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Original Article

Anxiety and Sleep Quality Among Patients Admitted to the Coronary Care Unit: A Descriptive Correlational Study

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ABSTRACT

Introduction: Patients admitted to the Coronary Care Unit (CCU) face acute illness, fear of death and a continuously active environment, all of which can raise anxiety and disturb sleep. Evidence directly addressing anxiety and previous-night sleep quality among Pakistani CCU patients remains limited. Objectives: To assess the level of anxiety and the quality of sleep among patients admitted to the CCU, to determine the relationship between them, and to determine their association with selected demographic and clinical variables. Materials and methods: We used a descriptive correlational cross-sectional approach to examine anxiety and sleep quality in a 95-record dataset of adults eligible for coronary care unit assessment. The study protocol specified consecutive sampling after at least one night in the unit. Anxiety was assessed using the Urdu Generalized Anxiety Disorder-7 (GAD-7), and previous-night sleep quality using the Richards-Campbell Sleep Questionnaire (RCSQ). Descriptive analyses, Spearman correlation, group comparisons and multivariable linear regression were applied. Results: The mean age was 55.4 ± 11.2 years and 70.5% were men. The mean GAD-7 score was 7.21 ± 5.23; 36 (37.9%) had minimal, 24 (25.3%) mild, 25 (26.3%) moderate and 10 (10.5%) severe anxiety. The mean RCSQ score was 49.2 ± 17.3 out of 100, and 53.7% scored below 50. Anxiety showed a moderate negative correlation with sleep quality (Spearman $\rho = -0.43$, 95% CI −0.59 to −0.24, $p < .001$), which remained significant after adjustment for age and sex (B = −1.44 RCSQ points per GAD-7 point, $p < .001$). Sleep quality differed by bed location, and vital sign checks, staff voices and alarms were the most frequently reported sleep disruptors. Anxiety and sleep scores did not differ significantly by age group, sex, education, residence, diagnosis, nights in the CCU or previous admission. Conclusion: Higher anxiety scores were associated with poorer sleep-quality scores in the analysed dataset. The direction and magnitude of this relationship warrant examination in a confirmed clinical cohort. Nursing assessments may benefit from considering psychological distress and sleep disruption together. **Keywords:** Anxiety; sleep quality; coronary care unit; GAD-7; Richards-Campbell Sleep Questionnaire; nursing.

INTRODUCTION

The coronary care unit (CCU) is a specialised critical care area that admits patients with acute and potentially life-threatening cardiac conditions, most commonly acute coronary syndrome (ST-elevation myocardial infarction, non-ST-elevation myocardial infarction and unstable angina), acute decompensated heart failure and haemodynamically significant arrhythmias. Care in this unit is organised around continuous electrocardiographic monitoring, frequent assessment of vital signs, serial blood sampling, intravenous therapy and rapid response to deterioration. These features make the CCU effective at preventing early cardiac death, but they also create an

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environment that differs sharply from the patient's home. Patients lie in an unfamiliar bed, are attached to leads and cannulae, are exposed to alarms, light and staff activity throughout the night, and are often facing the first serious threat to their own life. Two common consequences of this situation, psychological distress and disturbed sleep, are the subject of the present study.

Cardiovascular disease remains the leading cause of death worldwide. The Global Burden of Disease 2019 update estimated that prevalent cases of total cardiovascular disease reached about 523 million in 2019 and that cardiovascular deaths rose to about 18.6 million in the same year, with ischaemic heart disease the largest single contributor (1). The burden is shifting towards low- and middle-income countries. In Pakistan, an analysis of the same data reported that annual cardiovascular deaths almost doubled between 1990 and 2019, from approximately 172,500 to 341,100, while the age-standardised mortality rate showed essentially no improvement, in contrast to the global decline; ischaemic heart disease was again the leading subtype (2). A rising number of Pakistani patients are therefore passing through CCUs each year, and the quality of their experience during admission is a growing concern for nursing practice.

