that sleep is associated with both physiological and psychological restitution, nurses (and other hospital staff) should attempt to provide conditions in hospital which are optimum for sleep.

SUBJECTIVE METHODS OF EVALUATION

Subjective evaluations provide quantitative estimates or qualitative assessments of sleep as it is experienced by the sleeper. How a person feels about his sleep, whether it is restful and refreshing or restless and disturbed by nightmares can only be reported by the individual who experienced that sleep. Sleep and wakefulness are interdependent; a good night's sleep is associated with a good day's wakefulness before and after it. Normal sleep is difficult to define since individuals vary enormously, being affected by many factors such as age, gender, diet and physical and psychological health.

Individual assessments of sleep quality necessitate subjective ratings. These assessments do not necessarily accord with objective measures; satisfaction with sleep may not be related to time spent asleep, depth of sleep, etc. No matter how much or how little sleep a person has, regardless of any objective sleep measures, if he is satisfied with it then it may be considered normal for him.

It has been demonstrated that responses to simple questions asking both normal and insomniac subjects for assessments of their own sleep duration or number of arousals during the night do not provide accurate information (Monroe 1967, Carskadon *et al.* 1976, Frankel *et al.* 1976). Carskadon *et al.* (1976) compared subjective and EEG data from subjects complaining of insomnia. Results indicated that most of them consistently underestimated the length of time spent asleep (total sleep time TST) and overestimated the time taken to get to sleep (sleep onset latency SOL). Interestingly, a degree of internal consistency exists in such estimates, for both insomniacs and normal controls. 'Even though insomniacs consistently overestimated their sleeplessness, their polygraphic sleep patterns could be predicted from their subjective estimates' (Frankel *et al.* 1976).

Monroe (1967) showed that subjects who were selected as 'good' or 'poor' sleepers according to the results of a sleep questionnaire had corresponding objective differences in sleep as measured by EEG. This was corroborated by Adam *et al.* (1986) who matched two groups of 18 subjects according to age, sex, height and weight. One group were considered to be good sleepers and the other group poor sleepers, based on their stated opinions about their sleep. Polygraphic recordings showed that the poor sleepers had a TST half an hour shorter and woke more often in the early hours of sleep than the good sleepers. In addition the poor sleepers were more anxious and had higher body temperatures. It seems that normal individuals can provide a reasonably accurate estimate of their own sleep patterns, and that although insomniacs are unable to provide accurate reports of their sleep, they are very sensitive to any changes in their own normal sleep patterns. It is therefore probable that self-assessments of sleep can produce useful information about changes in sleep for individuals provided that any physical or psychological disorders are taken into account.

Since no-one but a given sleeper has access to his personal satisfaction with sleep, it is only he who can say whether or not he has 'slept well'. Although it is impossible for individuals to quantify their sleep accurately, assessments of changes in sleep quality have been used successfully. Subjective methods of assessing sleep including visual analogue scales, subjective rating scales, questionnaires, interviews and daily sleep charting are discussed below.

Visual analogue scales

Perhaps the simplest and most effective subjective method is that of the visual analogue scale. A 100 mm horizontal line with opposing statements at each end, e.g. 'best sleep ever' at one end and 'worst night ever' at the other is presented to the respondent. The subject being assessed is asked to place a mark on the line in a position corresponding to his perception of his previous night's sleep, a mark in the centre denoting an average night. The distance of that mark along the line may then be measured in mm, providing a numerical value for satisfaction with the previous night's sleep. Each subject creates his own scale which is extremely sensitive to change and therefore particularly useful for serial assessments (Oswald 1980). A research question such as 'How does the sleep satisfaction of routine surgical patients vary over the duration of admission to hospital' could usefully be addressed using this approach.

A major disadvantage of this particular method is that some people are unable to grasp the principles necessary to use it, but it has been used successfully by many sleep researchers (Zealley & Aitken 1969, Oswald *et al.* 1971, Bond & Lader 1974, Hindmarch *et al.* 1977). Visual analogue scales have been particularly useful in studies of the effects of various hypnotic drugs on sleep.

Subjective rating scales

Subjective rating scales serve as a simple and useful means of assessing perceived moods and feelings relating to sleep. A simple method might require subjects to compare consecutive nights, saying whether night 2 was or was not better than night 1. This is particularly good if a group of ill patients is being studied since it is not very demanding. However, the information provided is somewhat limited.

Many different types of measure of mood state have been devised, looking at parameters such as depression, vigour and lethargy; sleepiness, however, is the only aspect of mood which is consistently and systematically affected by manipulations of sleep. One of the most sensitive of these types of scales is the Stanford Sleepiness Scale (SSS). This was designed by Hoddes *et al.* (1972) to quantify subjective sleepiness levels. The SSS utilizes a seven point scale of equal intervals varying from 1 (very alert) to 7 (excessively sleepy). Several adjectives are used, including 1 (feeling active and vital; alert; wide awake) to 7 (almost in reverie; sleep onset soon; lost in struggle to remain awake). The SSS is sensitive to partial as well as total sleep deprivation, with ratings changing in parallel with polygraphic recordings.

Subjective rating scales are inexpensive and simple to use, producing relevant and useful information when assessing sleep satisfaction in, for example, cardiac patients. It might be possible to implement more effective schedules for physical and psychological rehabilitation by studying variations in subjective sleepiness throughout the day. Little effort is required by the patient to use such a scale.

Questionnaires

Self-administered questionnaires may be used in order for the subject to answer specific questions about his sleep pattern. For example, a question such as 'what time do you usually wake up in the morning?' is followed by a range of possible answers such as:

1. Before 5 a.m.
2. 5 a.m.–5·59 a.m.
3. 6 a.m.–6·59 a.m.
4. 7 a.m.–7·59 a.m.
5. 8 a.m.–8·59 a.m.
6. 9 a.m. or later

The respondent is simply required to tick the appropriate box. The sensitivity of such instruments may be adjusted by changing the intervals from hourly (as above) to half hourly, or whatever time intervals are appropriate to the research question.

More detailed questionnaires have been devised which ask for precise answers to questions such as 'What time do you usually settle down in bed ready to go to sleep?', 'How long does it take you to fall asleep?', and 'What time do you usually wake up in the morning?'. Webb (1965) found that this method was reliable on test-retest administrations of the questionnaire, that is when the questions were answered on several different occasions, the subjects gave the same response each time. A specific questionnaire which has been shown to be similarly reliable is the St Mary's Hospital Sleep Questionnaire which assesses the previous night's sleep of a subject (Ellis *et al.* 1981).

Such questionnaires are useful for investigating how a stay in hospital alters normal sleep patterns and routines. Unfortunately some practical problems may be encountered, such as the presence of an intravenous infusion sited in the dominant hand or arm which could make it difficult to write. Reading might also present difficulties, where bulky facial dressings or inconveniently positioned nasogastric tubes may make it awkward for patients to wear their spectacles. Finally, those who are tired or in pain may be reluctant to respond to the extra demand of completing a questionnaire.

Interviews

These can be structured in much the same way as questionnaires, but may be more appropriate for use with hospital patients who might have difficulty in reading or writing, either due to their illness or otherwise. This method enables the interviewer to clarify questions if necessary and to ensure that no data are missing, these being major advantages when compared with the use of self-administered questionnaires. One disadvantage is that it is more time consuming. An example of such an interview is provided by Dodds (1980).

Daily sleep charting

Daily sleep charting is a method which has been used successfully with normal subjects of different occupational groups (Lewis & Masterton 1957, Masterton 1965) and ages (Tune 1969a, Tune 1969b). A chart is filled in every morning for the duration of the study producing information on day-to-day variations in sleep/wake patterns over long periods. Generally the questions posed ask for details such as time of going to sleep, night-time awakenings and final morning awakening. This method is not sensitive enough to show differences between individuals, but is useful for studying group differences. For example, sleep charts could be used to study whether reported sleep patterns of patients on wards with differing routines and policies (regarding daytime naps, hypnotic administration, times of lights-out and morning awakening and so forth) differ significantly. Ward routines which allow individuals to fulfil their own sleep requirements might then be identified.

The target sample needs to be motivated to participate in such research, otherwise recordings are liable to be missed. This method is generally used over long periods, and therefore is inappropriate for studying acutely ill patients who have relatively short stays in hospital.

OBJECTIVE METHODS OF MEASUREMENT

While strictly speaking there is no objective way of measuring sleep itself, measurements of the physiological and psychological changes associated with sleep may be made with considerable accuracy. Changes in levels of consciousness may be observed as well as changes in arousal thresholds, body movements, electrodermal activity, EEG (electroencephalogram), EOG (electro-oculogram), and EMG (electromyogram). Daytime vigilance and sleepiness have also been used since they reflect the quality of sleep prior to testing. These methods are discussed here.

Polysomnography

Typical polygraphic recordings of sleeping subjects include not only EEG traces of the electrical activity of the brain, but also simultaneous recordings of EOG and EMG traces. The latter recordings provide information about eye movements and (usually submental) muscle tone respectively, which differ markedly between REM and NREM sleep. These recordings provide the only reliable method of measuring the onset, progress and depth of sleep and polysomnography is currently the best method available for detailed studies of small numbers of subjects.

The EEG signal is amplified and is usually recorded onto paper running at 10 or 25 mm per second, though it may be recorded onto magnetic tape and later played back on a visual display unit. The recording is then scored visually into stages 1–4, REM and wakefulness according to precise criteria (Rechtschaffen & Kales 1968), in epochs of 20 or 30 seconds.

Concurrent recordings of EEG, EOG and EMG show the various stages of sleep, i.e. REM and NREM stages 1, 2, 3 and 4. In each of the four stages of NREM, electrical activity slows progressively and increases in amplitude.

During REM (sometimes called paradoxical sleep) the EEG is virtually indistinguishable from awake, with low amplitude mixed frequency activity. Bursts of rapid eye movement occur, and if subjects are woken up they frequently report that they were dreaming. These jerky eye movements are accompanied by a drastic reduction in skeletal muscle tone, irregularities in respiration and heart rates, high cerebral blood flow, and in men penile erections frequently occur.

The relative quantities of time spent in the various stages of sleep change during adult life, with stages 3 and 4 diminishing with age, and stages 1 and 2 showing a reciprocal increase. There is only a slight decrease in the proportion of REM sleep with age (Williams *et al.* 1974). However, the timing and length of REM sleep episodes is very sensitive to other influences, including psychological tension, some physical illnesses and many psychiatric illnesses.

Sleep duration varies widely between healthy adult subjects. A range of 3–12 hours has been cited (Johns 1984), with a mean of 7·25 hours. No consistent sex differences have been demonstrated, although women frequently complain more than men about their sleep (McGhie & Russell 1962). A reduction in both SWS and REM is seen in older people, they undergo more stage changes, and their sleep-wake patterns become more fragmented. It may be that older people need reassurance that the changes in sleep pattern they experience are normal, rather than intervening with 'treatment' such as hypnotic drugs. Physical illnesses such as congestive cardiac failure, severe asthma and chronic obstructive airways disease increase the frequency of night-time awakenings. Psychological disorders may also affect sleep; depression is often associated with difficulty in falling asleep and early morning awakening, while anxiety is associated with a very long sleep onset latency, and a reduction in stage 4 and REM sleep, with more stage shifts and awakenings during the night. Both a raised ambient temperature and fever are associated with an increase in the number of awakenings, and a reduction in SWS and REM (Karacan *et al.* 1968, Karacan *et al.* 1978), though the effects of such changes are not clear. In addition, obese people tend to sleep for longer than thin ones (Oswald 1984) and changes in body weight are reflected in sleep patterns, duration of sleep becoming shorter as weight is lost.