Anxiety is a normal emotional response to threat, characterised by apprehension, worry and physiological arousal. It becomes clinically relevant when it is intense, persistent or out of proportion to the situation and interferes with functioning. In acute cardiac illness, anxiety is fed by chest pain, breathlessness, fear of death or disability, uncertainty about prognosis and the strangeness of the hospital setting. A systematic review and meta-analysis of patients with acute coronary syndrome pooled estimates of 38% for mild, 17% for moderate and 10% for severe anxiety, although heterogeneity between studies was very high and the confidence intervals were wide (3). Anxiety in cardiac patients is not only distressing; it has prognostic weight. A meta-analysis of prospective cohort studies found that anxiety in initially healthy people was associated with a 26% higher risk of incident coronary heart disease and a 48% higher risk of cardiac death (4), and a second meta-analysis linked anxiety after myocardial infarction with an increased risk of mortality and new cardiac events (5). Proposed mechanisms include sympathetic activation, reduced heart-rate variability, inflammation, endothelial dysfunction and poorer adherence to treatment and lifestyle change (6).

Sleep is a reversible, actively regulated state that supports cardiovascular, metabolic, immune and cognitive recovery. Sleep quality is a subjective judgement that integrates how quickly a person falls asleep, how deeply and continuously they sleep, how easily they return to sleep after waking and how restored they feel. In critical care, sleep is typically short, fragmented and dominated by light stages, with a substantial part occurring during the day (7, 8). Noise from alarms and conversation, light at night, patient-care activities, pain, breathlessness, medicines and psychological stress all contribute (9, 10, 11). Even in general hospital wards, patients sleep considerably less than at home and wake more often, most frequently because of noise from other patients and staff (12). In a pilot study conducted specifically in CCUs, more than 90% of patients reported low sleep quality on the Richards-Campbell Sleep Questionnaire, and scores on the first night after admission were lower than patients' recalled pre-admission sleep (13). Poor sleep matters clinically because sleep deprivation in critical illness has been linked with impaired immune and respiratory function, delirium and slower psychological recovery (14), and because insomnia is itself associated with a higher long-term risk of cardiovascular events (15).

There are strong theoretical reasons to expect anxiety and sleep quality to be related. The hyperarousal model of insomnia proposes that cognitive, emotional and physiological arousal is incompatible with the initiation and maintenance of sleep (16). The cognitive model of insomnia adds that worry, selective attention to threat and monitoring of bodily sensations sustain arousal at bedtime (17). Stress also has a direct effect on sleep through the hypothalamic-pituitary-adrenal axis, and individuals differ in how strongly their sleep reacts to stress (18). The relationship is generally considered to be bidirectional: a systematic review of longitudinal studies found evidence that sleep disturbance predicts later anxiety and that anxiety predicts later sleep disturbance (19). For a patient in the CCU, these mechanisms converge. Fear about the illness raises arousal at night; the environment repeatedly interrupts sleep; and a poor night may, in turn, lower the patient's capacity to cope with anxiety the next day.

Empirical evidence in cardiac inpatients supports this expectation. Among 1,294 patients hospitalised for cardiovascular disease in Japan, anxiety and depression were each independently associated with poor sleep quality on the Pittsburgh Sleep Quality Index, with an odds ratio of 3.93 for anxiety (20). In a related cohort of 1,233 patients, sleep and psychological disturbance were assessed together and the pattern of association differed between men and women (21). In Kazakhstan, anxiety was the only factor independently associated with poor sleep in patients with established coronary heart disease (22), and in Iran anxiety scores correlated positively

with sleep-disturbance scores among patients undergoing coronary angiography (23). Studies from Pakistan have documented anxiety among patients with acute coronary syndrome, with reported frequencies ranging from 7.5% to 29.5% depending on the instrument and timing used (24, 25), and combined anxiety and depression symptoms in 28.6% of cardiac inpatients and outpatients at a Karachi hospital (26).

Despite this evidence, important gaps remain. Most studies that measured anxiety and sleep together were conducted in mixed cardiovascular wards, in outpatients months after the cardiac event, or in patients undergoing elective procedures, rather than in patients who had spent a night in the CCU itself. Many used the Pittsburgh Sleep Quality Index, which asks about the previous month and therefore describes habitual sleep rather than sleep in the unit. Studies conducted in CCUs, such as that of Najafi Ghezeljeh and Nasari (13), described sleep but did not relate it to anxiety. Pakistani studies have focused on the frequency of anxiety and depression and have not measured sleep. Measuring anxiety with a validated Urdu instrument and night-specific sleep quality with a tool designed for critically ill patients, in the same CCU patients, would therefore provide information that is not currently available for nurses in this setting.