Unlike other methods, the all-night EEG recording can be used to determine accurately the following:

1. Sleep onset latency, the time from settling down ready to go to sleep to the appearance of 30 seconds of stage 1 sleep (though some researchers use stage 2).
2. Sleep period time, the length of time between sleep onset and final awakening.
3. Wakefulness after sleep onset, episodes of 30 seconds or more of 'awake' EEG during the sleep period. This information indicates the degree of disturbance in terms of either duration (time spent awake) or frequency (number of awakenings).
4. Frequency of stage shifts, i.e. the number of changes from one stage to another may also indicate sleep disturbance.
5. Total sleep time, the total time spent asleep between sleep onset and final awakening.
6. Sleep efficiency, the proportion of time in bed actually spent asleep. This is calculated by dividing total sleep time by time in bed, and assumes that the individual in bed is attempting to get to sleep.

'Do sedated and paralysed patients on an intensive care unit undergo undetected sleep deprivation' is the kind of research question which could be addressed very effectively using polygraphic techniques.

The shortcomings of this method of measuring sleep should not, however, be ignored. One of the drawbacks is that a single nights sleep recording may produce thousands of metres of recorder paper which then has to be scored by hand. These interpretations of EEG traces may not always be as objective as has frequently been claimed, since stage changes in the EEG trace usually occur gradually, each stage of NREM merging into the next. Different scorers may therefore dispute whether a particular epoch is; for example, stage 3 or 4 if it is borderline. Strict adherence to the criteria specified by Rechtschaffen & Kales (1968) should minimize this problem. Another disadvantage is that the results obtained from the first night's recordings are generally discarded because of the unusually disturbed sleep; the so-called first night effect. Certain drugs often used for premedication, such as atropine sulphate and hyoscyamine sulphate produce an EEG characteristic of sleep even during wakefulness (Bradley & Elkes 1957). Harden *et al.* (1968) found that uncomplicated cardiac surgery may be followed by a waking EEG including increased amounts of slow activity similar to SWS. This appeared to be related to hyponatraemia. In addition, elderly people frequently show slow wave activity during wakefulness.

Recently there have been developments in portable telemetry techniques, making it possible to record polysomnographic traces onto audio cassettes. These cassettes may be played back and decoded through a visual display unit, and in some cases 'sleep stagers' will perform an automatic analysis and printout of a night's sleep. Unfortunately, this type of equipment is prohibitively expensive at present.

Observation of sleeper

Several researchers have used observation as a method of quantifying sleep but it is not particularly reliable. This nominal method of sleep measurement attempts to identify two qualitatively different states only: wakefulness and sleep. Intermittent observations are of limited use since the sleeper may wake up between observations without this being observed. The time of initially falling asleep and of finally waking up cannot be judged with any precision. Nevertheless, a study by Platman & Fieve (1970) in which nurses observed psychiatric patients every half hour produced results in which nights of depression could be differentiated from nights of recovery from depression.

Some of the problems inherent in this method can be overcome by using continuous observation, perhaps by using a video camera or closed circuit television (Johns *et al.* 1969). It is impossible, however, to accurately assess level of consciousness simply by looking at the sleeper. Neither is it possible to measure precisely the length of time spent asleep or the time taken to fall asleep. Dodds (1980) found from her interviews with hospital patients that many of them pretended to be asleep when nurses approached them during the night, since they perceived the nurses as being busy and did not wish to create any extra work for them.

Observations of sleeping patients do not provide detailed information about quantity or quality of sleep but are non-intrusive and provide an estimate of duration of sleep when observations are sufficiently frequent, that is, not more than half an hour apart.

Arousal thresholds

This is one of the earliest methods of measuring 'depth' of sleep. Generally, the degree of difficulty encountered in arousing someone from sleep increases progressively from stage 1 to stage 4, with REM being intermediate. Thus if sound is the arousing stimulus, increasing volumes are required to wake the subject as sleep becomes deeper. This indicator of the depth of sleep is confirmed by other studies; similarly diminishing degrees of responsiveness have been shown in motor responses to auditory signals during sleep (Williams *et al.* 1966), amounts of spontaneous scratching by itchy patients (Savin *et al.* 1979), and whole body oxygen consumption (Brebbia & Altschuler 1968). Although it is more difficult to waken an individual from stage 4 than any other stage of sleep, it cannot be said that stage 4 is 'deeper' than REM since they are completely different states.

The determination of arousal thresholds is the best method for measuring depth of sleep, in healthy volunteers, but it is obviously unsuitable for the study of sleep in hospital patients since it depends on disturbing the subjects' sleep in order to determine its depth.

Body movements

Body movements diminish during sleep, particularly during REM when muscle relaxation is profound. The measurement of such body movements may either record the number of body movements made or the energy put into them. Kleitman (1963) was the first to make all night recordings of body motility with electromechanical devices such as sensitive microphones attached to bedsprings at one end and some kind of recorder at the other. He found that normal subjects tended to move 20–60 times per night, but concluded that 'One is certainly not justified in judging the quality of sleep entirely or mainly on the basis of how many movements per hour or per night the sleeper made'. These actogrammes do not measure sleep *per se*, but how 'restful' or otherwise sleep is under the influence of various hypnotics for example. Monroe (1967) used a piezoelectric crystal attached to bedsprings to show that significant differences in body motility exist between good and poor sleepers, particularly in stages 3 and 4.

The wrist actigraph is a relatively new means of measuring sleep which works on a similar principle. A piezoelectric transducer is worn like a wristwatch, and attached to a Medilog 24-hour tape recorder so that a single recording of all night wrist movements may be made (Mullaney *et al.* 1980).

Measurements of motility are really only useful as indicators of the restlessness or otherwise of sleep, and do not record nocturnal awakenings or any other details of sleep. This would not be an appropriate measure for patients suffering pain, since lack of motility might indicate difficulty in moving rather than the presence of sleep. Consequently, this method could be used to investigate, for example, the movements made by patients suffering from severe arthritis when in bed, which might have implications for pressure area management.

Vigilance and sleepiness

Objective studies of the effects of sleep loss have focused on two major aspects of waking function: performance and objective sleepiness. Performance tests vary in their sensitivity to changes in sleep, with long monotonous tasks which test vigilance being the most sensitive. Vigilance may be defined as the ability to sustain attention. Tests devised to assess daytime vigilance and sleepiness reflect the quality of previous sleep. Cerebrally demanding tasks which involve complex decision making are not primarily affected by sleep deprivation, it is mainly motivation and willingness which are reduced, making uninteresting repetitive tasks the first to be adversely affected. The Wilkinson Auditory Vigilance test requires that the subject remain alert for 1 hour. The subject is presented with regularly spaced tones half a second in duration, occurring at 2-second intervals. Forty of the tones randomly presented over the hour are slightly shorter (400 msec instead of 500 msec) and the subject is asked to identify these. Failure to identify these short bleeps has been used successfully as an indicator of impaired vigilance, reflecting deficits in sleep quality.

The Multiple Sleep Latency Test (MSLT) was developed at Stanford to objectively assess 'sleepiness', which is simply the tendency to fall asleep. This test measures the time taken for a subject attached to an EEG monitor to fall asleep while lying on a comfortable bed in a darkened room. The MSLT is the only direct measure of sleepiness which has been shown to give a reliable indication of the effects of different manipulations of sleep. It has been shown to be sensitive to both sleep deprivation and sleep extension (Carskadon & Dement 1979a, Carskadon & Dement 1979b). This objective measure of sleepiness has shown effects with only 2 hours sleep loss (Carskadon *et al.* 1981). Unlike performance tests, motivation does not seem to reduce the effect of sleep loss as measured by MSLT.

Vigilance and sleepiness tests are not particularly appropriate for assessing sleep among hospital patients, because they are fairly stressful, time consuming or require specialized equipment.

Electrodermal activity

Studies have shown that electrodermal activity (EDA) follows a predictable pattern during sleep (Freixa i Baqué *et al.* 1983). The electrical activity of the skin may be monitored by applying an electrode to the plantar surface of the hand and a second to the ventral surface of the arm in order to measure the potential difference between them. Prior to sleep electrodermal responses (EDR) are relatively rare. Falling asleep does not appear to affect EDA (Broughton *et al.* 1965). EDRs are more common in stage 2 than during wakefulness and continue to increase during stages 3 and 4. During REM sleep the number of responses decreases and is usually associated with eye movements. Although this technique causes little inconvenience to the patient, it is not sensitive enough for most purposes, though it might give an indication of time spent in SWS when EDRs are at their highest.

CONCLUSIONS

Obviously there are many different ways of measuring the various physiological and psychological changes occuring in association with sleep, as well as of making subjective assessments of sleep quality. When deciding on which method to use, first, and most importantly, research issues should be defined clearly. The variable of interest can then be measured using the most appropriate method. Obviously a method which is convenient but which does not address precisely the research question is liable to produce invalid results. Secondly, the cost of equipment and inconvenience to the patient should be considered. Many objective measures necessitate the use of expensive equipment to which the majority of nurses would be unable to gain access, and some patients might find such monitoring anxiety provoking, restrictive or uncomfortable.

Finally, individual patient factors pertinent to the chosen method should be considered. For example, patients with cataracts or arthritic fingers would not be able to complete a self-administered questionnaire, even if in theory it was the best way of gathering the data. Similar problems could be encountered when using subjective rating or visual analogue scales. If polygraphic recordings were selected as the method of choice it would not be possible to include patients taking barbiturates, or those with skin conditions since they might not be able to tolerate electrodes being attached to their skin. An interview might not be possible with a deaf person.

The chosen research problem should be carefully defined in order that an appropriate method of measurement may be used to provide valid and reliable results; the practicalities of using that method should be taken into account, and finally, variables such as age, and physical and psychological health should be considered when interpreting the results.

Acknowledgements

This review has been prepared as part of a study of sleep patterns in hospital patients. This project is part of the Nursing Research Unit's core programme of research at the Department of Nursing Studies, University of Edinburgh. The programme is funded by the Scottish Home and Health Department and directed by Dr Alison Tierney. I would like to thank both Dr Tierney and Dr Kevin Morgan for their help in preparing this paper.

References

Adam K. & Oswald I. (1984) Sleep helps healing. *British Medical Journal* **289**, 1400–1401.

Adam K., Tomeny M. & Oswald I. (1986) Physiological and psychological differences between good and poor sleepers. *Journal of Psychiatric Research* **20**(4), 301–306.

Akerstedt T. & Gillberg M. (1981) The circadian variation of experimentally disturbed sleep. *Sleep* **4**, 159–170.

Aurell J. & Elmqvist D. (1985) Sleep in the surgical intensive care unit: continuous polygraphic recording of sleep in nine patients receiving postoperative care. *British Medical Journal* **290**, 1029–1032.

Bond A. & Lader M. (1974) The use of analogue scales in rating subjective feelings. *British Journal of Medical Psychology* **47**, 211–218.

Bradley F.B. & Elkes J. (1957) The effect of some drugs on the electrical activity of the brain. *Brain* **80**, 77–117.

Brebbia D.R. & Altschuler K.Z. (1968) Stage related patterns and nightly trends of energy during sleep. In *Computers and Electronic Devices in Psychiatry* (Kline E.S. & Laska E. eds), Grune & Stratton, New York, pp. 319–335.

Broughton R., Poire R. & Tassarini C. (1965) The electrodermogram (Tarchanoff effect) during sleep. *Electroencephalography and Clinical Neurophysiology* **18**, 691–708.

Canavan T. (1984) The psychobiology of sleep. *Nursing* **2**(23), 682–683.

Carskadon M., Dement W.C., Mitler M.M., Guilleminault C., Zarcone V.P. & Spiegel R. (1976) Self-reports versus sleep laboratory findings in 122 drug free subjects with complaints of chronic insomnia. *American Journal of Psychiatry* **133**, 1382–1388.

Carskadon M. & Dement W. (1979a) Effects of total sleep loss on sleep tendency. *Perceptual and Motor Skills* **48**, 495–506.

Carskadon M. & Dement W. (1979b) Sleep tendency during extension of nocturnal sleep. *Sleep Research* **8**, 147.

Czeisler C.A., Weitzman E.D., Moore-Ede M.C., Zimmerman J.C. & Knauer R.A. (1980) Human sleep: its duration and organisation depend on its circadian phase. *Science* **210**, 1264–1267.

Carskadon M., Harvey K. & Dement W. (1981) Acute restriction of normal sleep in children. *Perceptual and Motor Skills* **53**, 103–112.

Dodds E.J. (1980) Slept well? A study of ward activity and nurse-patient interaction at night. Unpublished MSc thesis, University of Surrey.

Ellis B.W., Johns M.W., Lancaster R., Raptopoulos P., Angelopoulos N. & Priest R.G. (1981) The St Mary's Hospital Sleep Questionnaire: a study of reliability. *Sleep* **4**(1), 93–97.

Frankel B.L., Course R.D., Buchbinder R. & Snyder F. (1976) Recorded and reported sleep in chronic primary insomnia. *Archives of General Psychiatry* **33**, 615–623.

Freixa I Baqué E., Chevalier B., Grubar J.C., Lambert C., Lancry A., Leconte P., Meriaux H. & Spreux F. (1983) Spontaneous electrodermal activity during sleep in man: an intranight study. *Sleep* **6**(1), 77–81.

Harden A., Glaser G.H. & Pampiglione G. (1968) Electroencephalographic and plasma electrolyte changes after cardiac surgery in children. *British Medical Journal* **4**, 210–213.

Herscovitch J. & Broughton R. (1981) Sensitivity of the Stanford Sleepiness Scale to the effects of cumulative partial sleep deprivation. *Sleep* **4**(1), 83–92.

Hilton B.A. (1976) Quantity and quality of patients' sleep and sleep disturbing factors in a respiratory intensive care unit. *Journal of Advanced Nursing* **1**, 453–468.

Hindmarch I., Parrott A.C. & Arenillas L. (1977) A repeated dose comparison of dichloralphenazone, flunitrazepam and amylobarbitone sodium on some aspects of sleep and early morning behaviour in normal subjects. *British Journal of Clinical Pharmacology* **4**, 229–233.

Hoddes E., Dement W.C. & Zarcone V. (1972) The history and use of the Stanford Sleepiness Scale (Abstract). *Psychophysiology* **9**, 150.

Horne J.A. (1983) Human sleep and tissue restitution: some qualifications and doubts. *Clinical Science* **65**, 569–578.

Johns M.W., Cornell B.A. & Masterton J.P. (1969) Monitoring sleep of hospital patients by measurement of electrical resistance of skin. *Journal of Applied Physiology* **27**, 898–901.

Johns M.W. (1984) Normal sleep. In *Sleep: An International Monograph*. (Priest R.G. ed.), Update Books, London, p. 16.

Karacan I., Wolff S.M., Williams R.L., Hursch C.J. & Webb W.B. (1968) The effect of fever on sleep and dream patterns. *Psychosomatics* **9**, 331–339.

Karacan I., Thornby J.I., Anch A.M. & Williams R.L. (1978) The effects of high ambient temperature on sleep in young men. *Sleep Research* **7**, 171.

Kleitman N. (1963) *Sleep and Wakefulness*. University of Chicago Press, Chicago.

Korner A. (1965) Growth hormone control of biosynthesis of protein and ribonucleic acid. *Recent Progress in Hormone Research* **21**, 205–236.

Lewis H.E. & Masterton J.P. (1957) Sleep and wakefulness in the Arctic. *Lancet* **i**, 1262–1266.

Masterton J.P. (1965) Patterns of sleep. In *The Physiology of Human Survival* (Edholm O.G. & Bacharach A.L. eds), Academic Press, London, pp. 388–397.

McGhie A. & Russell S. (1962) The subjective assessment of normal sleep patterns. *Journal of Mental Science* **108**, 642.

Monroe L.J. (1967) Psychological and physiological differences between good and poor sleepers. *Journal of Abnormal Psychology* **72**, 255–264.

Mullaney D.J., Kripke D.F. & Messin S. (1980) Wrist-actigraphic estimation of sleep time. *Sleep* **3**(1), 83–92.

Oswald I., Lewis S.A., Dunleavy D.L.F., Brezinova V. & Briggs M. (1971) Drugs of dependence though not of abuse: fenfluramine and imipramine. *British Medical Journal* **3**, 70–73.

Oswald I. (1976) *Sleep*, 3rd edn. Penguin, London.

Oswald I. (1984) Good, poor and disordered sleep. In *Sleep: An International Monograph* (Priest R. G. ed.), Update Books, London, pp. 18–24.

Oswald I. (1980) Sleep studies in clinical pharmacology. *British Journal of Pharmacology* **10**, 317–326.

Platman S.R. & Fieve R.R. (1970) Sleep depression and mania. *British Journal of Psychiatry* **116**, 219–220.

Rechtschaffen A. & Kales A. (1968) *A Manual of Standardised Terminology, Techniques and Scoring System for Sleep Stages of Human Subjects*. US Dept of Health, Education and Welfare, Bethesda, Maryland.

Savin J.A., Paterson W.D., Adam K. & Oswald I. (1979) Effects of trimeprazine on nocturnal scratching in patients with atopic eczema. *Archives of Dermatology* **115**, 313–315.

Tune G.S. (1969a) Sleep and wakefulness in 509 normal human adults. *British Journal of Medical Psychology* **42**, 75–80.

Tune G.S. (1969b) The influence of age and temperament on the adult human sleep wakefulness pattern. *British Journal of Psychology* **60**, 431–441.

Walker B.B. (1972) The postsurgery heart patient: amount of uninterrupted time for sleep and rest during the first, second and third postoperative days in a teaching hospital. *Nursing Research* **21** (2), 164–169.

Webb W.B. (1965) Sleep characteristics of human subjects. *Bulletin of the British Psychological Society* **18**, 1–10.

Webb W.B. & Agnew H.W. (1971) Stage 4 sleep: influence of time-course variables. *Science* **174**, 1354–1356.

Williams H.L., Morlock H.C. & Morlock J.V. (1966) Discriminative responses to auditory signals during sleep. *Psychophysiology* **2**, 208–215.

Williams R.L., Karacan I. & Mursch C.J. (1974) *EEG of Human Sleep*. John Wiley, New York, pp. 51–64.

Woods N. (1972) Patterns of sleep in post-cardiotomy patients. *Nursing Research* **21**, 347–352.

Zealley A.K. & Aitken R.C.B. (1969) Measurement of mood. *Proceedings of the Royal Society of Medicine* **62**, 993–996.

SUBTLE DECISION-MAKING

MEDICAL sociology usually treats the working relationship between doctors and nurses as a case of professional dominance[1]: nurses play a generally subordinate role, particularly in relation to diagnosis and treatment. Studies only report significant nurse influence in diagnosis and treatment where nursing posts less amenable to medical surveillance are involved — the clinical specialist, the nurse practitioner, or the community nurse.

But their lack of first-hand contact with everyday nursing may have led many researchers to underestimate the variability of the division of labour in the modern hospital, and to neglect opportunities for nurse decision-making of a more subtle kind. The findings from my own study, based on 10 months 'participant-observation' research in the casualty department of a provincial general hospital, suggest that many hospital nurses play a more active role in patient categorisation and treatment than is acknowledged officially.

Nursing work in casualty is shaped by the need to process large numbers of acute cases with limited resources, often against the background of considerable clinical uncertainty. Patients presenting with apparently 'serious' conditions often turned out to have little amiss, and vice versa. Given the heavy demands on doctors' time, much of the responsibility for the initial sorting of patients inevitably fell on experienced nursing staff. There were many instances where clues found and hypotheses formulated by nurses at the triage stage had a clear influence on doctors' later decisions.

Nurse influence was increased because of the high turnover of medical staff. Most casualty officers were relatively inexperienced, and problems were compounded because many were overseas doctors adjusting to an unfamiliar culture. Unsurprisingly, inexperienced doctors depended heavily on experienced nurses for advice on departmental policy and usual practice, and even, on occasion, on matters relating to diagnosis and treatment.

As in Leonard Stein's account of the 'doctor-nurse game'[2], recommendations often took the form of subtle clues or cryptic references to information unearthed by the nurse. But for much of the time nurses seemed less preoccupied with concealing their role of advice-givers than the game metaphor suggests. They frequently offered advice in an open and straightforward way, and occasionally intervened quite bluntly to point out shortcomings in the work of junior doctors.

Such breakdowns of deference usually involved overseas doctors who faced particular problems of communication and interpretation. In a setting in which appearances are not always what they seem, medical expertise needs to be supplemented with a fine grained knowledge of the social types, and typical motives and circumstances associated with cases of different kinds. Where overseas doctors were involved, nurses' skill in recognising social cues, or indicating the significance of social information passed on by ambulance crews or receptionists, was often critical in framing clinical work. In guiding the course of consultations and interpreting patient histories for junior doctors it was found that their role frequently went well beyond that of passive subordinates.

• A fuller account of this study can be found in: Hughes, D. When nurse knows best: some aspects of nurse/doctor interaction in a casualty department. *Sociology of Health and Illness* 1988; 10: 1, 1-22.

REFERENCES
[1]Freidson, E. *Profession of Medicine*. New York: Dodd, Mead & Co., 1970.
[2]Stein, L. The doctor-nurse game. *Archives of General Psychiatry* 1967; 16: 699-703.

David Hughes, PhD, is a senior research officer at the Centre for Socio-Legal Studies, Wolfson College, Oxford.