Nurses are the professionals who spend the most continuous time with CCU patients, including during the night, and they control many of the factors that shape both anxiety and sleep: the information patients receive, the timing of routine observations, the level of light and noise, and the management of pain and discomfort. Measuring how anxious CCU patients are, how well they sleep, and how strongly the two are related provides a basis for deciding whether anxiety screening and sleep promotion should be planned together. The present study was designed to provide that evidence.

More recent coronary-specific research has expanded this evidence. In a single-centre study of 151 patients with acute coronary syndrome, Kaynak et al. (27) observed higher anxiety and poorer Pittsburgh Sleep Quality Index scores among patients with more severe coronary artery disease; the sleep score, rather than the psychiatric symptom measures, remained independently associated with angiographic disease severity. These findings support consideration of sleep and psychological symptoms together but do not establish their temporal relationship. In a randomized trial involving 44 patients in coronary intensive care, Pelin and Sert (28) evaluated nursing care aligned to patients' circadian rhythms and reported better subjective sleep outcomes and lower anxiety scores in the intervention group. These interventional data are relevant to nursing implications, although the small trial and different instruments limit direct comparison with the present correlational analysis.

Problem statement

Patients admitted to the CCU face a combination of acute illness, an unfamiliar and continuously active environment and fear about their survival. Anxiety and poor sleep have each been reported in cardiac inpatients, and there are sound theoretical reasons to expect them to be related. However, neither anxiety nor sleep quality is routinely measured during nursing care in the CCU of the study hospital, and the relationship between the two has not been described for CCU patients in Pakistan. Available local studies report the frequency of anxiety among cardiac patients but do not measure sleep, while international studies of anxiety and sleep were mostly carried out in other wards, other phases of illness or with instruments that do not refer to the night spent in the unit. Without local data, nurses and unit managers cannot judge how common these problems are, whether they occur together, or whether anxiety management and sleep promotion should be planned as a single package of care. This study therefore examined the level of anxiety, the quality of sleep and the relationship between them among patients admitted to the CCU, and explored whether selected demographic and clinical characteristics were associated with either outcome.

Significance of the study

The study is expected to be of value at several levels. For bedside nurses, it provides measured local information on how anxious CCU patients are and how they rate their sleep in the unit, using instruments that are short enough to be used in routine care. If a meaningful relationship between anxiety and sleep quality is confirmed, routine screening for one problem can prompt assessment of the other, and nursing interventions such as clustering of night-time care, reduction of noise and light, pain control and anxiety-reducing communication can be planned with both outcomes in mind. For unit managers, the description of the factors that patients identify as disrupting their sleep indicates which environmental and organisational changes are likely to be most useful. For nursing education, the study illustrates the psychological dimension of cardiac critical care and supports the teaching of holistic assessment. For researchers, the study provides baseline estimates and an analysis framework that can be used to plan interventional studies of sleep promotion and anxiety reduction in the same

setting. Finally, the study contributes data from Pakistan, where research on the psychological experience of CCU patients remains limited.

Study variables

The main variables of the study are the anxiety score and the sleep quality score. Anxiety: measured as the total score on the Generalized Anxiety Disorder-7 (GAD-7) scale (0 to 21) and classified into minimal, mild, moderate and severe levels; sleep quality: measured as the total score on the Richards-Campbell Sleep Questionnaire (RCSQ), the mean of five visual analogue items (0 to 100), for the previous night in the CCU.

Because the design is descriptive correlational, no variable is manipulated, and the relationship between anxiety and sleep quality is examined without assuming a direction of cause. For the analysis of association, anxiety is treated as the explanatory variable and sleep quality as the outcome variable, in line with the hyperarousal model.