SLEEP IN SURGICAL WARDS

PATIENTS frequently suffer disturbances of their sleep following admission to hospital, according to the literature. I used a structured interview to elicit information about sleep patterns from 200 patients in eight surgical wards. Patients reported their usual sleep patterns at home and their experience of a specific night in hospital. I deduced the nature of any changes from their usual pattern from this information, taking into account factors such as the use of hypnotic drugs, analgesic drugs, smoking and drinking habits, ward design and type of mattess.

I found there were significant changes between sleep patterns at home and in hospital. The time patients settled down to sleep in hospital was, on average, almost one hour earlier. The time taken to fall asleep was virtually doubled from 24 to 49 minutes in hospital, while the duration of reported sleep was significantly reduced from a mean of 6.5 to 5.4 hours.

As might be expected, there were more night-time awakenings in hospital, the frequency increasing from a mean value of 1.4 to 2.3. Lastly, the time of morning waking was earlier in hospital, almost an hour earlier than at home. Over all, the picture patients painted of their sleep in hospital was one of a change in the normal timing of sleep to an earlier routine, less time spent asleep and an increase in the number of factors disturbing sleep.

I asked patients to compare their sleep in hospital with their sleep at home using a five-point scale ranging from 'far better' to 'far worse'. Of the 200, 122 felt their sleep had worsened, 54 felt it was the same and the remaining 24 felt it had improved.

Analysis showed that several factors influenced how patients slept. The major ones were living alone (they tended to sleep better in hospital), ward design (those sleeping in cubicles or two, three or four-bedded bays slept better than those in Nightingale wards), and for those sleeping in large wards, those who had foam mattresses slept significantly better than those on horsehair mattresses. Other factors included gender: women slept significantly better than men, both at home and in hospital; and hypnotic drugs, which decreased the time taken to fall asleep, increased the duration of sleep, reduced the number of night-time awakenings and delayed morning waking time.

The major causes of night-time disturbance were pain, mentioned by 127 patients, and noise, mentioned by 123 patients. In addition there were 122 complaints of uncomfortable environmental temperature (91 too hot, 31 too cold) and 110 complaints about the comfort of the beds. The two nursing actions which most frequently helped patients to get back to sleep during the night were the provision of hot drinks and analgesia.

Some of these findings are similar to those of previous researchers and it is important that the difficulties of sleeping in hospital are not underestimated. The well-researched theory that sleep is associated with healing suggests that ward staff should do all they can to help patients get a good night's sleep.

• This study is part of the core programme of research which is funded by the Scottish Home and Health Department.

Jose Closs, BSc(Hons), MPhil, RGN, is a research associate at the Nursing Research Unit, Department of Nursing Studies at the University of Edinburgh.

An exploratory analysis of nurses' provision of postoperative analgesic drugs

S. José Closs BSc (Hons) RGN MPhil
Research Associate, Nursing Research Unit, Department of Nursing Studies, University of Edinburgh, 12 Buccleuch Place, Edinburgh EH8 9LN

Accepted for publication 20 January 1989

CLOSS S.J. (1990) *Journal of Advanced Nursing* **15**, 42–49
An exploratory analysis of nurses' provision of postoperative analgesic drugs
Adequate pain relief during the postoperative period has long been recognized as difficult to accomplish. The reasons for this are mentioned in a brief review of methods of pain control, and an overview of the detrimental effects of acute pain is given. This retrospective analysis of data from 36 patients set out to examine whether those whose night-time sleep was found to be disturbed by pain were subject to different patterns of analgesic provision from those whose sleep was not. Although no such differences emerged, it was found that analgesics were given approximately half as frequently during the night when compared with during the day. It was also noted that only 30–35% of the maximum doses of analgesics prescribed were actually given within the immediate postoperative period. The possible reasons for these findings are discussed.

INTRODUCTION

Many researchers have commented on the under-use of narcotic analgesics in hospital and the adverse effects this has on patients (Keeri-Szanto & Heaman 1972, Marks & Sachar 1973, Cohen 1980, Donovan *et al.* 1987, Melzack *et al.* 1987, Seers 1987). The reasons for this underprovision appear to fall into two main areas: first, exaggerated beliefs about the addictive properties of opiates and their side-effect of respiratory depression (Weis *et al.* 1983), and second, difficulties in assessing pain, compounded by the reluctance of many patients to ask for analgesics (Teske *et al.* 1983, Taenzer *et al.* 1986, Walker & Campbell 1988).

There are many factors which affect how hospital patients experience pain, including anxiety and depression (Taenzer *et al.* 1986), the meaning attached to the pain (Beecher 1959), the type and frequency of analgesia provision, circadian variations in pain perception (Pollman & Hildebrandt 1987) and levels of relaxation and distraction (Cogan *et al.* 1987). Some of the responsibility for optimizing pain control lies with patients themselves. They may be reluctant to request painkillers, thinking it a sign of weakness, or believing that pain should be endured as an expected consequence of surgery. Many patients seem unwilling to bother nurses whom they perceive to be busy. Of course, both doctors and nurses must bear much of the responsibility for controlling pain, and have a variety of methods at their disposal.

The relationship between pain and sleep is of particular interest to this author (Closs 1988). Interviews were conducted with 200 patients on surgical wards about their sleep and it was found that 179 of them had had their sleep disturbed by pain at some point during their stay in hospital. Sriwatanakul *et al.* (1983) interviewed 81 post-operative patients about various areas of distress due to pain, with the finding that 56·7% of the group expressed some level of distress regarding their sleep. Donovan *et al.* (1987) found from interviews with 353 inpatients that sleep was considered to be one of the four major methods of decreasing pain. These results suggest that patients perceive some kind of interaction between pain and sleep, with pain disrupting sleep and sleep reducing pain.

The finding that analgesia provision in hospital at night appears frequently to be insufficient to allow undisturbed sleep prompted the following questions: 'is there a difference between day and night-time administration of analgesics, and if so, why?'. The work described in this paper is an attempt to answer the first part of this question. Before describing the analysis itself, a brief outline of current methods of postoperative pain relief and the detrimental effects of uncontrolled pain are given.

METHODS OF RELIEVING POSTOPERATIVE PAIN

The most commonly used methods of relieving post-operative pain currently practised in hospitals are pharmacological in nature, including intercostal and epidural nerve blocks as well as systemic opioids given either intramuscularly, intravenously or sublingually. The use of TENS (transcutaneous electrical nerve stimulation) and acupuncture are becoming more popular, but are still relatively uncommon in the majority of hospitals within the UK. The most appropriate methods of pain relief are obviously decided on by doctors who prescribe according to the regime of their choice. The most common system is still the 'on demand' prescription. Usually an opiate drug is prescribed as an intramuscular injection which may be administered when it is required by the patient, though usually no more frequently than every 4 hours, depending on the dose.

Nurses then assess the patients' needs for analgesia and at their own discretion provide intramuscular or oral drugs, within the limits of the prescribed regime. This 'on demand' system leaves much leeway for pain to become more severe than it need be. The very individual nature of pain means that some people need more analgesia than is prescribed while others may need less. Patients may wait until pain is becoming intolerable before requesting analgesics and may then have to wait until two nurses (a legal requirement in the UK) are available to check controlled drugs. The absorption of drugs given intramuscularly might be slowed down if blood circulation to the site of injection was poor, or if the patient were lying on the site. Graves *et al.* (1983) describe the cycle of events following a patient's request for analgesics showing the great potential for delay when using conventional analgesic therapy (see Figure 1).

Apart from problems of delay when using intramuscular doses of opiate, there is also the complication of fluctuating plasma levels of narcotic analgesics. These swing from high levels where sedation may occur, through the optimum levels where pain is relieved but consciousness is not clouded. The concentration of narcotics is then reduced to inadequate levels where pain is poorly controlled (Graves *et al.* 1983). The patient might then request more analgesia. If the requisite minimum of 4 hours between doses had passed, the nurse would then assess the patient's needs. If not, then the patient would almost certainly have to wait until the 4 hours had elapsed before obtaining this type of pain relief.

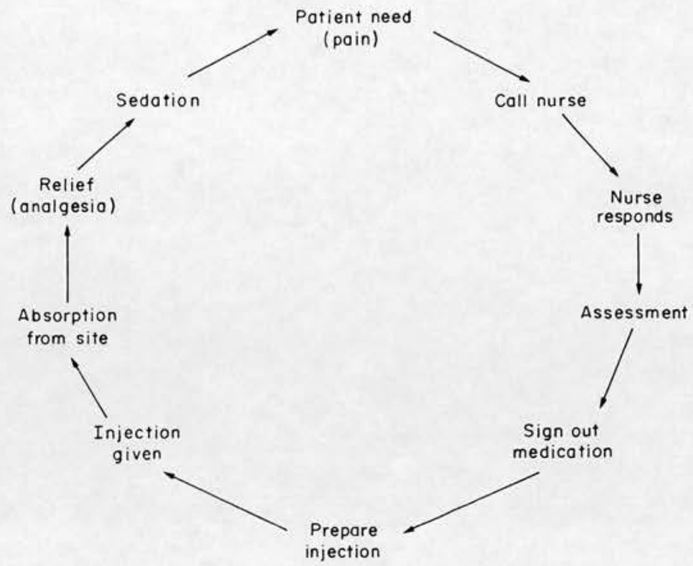


Figure 1 Pain relief cycle. Adapted from Graves *et al.* (1983).

THE UNDESIRABILITY OF POSTOPERATIVE PAIN

While unnecessary pain should not be permitted simply on humanitarian grounds, pain may also lead to undesirable consequences. As Bonica (1987) said, 'severe acute pain in the postoperative period . . . has no useful function, and if not adequately relieved, produces abnormal physiologic and psychologic reactions which often cause complications'. Four main areas of concern are outlined below.

Reduced mobility

Severe pain reduces movement, increasing the risk of deep vein thrombosis and damage to pressure areas. Early mobilization is more difficult. Pain may cause a reduction in respiratory movements (Craig 1981), particularly following surgery to the thorax. This in turn leads to difficulty taking deep breaths and coughing which contributes to post-operative hypoxia and increases the risk of developing a respiratory tract infection.

Metabolic and hormonal disruption

Pain increases the activity of the sympathetic nervous system. The consequent increase in the levels of circulating catecholamines can cause hypertension followed by myocardial ischaemia and a reduction in blood flow to some tissues. There is also an increase in levels of cortisol, ACTH and other catabolic hormones accompanied by a reciprocal decrease in levels of anabolic hormones (Wilmore *et al.* 1976). The metabolic and hormonal responses to surgery are exacerbated by pain, with greater breakdown of protein and mobilization of free fatty acids (Nimmo & Duthie 1987).

Long-term pain

Surgery itself produces a barrage of afferent nerve impulses, making the central nervous system hyperexcitable (Woolf 1983). This may result in prolonged hypersensitivity of the spinal cord, which then responds excessively to nervous impulses. These stimuli would not be painful if the cord had not been primed in this way. Once this hyperexcitable state has been established, extremely high doses of narcotics are needed to suppress it (Woolf & Wall 1986).

Bach *et al.* (1988) showed that prevention of this hyperexcitable state can reduce long-term pain for up to 12 months after surgery. It has been suggested that giving narcotics before and during as well as after surgery can suppress this hyperexcitable state, reducing the risk of long-term pain (Melzack 1988).

Sleep disruption

Finally, severe pain and anxiety disrupt sleep, reducing the postulate restorative role of slow wave sleep (Adam & Oswald 1983). Carli *et al.* (1987) found that, in cats (which have long been used successfully as models for human sleep), persistent pain reduced total sleep and lead to a reduction in slow wave sleep and rapid eye movement sleep relative to stages 1 and 2. The tiredness resulting from disturbed sleep may have adverse psychological effects, such as reduced motivation. This could then compound problems resulting from impaired movement and retard recovery.

It is the latter of these four areas of concern which prompted the work which is now described.

METHOD

This was a retrospective study of two sub-samples of 200 patients on surgical wards who had been interviewed about their sleep in hospital (Closs 1988). In order to achieve this the patients' medication charts were used as the source of information. These were stored in their medical notes in the medical records department of a large general hospital, and were accessed by the researcher with permission.

The intention was to gather further exploratory data in order to compare analgesia provision as recorded on medication charts for the two sub-samples. These were selected from the 129 of the original 200 who had undergone surgery. Data were gathered for 20 patients whose sleep had been disturbed by pain, and for 16 patients whose sleep had not been disturbed by pain. Sixteen was the maximum number of patients' medication records available for the latter group, due to missing or unusable charts. The assumption was made that those whose sleep was disturbed by pain had more severe pain than the other group.

Each of the two sub-samples had an age range of 50–65 years and comprised equal numbers of men and women. These patients were from eight different surgical wards in two different hospitals; the two groups had undergone comparable types of surgery, ranging from hernia repair to abdomino-perineal resection.

Doses and times of administration of all analgesic drugs were taken from the records, for the day of surgery through to the 5th post-operative day. The numbers of doses of controlled and other painkilling drugs at various times of the day were analysed, as well as what proportion of the maximum available dosage had been received. Patterns of hypnotic use were also recorded since these drugs are both anxiolytics and muscle relaxants, and each of these properties may help to reduce pain.

RESULTS

For much of the data, analysis was kept very simple due to the exploratory nature of the study and the small sample size. More complex analysis was required to make sense of the data pertaining to hypnotic use. For the most part, the two groups of patients were compared. The group of patients whose sleep had been disturbed by pain was designated group A, while those whose sleep had not been disturbed by pain were designated group B.

Provision of controlled analgesics

The number of doses of controlled drugs given during the night and the number given during the day was counted for the 36 patients. Doses given over the day of operation and 5 days afterwards were used. The 8-hour period best approximating to the patients' usual sleeping time at home was 11 pm–7 am and was therefore designated 'night-time' for the purposes of analysis. The day was then further divided into two 8-hour periods; 7 am–3 pm and 3 pm–11 pm. Any dose given on the border between these times

Table 1 The mean number of doses of opiate analgesics given per patient per 8-hour period during the first 5 postoperative days

	11 pm–7 am	7 am–3 pm	3 pm–11 pm
Group A (disturbed by pain)	0·95	2·15	1·95
Group B (not disturbed by pain)	0·88	2·0	1·94

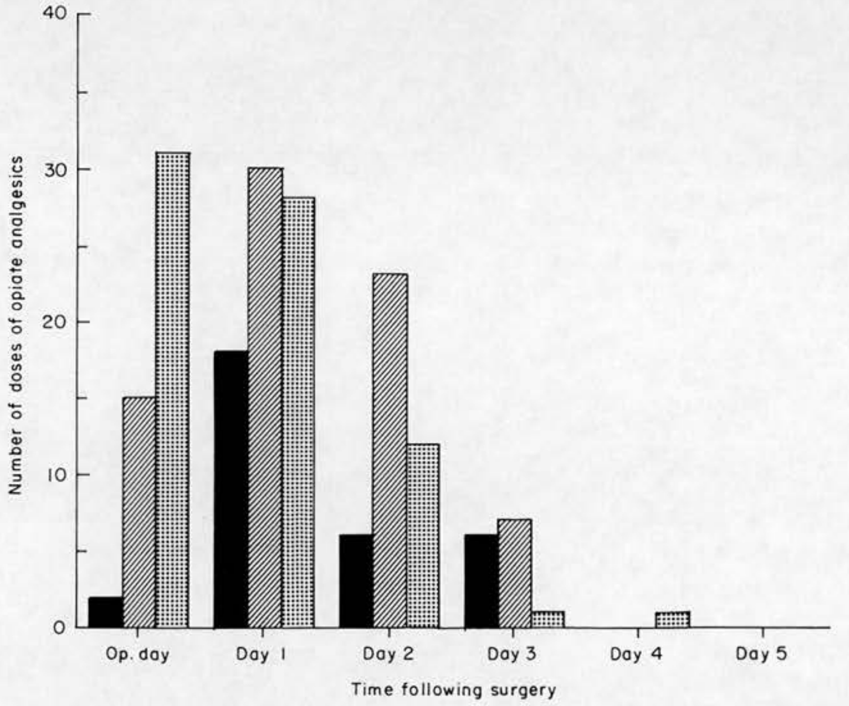


Figure 2 Frequency of administration of opiate analgesic drugs per 8 hours during the postoperative period. ■ = 11 pm–7 am; ▨ = 7 am–3 pm; ▦ = 3 pm–11 pm.

Table 2 The mean number of doses of non-opiate analgesics given per patient per 8-hour period during the first 5 postoperative days

	11 pm–7 am	7 am–3 pm	3 pm–11 pm
Group A (disturbed by pain)	1·15	2·1	2·45
Group B (not disturbed by pain)	0·75	2·4	2·25

was counted as being in the later of the two periods. The mean number of doses given per patient during each 8-hour period over the operative and postoperative period were as shown in Table 1.

It may be seen that these two groups are almost identical for each 8-hour period. The data for the two groups, therefore, were combined, so the pattern of provision of opiate analgesia over the week may be seen (Figure 2). The figures in Table 1 show that about half as many doses were given at night as during the daytime.

Provision of non-opiate analgesics

The analysis explained above was repeated for the non-opiate analgesics. The mean numbers of doses for the 8-hour periods were as shown in Table 2.

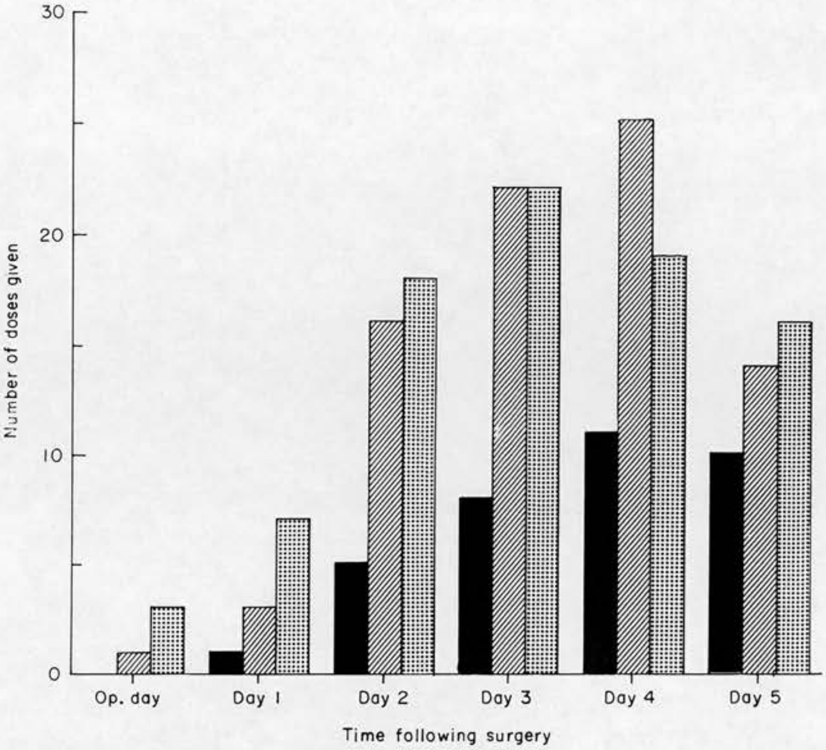


Figure 3 Frequency of administration of non-opiate analgesic drugs per 8 hours during the postoperative period. ■ = 11 pm–7 am; ▨ = 7 am–3 pm; ▦ = 3 pm–11 pm.

Again, the two groups are similar, with slightly greater variation during the night-time period. The data were combined and the pattern of administration may be seen in Figure 3. Less than half the mean number of doses were given during the night-time period when compared with the day.

24-hour pattern of analgesic administration

Closer analysis was made of the 24-hour administration pattern by dividing the day into 4-hour segments from midnight to midnight. The mean number of doses of controlled analgesics per patient per 4 hours was calculated for the 5 postoperative days and the result is shown in Figure 4(a). This was repeated for non-opiate drugs, as shown in Figure 4(b). Group A received fewest mean number of doses of opiate analgesics between midnight and 4 am, and most between 12 pm and 4 pm. Group B received most opiates between 4 am and 8 am, and least between 4 pm and 8 pm. When considering non-opiate analgesics, the patterns for groups A and B were similar, with fewest doses given between midnight and 4 am and most between 12 pm and 4 pm.

Proportion of prescribed analgesics administered

A calculation was made of the proportion of prescribed opiate drugs which were actually given during the 24 hours immediately postoperatively. This was done by calculating the maximum possible dose each patient theoretically could receive between 6 pm on the day of surgery and 6 pm the following day and expressing the number of doses actually given as a percentage of the maximum possible. The patients who were disturbed by pain received 30%, while the others received 35% of the maximum amount prescribed.