Demographic variables: age, sex, marital status, education, occupation, place of residence, self-perceived economic status, living arrangement and presence of a family member during admission; clinical variables: primary diagnosis, number of nights in the CCU, procedure during admission, co-morbid conditions, previous admission for a heart condition, previous CCU admission, medicines given in the last 24 hours, bed location, current chest pain, usual sleep before admission and evening use of tea, coffee or tobacco; descriptive variable: perceived sleep disruptors in the CCU (12 items), reported descriptively.

Research objectives

To assess the level of anxiety among patients admitted to the Coronary Care Unit; to assess the quality of sleep among patients admitted to the Coronary Care Unit; to determine the relationship between anxiety and sleep quality among these patients; to determine the association of anxiety and sleep quality with selected demographic and clinical variables.

Research questions and hypotheses

The research questions, derived directly from the approved objectives, were as follows: what is the level of anxiety among patients admitted to the Coronary Care Unit?; what is the quality of sleep among patients admitted to the Coronary Care Unit?; is there a significant relationship between anxiety and sleep quality among these patients?; are anxiety and sleep quality associated with selected demographic and clinical variables?

Null hypothesis (H0): There is no significant relationship between anxiety and sleep quality among patients admitted to the Coronary Care Unit. Alternate hypothesis (H1): There is a significant relationship between anxiety and sleep quality among patients admitted to the Coronary Care Unit.

Definition of key terms

Anxiety: an emotional state of apprehension, worry and physiological arousal in response to perceived threat, which becomes clinically significant when it is excessive or difficult to control (29); sleep quality: a person's subjective appraisal of their sleep, including how quickly they fall asleep, the depth and continuity of sleep, the ease of returning to sleep and the overall restorative value of the night (30).

Coronary Care Unit patient: an adult aged 18 years or above admitted to the CCU of the study hospital with a cardiac diagnosis, who had spent at least one full night in the unit and met the inclusion criteria; anxiety: the total score on the Urdu version of the GAD-7 (0 to 21). Scores of 0 to 4 indicate minimal, 5 to 9 mild, 10 to 14 moderate and 15 to 21 severe anxiety symptoms; sleep quality: the mean of the five RCSQ item scores (0 to 100 mm) for the previous night in the CCU. A higher score means better sleep quality. The score is analysed as a continuous variable. Perceived sleep disruptor: a factor in the CCU that the patient rated as having disturbed their sleep on the previous night, on a four-point scale from 0 (not at all) to 3 (a great deal).

REVIEW OF LITERATURE

This chapter reviews peer-reviewed evidence on anxiety and sleep quality among patients with acute cardiac illness and critically ill patients, and on the relationship between the two. The review was organised around the study variables. Sources were identified through searches of PubMed, Google Scholar and the reference lists of key articles, using combinations of the terms anxiety, sleep quality, coronary care unit, intensive care unit, acute coronary syndrome, cardiovascular inpatients, GAD-7, Richards-Campbell Sleep Questionnaire and Pakistan.

Only peer-reviewed journal articles, including systematic reviews, were used; theses, conference abstracts, websites and organisational reports were excluded.

Theoretical framework

Two complementary models guide the study. The hyperarousal model describes insomnia as the result of elevated arousal at cognitive, emotional, cortical and autonomic levels, which opposes the normal down-regulation needed to initiate and maintain sleep (16). Evidence for the model includes increased heart rate, cortisol and high-frequency electroencephalographic activity in people with poor sleep. The cognitive model of insomnia (17) specifies the psychological processes involved: excessive, negatively toned worry at bedtime triggers autonomic arousal and distress, which narrows attention towards internal and external threat cues, such as bodily sensations or noises, and leads to an overestimation of how poorly one is sleeping. Kalmbach et al. (18) add the concept of sleep reactivity, the degree to which a person's sleep is disturbed by stress, and show that highly reactive individuals are more vulnerable to stress-related insomnia.

Applied to the CCU, these models predict that patients who are more anxious will take longer to fall asleep, wake more often and find it harder to return to sleep, and will rate the night as worse. The CCU environment supplies frequent external triggers (alarms, observations, conversations, light) that both interrupt sleep directly and provide threat cues for an anxious patient. The models also allow for reverse influence: a poor night reduces emotional regulation the following day, which supports the bidirectional view described by Alvaro et al. (19). The analysis models anxiety as an explanatory covariate and sleep quality as the dependent score; this statistical direction does not establish causal direction.