Prescription and administration of hypnotic drugs

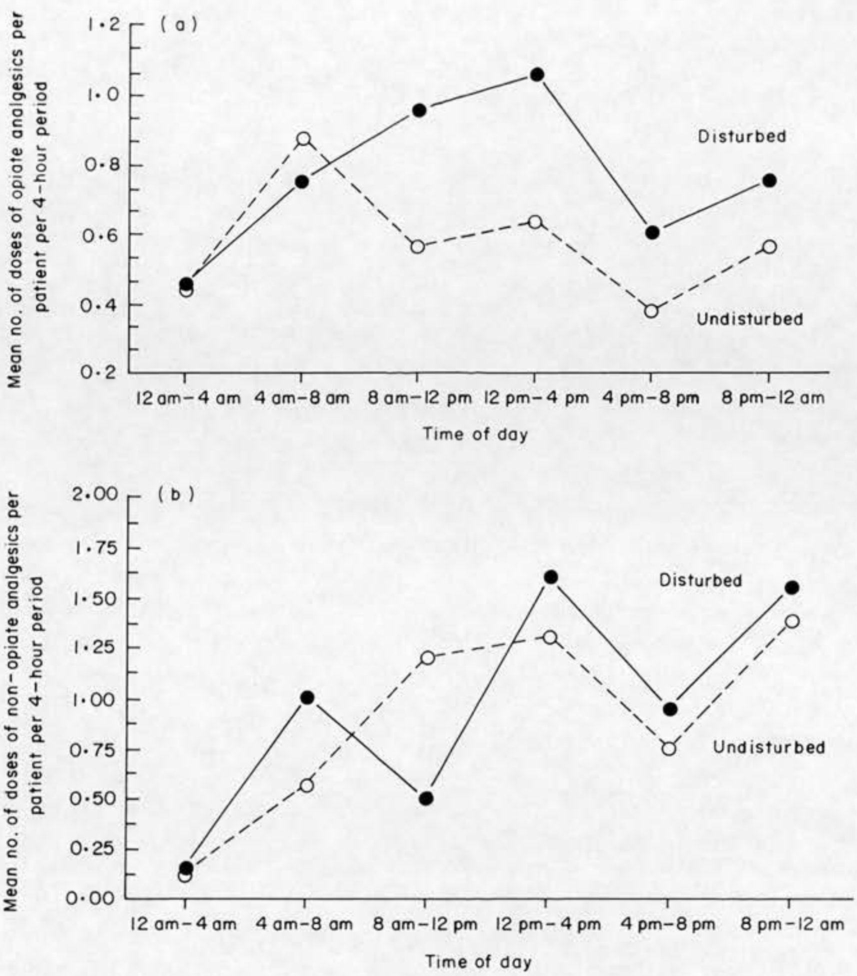
The number of patients who were prescribed hypnotic drugs and the number of those who received them are shown in Figure 5. A logit analysis using log (n given hypnotics/n not given hypnotics) was used to test for variations according to group and time (Table 3).

It can be seen that there was a significant variation with an increase in the number of doses being given over time. There was no significant difference in the administration of hypnotics for the two groups but a greater proportion of group B (not disturbed by pain) received the hypnotics that they had been prescribed than group A. There was no apparent interaction between variations due to group and time.

DISCUSSION

It is interesting that for both groups of patients, considerably less analgesia was given during the night than during

Figure 4 Mean number of doses of analgesics given per 4-hour period from midnight of the day of surgery until 5th postoperative night. (a) = opiate analgesics; (b) = non-opiate analgesics.



the day. There are several possible explanations for this. The patients may have experienced less pain at night, perhaps since patients are required to move less during the night. Alternatively, perhaps some inherent circadian rhythm automatically reduced pain intensity during the night. Pollman & Hildebrandt (1987) found that after oral surgery the greatest number of doses of analgesics were required around 6 am on days 2–3 postoperatively, suggesting that pain was worst in the early hours of the morning. This finding and those showing that pain was severe enough to disturb the sleep of 20 of these patients in the present study do not suggest a reduction in pain intensity overnight. Indeed, the absence of distractions at night would be likely to make the pain feel worse. It is more likely that patients were more reluctant to request analgesia at night, since they might not wish to disturb other patients or bother the nurses. Similarly for the nurses, they might not wish to disturb apparently sleeping patients in order to assess their pain.

The 24-hour pattern Figure 4(a) of opiate administration also shows clearly the considerably lower levels of provision during the night. The greatest number of doses were given between mid-day and 4 pm for Group A (disturbed by pain). A possible explanation for these fluctuations is a correlation with staffing levels. Staff numbers tend to be lowest at night and highest during the shift overlap in the afternoon. For the non-opiate analgesics a similar low level of provision is seen during the night, while a more erratic pattern which gradually increases over the day is seen. Some of these drugs were prescribed at fixed times so the peaks seen on Figure 4(b) are in part attributable to the timing of drug rounds.

The proportion of prescribed drugs actually received by patients during 24 hours postoperatively was quite low, 30–35%. This value is lower than found by other researchers: Sriwatanakul *et al.* (1983) found that of a sample of postoperative patients, a mean of 70% of the maximum dose was received. Donovan *et al.* (1987), however, found that less than a quarter of the amount of analgesic ordered was administered to a sample of both medical and surgical patients. The small proportion of analgesics used in the present study might be explained in part by the fact that three patients were written up for continuous intravenous morphine and this had not been

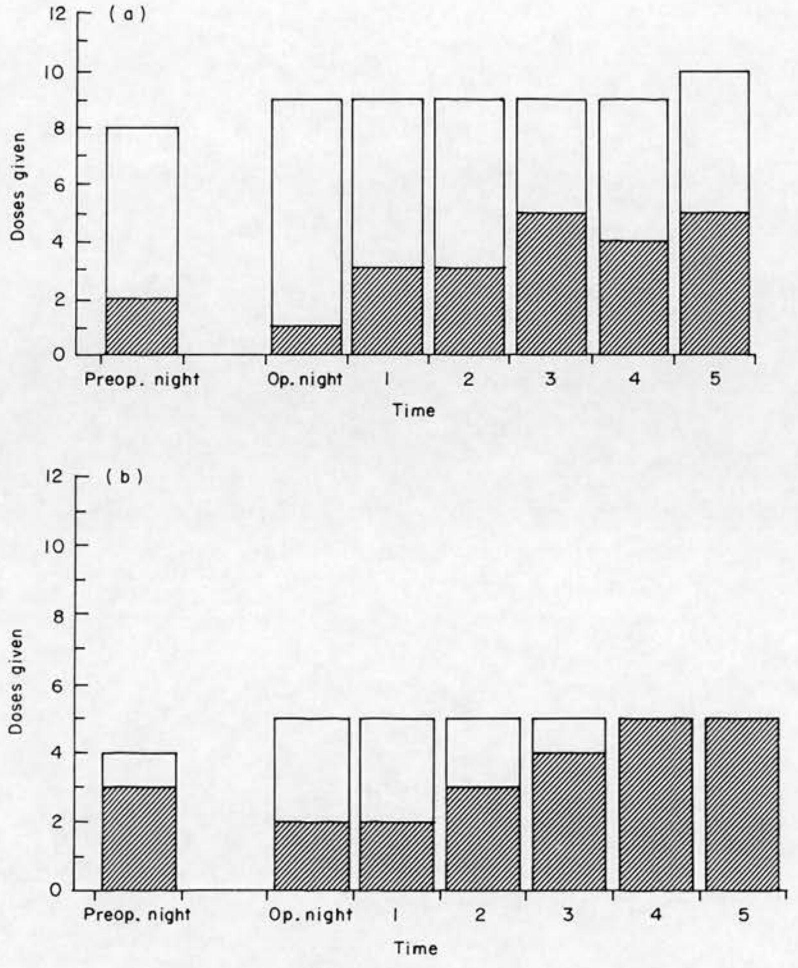


Figure 5 Stack chart indicating the numbers of patients for whom hypnotic drugs were prescribed and given during the peri-operative period. (a) = patients whose sleep was disturbed by pain ($n = 20$); (b) = patients whose sleep was not disturbed by pain ($n = 16$); □ = doses prescribed; ▨ = doses given.

Table 3 Variations according to group and time in the prescription and administration of hypnotic drugs

	Chi-squared	d.f.	*P*
Variation due to time	4·03	I	<0·05*
Variation due to group	9·62	I	<0·005**
Variation due to interaction	9·34	II	>0·59

*Significant
**Highly significant

signed for on their medication charts. In the case of one other patient who was given IV morphine a separate sheet had been use for recording rate and dose. No such sheet was found for the three patients mentioned above. Part of the reason for the low dosage levels, therefore, might be that some data were missing.

The use of hypnotic drugs increased significantly in a gradual manner over the postoperative period (Figure 5). Immediately postoperatively the majority of patients would not be taking anything orally, until the effects of the anaesthetic wore off. The gradual increase in usage over the 5 days suggests that some patients become increasingly in need of help in order to sleep. Although more of the patients in group A were prescribed hypnotics, a significantly greater proportion of group B received the hypnotics that they had been prescribed than did group A, clearly demonstrated by days 4 and 5. This is difficult to account for, but might have been because the patients in group B had their needs assessed more accurately, or that they were more assertive about their needs.

The lack of difference between groups A (sleep disturbed by pain) and B (sleep not disturbed by pain) in terms of their analgesic and hypnotic provision was clearly shown. It might have been expected that one group would have received more analgesia because they were in more pain, or conversely that those who received less analgesia were consequently in more pain. It is not possible to draw any conclusions about the relationship between analgesic provision and sleep without conducting a larger study and using a sensitive method of assessing pain levels.

SUMMARY

This exploratory study of data on sleep and pain in a group of postoperative patients confirms that there is considerably less analgesic provision at night than during the day. This was seen to be the case for both controlled and non-opiate drugs. In addition, the frequency of doses of painkilling drugs was not associated with whether or not pain was severe enough to disturb sleep. This suggests that the assessment of pain by nurses presents difficulties, particularly at night. Though no firm conclusions can be drawn about the relationship between analgesic provision and sleep from such a small study, it does seem that more detailed work in this area would be valuable, and planning for such a study is under way.

Acknowledgements

I would like to thank Dr Alison Tierney and Dr Hamish McLeod for their help in the preparation of this paper. This work is part of the core programme of research at the Nursing Research Unit, Department of Nursing Studies, at the University of Edinburgh and is funded by the Scottish Home and Health Department.

References

Adam K. & Oswald I. (1983) Protein synthesis, bodily renewal and the sleep-wake cycle. *Clinical Science* **65**, 561–568.

Bach S., Noreng M.F. & Tjellden N.U. (1988) Phantom limb pains in amputees during the first 12 months following limb amputation, after preoperative lumbar blockade. *Pain* **33**(3), 279–301.

Beecher H.K. (1959) *Measurement of Subjective Responses*. Oxford University Press, New York.

Bonica J.J. (1987) Importance of effective pain control. *Acta Anaesthesiologica Scandinavica* **31**, Suppl. **85**, 1–16.

Carli G., Montesano A., Rapezzi S. & Paluffi G. (1987) Differential effects of persistent nociceptive stimulation on sleep stages. *Behavioural Brain Research* **26**(2–3), 89–98.

Closs S.J. (1988) *A Nursing Study of Sleep on Surgical Wards*. Nursing Research Unit Report, University of Edinburgh, Edinburgh.

Cogan R., Cogan D., Waltz W. & McCue M. (1987) Effects of laughter and relaxation on discomfort thresholds. *Journal of Behavioural Medicine* **10**, 139–144.

Cohen F.L. (1980) Post-surgical pain relief: patients' status and nurses' medication choices. *Pain* **9**, 265–274.

Craig D.G. (1981) Post-operative recovery of pulmonary function. *Anesthesia and Analgesia* **60**, 46–52.

Donovan M., Dillon P. & McGuire L. (1987) Incidence and characteristics of pain in a sample of medical-surgical inpatients. *Pain* **30**(1), 69–78.

Graves D.A., Foster T.S., Batenhorst R.L., Bennett R.L. & Baumann T.J. (1983) Patient-controlled analgesia. *Annals of Internal Medicine* **99**, 360–366.

Keeri-Szanto M. & Heaman S. (1972) Post-operative demand analgesia. *Surgery, Gynaecology and Obstetrics* **134**, 647–651.

Marks R.M. & Sachar E.J. (1973) Undertreatment of medical inpatients with narcotic analgesics. *Annals of Internal Medicine* **78**, 173–181.

Melzack R.M. (1988) The prevention of post-operative pain. *Pain* **33**, 289–290.

Melzack R., Abbot F.V., Zackon W., Mulder D.S. & Davis M.W.L. (1987) Pain on a surgical ward: a survey of the duration and intensity of pain and the effectiveness of medication. *Pain* **29**, 67–72.

Nimmo W.S. & Duthie D.J.R. (1987) Pain relief after surgery. *Anaesthesia and Intensive Care* **15**, 68–71.

Pollman L. & Hildebrandt G. (1987) Circadian profiles and circaseptan periodicity in the frequency of administration of analgesic drugs after oral surgery. *Functional Neurology* **2**(2), 231–237.

Seers C.J. (1987) Pain, anxiety and recovery in patients undergoing surgery. Unpublished PhD thesis, University of London.

Sriwatanakul K., Weis O.F., Alloza J.L., Kelvie W., Weintraub M. & Lasagna L. (1983) Analysis of narcotic analgesic usage in the treatment of post-operative pain. *Journal of the American Medical Association* **250**(7), 926–929.

Taenzer P., Melzack R. & Jeans M.E. (1986) Influence of psychological factors on postoperative pain, mood and analgesic requirements. *Pain* **24**, 331–342.

Teske K., Daut R.L. & Cleeland C.S. (1983) Relationships between nurses' observations and patients' self-reports of pain. *Pain* **16**, 289–296.

Walker J. & Campbell S. (1988) Pain assessment and the nursing process. *Senior Nurse* **8**(5), 28–31.

Weis O.F., Sriwatanakul K., Alloza J.L., Weintraub M. & Lasagna L. (1983) Attitudes of patients, housestaff and nurses towards postoperative analgesic care. *Anesthesia and Analgesia* **62**, 70–74.

Wilmore D.W., Long J.M., Mason A.D. & Pruitt B.A. (1976) Stress in surgical patients as a neurophysiologic reflex response. *Surgery, Gynaecology and Obstetrics* **142**, 257–269.

Woolf C.J. (1983) Evidence for a central component of post-injury pain hypersensitivity. *Nature* **306**, 686–688.

Woolf C.J. & Wall P.D. (1986) Morphine-sensitive and morphine-insensitive actions of C-fibre input on the rat spinal cord. *Neuroscience Letters* **64**, 221–225.

Influences on patients' sleep on surgical wards

S José Closs
BSc(Hons) MPhil RGN

This is the first contribution to a series of articles on sleep in surgical patients. Sleep and wound healing, sleep management and sleep therapies will be discussed in future issues of SURGICAL NURSE.

There are many well established reasons why sleep is compromised among postoperative patients, including pain, noise and anxiety. Assessment of patients' sleep is difficult; a recent study* attempted to examine several aspects of the problems encountered when trying to get a good night's sleep in hospital.[1] This study formed the basis for the following discussion.

A structured interview was used to elicit information regarding sleep patterns from 200 patients on eight surgical wards. The patients reported details of their usual sleep patterns at home and for a specific night in hospital, so that any changes could be considered. Their use of hypnotic and analgesic drugs, and pre-sleep routines were documented, and environmental factors, such as ward design and type of mattress, were also taken into account. Finally, nurses' written accounts of their patients' sleep, both at home and in hospital were recorded.

Altered sleep patterns

Clear changes in sleep patterns occurred when patients came into hospital. Patients both retired to bed and rose almost 1 hour earlier than they would have at home, and their normal duration of sleep was shortened by over 1 hour. It appeared that even if patients settled down to sleep earlier than their usual time, this was no guarantee that they could fall asleep earlier, so that it did not compensate for early morning wakening. Almost 50% of a sample of 791 patients interviewed in an earlier study felt that they were woken up too early.[2] In a DHSS report, 9 years later, the same point was made, that such early morning waking was 'unnecessary, inappropriate and contrary to the philosophy of individualized patient care'.[3] It is interesting that, although this point seems to have been made for some considerable time now, rigid hospital routine is still implicated in reducing patients' sleep.

Although many patients woke during the night in hospital, very few informed the nursing staff. About 50% of those who woke were able to get back to sleep without any help, though most of the others received assistance from night nurses (see page 13).

Factors which disturb sleep in hospital

Pain and discomfort: the most commonly mentioned causes of waking were pain and discomfort. The problem of managing postoperative pain has been of interest to many nurse researchers in recent years.[4,5] Medical researchers have also demonstrated their concern, producing evidence that postoperative pain is poorly controlled.[6-8] Cohen reported that nurses tended to under-medicate,[6] and Marks and Sachar concluded that physicians often under-prescribed analgesics.[9] Obviously, nursing and medical staff need to reconsider their practice in order to improve the effectiveness of postoperative analgesia.

Currently, the use of patient-controlled analgesia (PCA) seems to be proving particularly effective in individualizing the provision of postoperative narcotic analgesics. PCA is not widely available, and the administration of opiates is usually the responsibility of nurses, given on request from the patient. The timing, dose and type of analgesic depend on the nurse's assessment of the patient's pain.

Noise at night has been acknowledged as a problem in hospitals for at least 16 years,[10-12] and the author's research showed that little has changed. The most common types of noise are either from other patients, or from nurses caring for those patients, and it is unlikely that these can be eradicated. The trend towards smaller bays of beds, however, appears to have produced a quieter environment. The noises mentioned by patients were extremely diverse in nature, requiring different action to be taken on different wards

*This study was undertaken as part of the core programme of research at the Nursing Research Unit in the Department of Nursing Studies at the University of Edinburgh, and funded by the Scottish Home and Health Department.

S José Closs is a Research Associate at the Nursing Research Unit, Department of Nursing Studies, University of Edinburgh, Edinburgh, UK. She graduated in human biology from the University of Surrey and trained as a nurse at St George's Hospital in London. She specialized in intensive and coronary care and later completed an MPhil at the University of Nottingham. Her current research interests include sleep, pain and circadian rhythmicity of the patient in hospital.

in order to reduce noise. For example, squeaky wheels on drip stands and dressing trolleys should be kept oiled, and radiators should be 'bled' if they are noisy.

Environmental temperature: 46% of patients woke because they were too hot, and 16% woke because they were cold. These findings agreed with those of the Royal Commission, who reported that 30% of patients found hospital too hot.[2] This is a particularly difficult problem to solve, as a comfortable temperature is likely to be different for each patient. Postoperative pyrexia influences the temperature perceptions of surgical patients, which in extreme cases might merit treatment with antipyrexial drugs, such as aspirin or paracetamol. The opportunity should be provided for patients to request more or less bedding, and nurse managers should perhaps consider the possibility of providing alternative types of bedding. Many people prefer a duvet to blankets; washable duvets which can be fastened together to provide various thicknesses and degrees of warmth might prove popular.

Hospital beds were a considerable source of dissatisfaction to approximately 35% of patients. Discomfort caused by ancient, hard, horsehair mattresses, plastic covers on mattresses and pillows, and beds without the facility to lower or tilt were all mentioned. The replacement of old-fashioned beds by more modern ones would be an improvement. More research and development of vapour-permeable waterproof materials, which could be used to cover mattresses and pillows, would be valuable, as they would reduce 'sweatiness'.

Pre-sleep routines

An attempt was made to discover whether patients were able to continue with established pre-sleep routines. Patients indicated their usual routines, which were very varied. The most common pre-sleep routines included:

- having a hot drink or snack
- having an alcoholic drink or cigarette
- relaxing by reading, watching television, listening to the radio or having a bath.

Most patients in the study were unable to conduct their usual routines, mainly because the ward routine did not permit it. Other reasons included not being allowed alcohol or cigarettes, finding the surroundings too distracting, treatment not permitting a particular routine and feeling too unwell. The problem of ward routine preventing patients from continuing with their own pre-sleep routines could be addressed by night-nurses, as routine care has long been recognized as detracting from the best interests of the individual. It should be remembered, however, that task allocation, though extremely unfashionable, may often be the only way to accomplish basic care when staffing levels are inadequate.

Improving sleep in hospital

The last part of the interview asked patients if they had any suggestions for improving sleep in hospital. Although more than 25% of the patients in the study were quite satisfied with their sleep, the remaining 75% (143 patients) made a total of 341 suggestions for improvement. The two most important concerns were reductions in noise, and improving hospital beds. Interestingly, only 17 patients mentioned improving pain control as a means of improving sleep, even though 127 of them had been disturbed by pain at night. This may have been because they had expected to suffer postoperative pain, or they may have assumed that nothing more could be done to reduce their pain.

The two nursing actions considered to be most helpful in getting patients back to sleep when they woke during the night were the administration of analgesics and the provision of hot drinks. Patients also appreciated nurses helping to make them more comfortable, and taking time to talk to them. Basic nursing care seems to be the key here; comforting measures taken by nurses appear to be very successful in helping patients to 'feel better' and get back to sleep.

More flexibility in hospital routine could improve patients' sleep, by allowing patients to go to bed when they are ready, get up during the night if they wish, and sleep on in the morning (unless it is vital that they are disturbed for treatment). Obviously, the degree of freedom which patients realistically could have depends to a great extent on the design of the wards, staffing levels and other practical considerations.

Assessing patients' sleep

How nurses recorded patients' sleep was examined by reviewing verbatim reports taken from the nursing notes. The admission sheet, where the patient's usual sleep at home was recorded, and the record for the previous night, were checked for the presence of four different aspects of sleep. These were:

- sleep quality
- sleep quantity
- use of medication
- pre-sleep routine.

None of the recordings (at home or in hospital) included all four elements. For sleep at home, 166/200 patients mentioned at least one of the four aspects of sleep; for hospital sleep, just 105 had such a mention.

The possibility was considered that nurses recorded sleep in hospital only if there was a problem. The patients were divided into two groups:

- patients who felt that they had slept as well or better in hospital than at home
- patients who felt that they had slept worse in hospital than at home.

No differences in the recording of sleep was observed between the two groups. It appeared that the recording of sleep was fairly sparse, and done on a random basis.

This lack of recording confirms the findings of earlier work. In 1970, Georgopolous and Jackson studied the written notes of 764 medical and surgical patients and found that sleep and pain were the least well reported aspects of patient care.[13] One reason for such scant recording might be that relevant information is communicated by other means, perhaps verbally at shift handovers. Another possibility is that nurses have no valid and reliable methods of assessing sleep, so that difficulties are not readily identified.

There is little in the literature about how nurses can assess their patients' sleep in a meaningful way, though several researchers have shown that nurses are likely to ask patients closed rather than open questions.[14-15] Good communication skills are essential in eliciting the required information. The question, 'did you sleep well last night?' is likely to produce a 'yes, thank you' sort of response. However, a question phrased, 'how did you sleep last night – any problems?' allows a patient to tell a nurse something about his sleep, by providing a clear opportunity to mention any difficulties. It would probably be useful to employ the familiar tactic of eliciting this kind of information while helping a patient to wash. Once a patient has a nurse's undivided attention, he is less likely to feel that he is 'bothering' the nurse, and will feel more able to talk about any difficulties he might be experiencing.