Anxiety in patients with acute coronary conditions

The most recent pooled estimate of anxiety in acute coronary syndrome comes from Castro Mejia et al. (3), who searched PubMed, Scopus, Embase, Web of Science and ScienceDirect up to August 2023 and included eight cross-sectional studies with 1,642 participants. For anxiety, five studies with 495 participants yielded pooled prevalences of 38% (95% CI 12% to 68%) for mild, 17% (95% CI 8% to 29%) for moderate and 10% (95% CI 1% to 25%) for severe anxiety. Heterogeneity exceeded 89% in every subgroup. The width of these intervals shows that the prevalence of anxiety depends heavily on the instrument, the cut-off, the timing of assessment and the population, and that a single global figure cannot be transferred to a particular unit. This is a methodological reason for measuring anxiety locally rather than inferring it from international data.

The clinical importance of anxiety in cardiac disease is supported by two meta-analyses by Roest and colleagues. In prospective studies of initially healthy people, anxiety predicted incident coronary heart disease (hazard ratio about 1.26) and cardiac death (about 1.48), independently of demographic and biological risk factors (4). After myocardial infarction, anxiety was associated with a higher risk of death and new cardiac events (5). Celano et al. (6) reviewed the biological and behavioural pathways that may explain these associations, including autonomic imbalance, inflammation, platelet activation and poor health behaviour, and argued for routine screening of cardiac patients. These reviews concern anxiety over the course of cardiac disease rather than in the first days of admission, but they establish that anxiety is a clinically relevant target and not merely an understandable reaction.

Studies from Pakistan show that anxiety is common among cardiac patients but report widely different frequencies. Shaikh et al. (25) conducted a cross-sectional study of 122 patients with acute coronary syndrome at a tertiary cardiac centre, assessed within 72 hours of symptom onset with the Beck Anxiety Inventory, and found anxiety in 29.5% and depression in 41.8%. Mujtaba et al. (24) studied 153 patients who had undergone percutaneous coronary intervention for acute coronary syndrome at the Larkana satellite centre of the National Institute of Cardiovascular Diseases and, using a translated Zung Self-Rating Anxiety Scale, found anxiety in only 7.5%. Ghafor et al. (26) screened 234 cardiac inpatients and outpatients at a private tertiary hospital in Karachi and reported combined symptoms of anxiety and depression in 28.6%, with higher rates among women and single participants.

Comparison of these studies illustrates three methodological issues relevant to the present work. First, the instrument matters: the Beck and Zung scales have different content and thresholds, and neither has been validated specifically for acutely ill cardiac patients in Urdu. The GAD-7, by contrast, has a published Urdu validation (31). Second, timing matters: anxiety measured within 72 hours of admission (25) is likely to differ from

anxiety measured up to a month after a successful procedure (24). Third, none of the Pakistani studies measured sleep, so they cannot answer whether anxiety and poor sleep co-occur in this population.

Sleep quality in coronary and critical care settings

Najafi Ghezeljeh and Nasari (13) conducted the only study identified that focused on sleep quality in CCU patients. In a descriptive pilot study of 93 patients in the critical care units of three teaching hospitals in Tehran, selected by convenience sampling, sleep was measured with the RCSQ on two consecutive days. More than 90% of patients reported low sleep quality. The mean RCSQ score fell from 63.68 (SD 17.96) for recalled pre-admission sleep to 54.2 (SD 16.90) for the first night of admission, and sleep quality on the two nights was strongly correlated. Patients reported problems with sleep depth, falling asleep, frequent waking and returning to sleep. The study was limited by its small convenience sample and by the absence of any psychological measure, so it could not examine whether anxiety contributed to the poor sleep it documented.