Conclusion

The problem of patients getting a good night's sleep in hospital persists. Pain and noise consistently seem to be the two main causes of sleep disturbance, requiring attention by both nurse researchers and practitioners. Hospital routine could usefully be reviewed in areas where it is strictly adhered to, and, where possible, could allow patients more autonomy as regards their sleeping habits. Nursing measures, such as making patients comfortable, and giving them analgesics and hot drinks during the night, should be encouraged.

Ways of assessing both sleep and pain require further exploration and evaluation. If successful assessment methods could be developed, this would be a valuable basis on which to plan nursing interventions with the objective of improving the sleep of patients postoperatively.

Cross references

Burnard P. Counselling skills in surgical nursing. *Surgical Nurse* 1989; **2:5** (October): 12–14.

Jones C. Pain assessment. *Surgical Nurse* 1988; **1:2** (December): 5–8.

References

1 Closs SJ. *A nursing study of sleep on surgical wards.* Nursing Research Unit Report, Department of Nursing Studies, University of Edinburgh, 1988.

2 Royal Commission on the National Health Service. *Patients' attitudes to the hospital service. (Research Paper. No. 5).* London: HMSO, 1978.

3 NHS Management Consultancy Services. *Study of night nursing services. (Report No. 2/87).* London: DHSS, 1987.

4 Sofaer B. *Pain: a handbook for nurses.* London: Harper and Row, 1984.

5 Seers CJ. *Pain, anxiety and recovery in patients undergoing surgery.* Unpublished PhD thesis, University of London, 1987.

6 Cohen FL. Post-surgical pain relief: patients' status and nurses' medication choices. *Pain* 1980; **9:** 265–74.

7 Sriwatanakul K, Weis OF, Alloza JL *et al.* Analysis of narcotic analgesic usage in the treatment of postoperative pain. *JAMA* 1983; **250:** 926–9.

8 Melzack R, Abbott FV, Zackon FW *et al.* Pain on the surgical ward: a survey of the duration and intensity of pain and the effectiveness of medication. *Pain* 1987; **29:** 67–72.

9 Marks RM, Sachar EJ. Undertreatment of medical inpatients with narcotic analgesics. *Ann Intern Med* 1973; **78:** 173–81.

10 Falk SA, Woods NF. Hospital noise-levels and potential health hazards. *N Engl J Med* 1973; **289:** 774–81.

11 Bentley S, Murphy F, Dudley H. Perceived noise in surgical wards and an intensive care area: an objective analysis. *Br Med J* 1977; **2:** 1503–6.

12 Soutar RL, Wilson JA. Does hospital noise disturb patients? *Br Med J* 1986; **292:** 305.

13 Georgopoulos BS, Jackson M. Nursing Kardex behaviour in an experimental study of patient units with and without clinical nurse specialists. *Nursing Research* 1970; **19:** 196–218.

14 Faulkner A. Monitoring nurse-patient conversation in a ward. *Nursing Times* 1979; **75:** 95–6.

15 Macleod Clark J. Nurse-patient communication – an analysis of conversations from surgical wards. In: Wilson-Barnett J, ed. *Nursing research: ten studies in patient care.* Chichester: John Wiley, 1983: 25–56.

POSTOPERATIVE PAIN AT NIGHT

ALTHOUGH postoperative pain is often poorly controlled, little is known about the aspects of this problem which are specific to night-time nursing care. This study gathered information from patients about their experiences of night-time pain, pain control and sleep following abdominal surgery. I interviewed 100 patients from four surgical wards on the third day following surgery. The sample included 37 men and 63 women, aged from 18 to 83 years.

Patients' reported experiences of postoperative pain were examined and an assessment of their sleep disruption was made. Patients' own methods of managing their pain, and views on the use of alternative methods of pain control in hospital were also recorded. Patients' beliefs about the relationships between sleep and pain and recovery were then explored. The type of analgesics prescribed and patterns of provision were taken from medication charts and staffing levels noted.

Sleep was shortened and frequently disturbed during the postoperative period. A mean reduction of one hour in patients' total night-time sleep in hospital compared with at home was reported, with a mean of 3.3 night-time awakenings. Pain was the most commonly reported cause of night-time sleep disturbance, with noise coming second. Almost three-quarters of the sample reported that pain had interfered with sleep in some way. Almost half of the patients felt that their pain was worse at night.

Patients described a variety of methods of managing their own pain. The main ones were supporting their wounds (either with a dressing or by using a pillow or their hands), deep breathing or relaxation, distraction and mobilisation. They expressed considerable interest in using alternative therapies for controlling postoperative pain, with relaxation being the favourite method. Almost half the patients thought it would be helpful if nurses could suggest such therapies to them.

Over one-third of the subjects felt that tiredness affected postoperative pain, usually making it worse. One third felt that sleep reduced the intensity of the pain. Over three-quarters felt that sleep helped them to cope effectively with their pain, and virtually all believed that sleep had a positive effect on recovery.

Analysis of patterns of analgesic provision produced some interesting findings. Patients received fewest doses of opioid analgesics during the night — the majority of doses were given in the morning and evening. This circadian pattern was not evident for non-opioid analgesics. Between one-fifth and one-quarter of the maximum possible amount of analgesics prescribed was actually given during the first two postoperative days.

Clearly postoperative pain at night posed particular problems for these patients, since little analgesia was given at night, even though pain was the most common disrupter of sleep and half the sample felt that pain was worse at night. Further research into this area of night-time nursing care would be of value.

● A full report of this study, entitled *A Nursing Study of Patients' Night-time Pain, Analgesic Provision and Sleep Following Surgery*, by S.J. Closs, is available from the Nursing Research Unit, Department of Nursing Studies, University of Edinburgh. This study was funded by the Chief Scientist Office, Scottish Home and Health Department as part of the Nursing Research Unit's core programme of research. The opinions expressed in this report do not necessarily reflect those of the funding body.

S. José Closs, BScHons, SRN, MPhil, is a research associate, Nursing Research Unit, University of Edinburgh

USING PEPLAU'S MODEL IN AFFECTIVE DISORDERS

DESPITE their lack of empirical testing in ward settings, nursing models as a framework for delivery of care remain a popular pursuit for nurses. The value of models lies in the direction they provide in terms of offering a suitable knowledge base for nursing practice.

We carried out a study in a small unit for individuals with affective disorders in a large psychiatric hospital. Peplau's nursing model was introduced and evaluated in terms of outcome both for patients and staff. The interpersonal model was chosen for its emphasis on psychiatric nursing as a therapeutic process in which both the patient and nurse work together to 'achieve goals, satisfaction and personal growth'[1] as well as promoting nursing activity to give education towards productive living and personal maturity. This view of nursing offered the nearest model of thinking to describe the work in the unit.

Eight nurses (seven RMNs, one EN(M)) were involved, all of whom worked full time in the unit as primary or associate nurses. A series of seminars took place to help nurses develop their knowledge and awareness of the model and evaluate whether learning had taken place. Knowledge of the model significantly improved following the seminars, and this was sustained at follow-up three months later.

Content analysis of the nursing notes before the introduction of the model revealed little evidence of Peplau's theory. This was significantly improved three months later, although the more esoteric aspects of the theory were not fully understood by nurses. Using the model significantly improved nurses' use of the nursing process as measured by the Nursing Process Rating Scale[2]. Staff satisfaction changed little, as measured by the Index of Job Satisfaction[3].

All 10 in-patients in the unit were included in the study; all were diagnosed with depression. Patients were significantly less satisfied once the model was introduced, according to their scores on Risser's scale[4].

Peplau's model thus seems to have potential for increasing the individuality of patient care, because staff use of the nursing process improves and for encouraging nurses to involve both patients and families in care. However, if it is to be truly successful, all aspects need to be clearly understood by nurses.

Patient satisfaction is adversely affected, perhaps because of the increasing administrative tasks of the model which take nurses away from patients. As the model emphasises the partnership between the nurse and the patient, the added responsibility expected from the patient may invoke an increase in stress. Patients whose very problems may stem from difficulties in assuming responsibilities for their activities of living may see this stress as a deterioration in their health and thus in their satisfaction with nursing care.

Patients experiences of post-operative pain at night

The control of post-operative pain is often poor. Most research studies have concentrated on pain management during the day. Relatively little is known about patients' experiences of post-operative pain at night.

In this study of night-time pain, pain control and sleep following abdominal surgery, patients reported that their sleep was shortened and frequently disturbed during the post-operative period. Pain was the most commonly reported cause of night-time sleep disturbance, with noise coming second. Almost three-quarters of the sample reported that pain had disturbed sleep in some way. Virtually half of the patients felt that their pain was worse at night.

An analysis of analgesic provision showed that patients received fewest doses of opioid analgesics during the night; most doses were given in the morning and evening. Between one fifth and one quarter of the maximum possible amount of analgesics prescribed was actually given to patients during the first two days after surgery.

Fewest analgesics were given at night even though pain was the commonest reason for broken sleep and half the sample felt that pain was worse at night.

A wide range of methods of managing their own pain was described by patients, including supporting their wounds(either via a dressing or by using a plllow or their hands), deep breathing or relaxation, distraction and mobilisation. Patients expressed a lot of interest in using alternative therapies for controlling post-operative pain, with relaxation being the most favoured method. Almost half the patients thought it would be helpful for nurses to suggest such therapies to them.

Copies of the full report can be obtained from the Nursing Research Unit, Department of Nursing Studies, University of Edinburgh, 12 Buccleugh Place, Edinburgh EH8 9LW. Cheques for £5 should be made payable to the University of Edinburgh

Jose Closs

Register of Scottish children with a motor deficit of central origin

The prevalence of "cerebral palsy" is thought to be increasing, with more children having intellectual and sensory impairments in addition to the motor impairment. As there is no statutory requirement to record this information, we do not know what the situation is in Scotland, and do not have adequate information for planning services.

The register will provide Health Boards with a much needed basis for planning, monitoring and comparing the services provided for children with cerebral palsy

Once established it is intended that the Scottish register will provide a basis for monitoring trends in the prevalence of various types of motor disorder, addressing aetiological questions, evaluating therapeutic interventions and monitoring the system of "records of need".

A problem with cerebral palsy is the lack of a clear working definition of the condition which is inclusive but still acceptable to parents. The informed parent with a severely disabled child has no difficulty accepting the term "cerebral palsy" but those with a less affected child may prefer a more problem-oriented term such as "motor disorder".

Unlike most disease-based registers such as those for congenital malformations, hypothyroidism or phenylketonuria, we have sought permission from parents before entering their child's name in the register. They have a vested interest in ensuring that those planning services for children with motor impairments are fully informed of their likely needs. We hope that by involving them at an early stage we will achieve high levels of ascertainment, permitting firstly, more reliable estimates of prevalence. We hope that this will mean that they will also be more willing to co-ooperate in subsequent research.

For further information about the register, contact Lesley Mutch or Carolyn Morrison at SPORU, 1 Lilybank Gardens, Glasgow G12 8RZ, Tel 041-339-3118.

Lesley Mutch