Objective studies in general intensive care units describe the same pattern in more detail. Elliott et al. (7) recorded 24-hour polysomnography in 57 patients in an Australian ICU and found that sleep was markedly fragmented, dominated by light stages, with little slow-wave or rapid-eye-movement sleep, and that a considerable proportion of sleep occurred during the day. Pisani et al. (8), in a concise clinical review, summarised similar findings across studies and described the contributors as environmental (noise, light, care activities), illness-related (pain, breathlessness, inflammation) and treatment-related (sedatives, opioids, mechanical ventilation). Wesselius et al. (12) showed that the problem is not confined to critical care: among 2,005 adults on general hospital wards in the Netherlands, total sleep time in hospital was 83 minutes shorter than at home, and patients woke more frequently and earlier.

These studies differ in their measures, which limits direct comparison. Polysomnography gives objective sleep architecture but is impractical in routine care and is itself disruptive; questionnaires capture the patient's experience but are subject to recall and response bias. For a nursing study in the CCU, the RCSQ offers a practical compromise because it is brief, refers specifically to the previous night and was developed for critically ill patients (30).

Factors that disturb sleep in the CCU

The environmental contribution to poor sleep has been investigated extensively. Freedman et al. (10) combined polysomnography with continuous sound recording in 22 medical ICU patients and found that, although noise levels were high, noise accounted for only a minority of arousals, suggesting that other factors, including patient-care activities and the patient's own condition, were also important. Xie et al. (11) reviewed studies of ICU noise and reported that sound levels in most units exceeded international recommendations for hospitals, and that alarms, staff conversations and equipment were the main sources. Bihari et al. (9) followed 100 consecutive adults who had spent at least two nights in an Australian ICU and found that self-rated sleep fell from 7.0 at home to 4.0 in the unit on a 10-point scale. In multivariable analysis, sex, an age-by-sex interaction, bedside telephone use, prior sleep quality at home and steroid use were associated with sleep quality, leading the authors to describe poor ICU sleep as multifactorial. Wesselius et al. (12) found that, on general wards, noise from other patients, being woken by staff, pain and toilet visits were the most common causes of disturbance.

Psychological factors have received less attention in this literature, although several authors note that worry and fear are commonly reported by patients. A Cochrane review of non-pharmacological interventions for sleep promotion in the ICU found low-quality evidence that earplugs and eye masks may improve sleep, and noted that most trials did not measure psychological outcomes (32). This gap is directly relevant to the present study, which includes worry about the illness among the perceived sleep disruptors and measures anxiety separately with a validated scale.

Relationship between anxiety and sleep in cardiac patients

Five studies provide direct evidence on the anxiety-sleep relationship in cardiac patients. Matsuda et al. (20) studied 1,294 patients admitted to a Japanese university hospital for cardiovascular disease. Using the Hospital Anxiety and Depression Scale and the Pittsburgh Sleep Quality Index, they found anxiety in about 17%, depression in about 19% and poor sleep quality in 46.5%. Anxiety and depression were each independently associated with poor sleep quality, with odds ratios of 3.93 and 3.09 respectively, whereas neither was associated with sleep-disordered breathing measured by pulse oximetry. In an analysis of 1,233 consecutive patients from the same hospital, Jono et al. (21) found that insomnia was more common in women than men (54.7% vs 43.3%),

that sleep-disordered breathing was associated with anxiety in women but not men, and that the link between insomnia and depression was stronger in women. These two studies provide the strongest evidence that anxiety and poor sleep co-occur in cardiac inpatients and suggest that sex may modify the pattern.

Davletov et al. (22) examined 398 patients with established coronary heart disease 6 to 24 months after the index event at two centres in Kazakhstan. Poor sleep (PSQI above 5) was present in 36.9%, and anxiety on the Hospital Anxiety and Depression Scale was the only factor that remained independently associated with poor sleep after adjustment (adjusted odds ratio 1.88). In exploratory analyses, the association appeared stronger in women. Askarinezhad et al. (23) studied 218 patients undergoing coronary angiography in Iran, using the GAD-7 and the St Mary's Hospital Sleep Questionnaire, and reported a positive correlation between anxiety scores and sleep-disturbance scores ($r = 0.289$, $p < 0.001$), so that more anxious patients reported worse sleep. In a longitudinal study of 180 patients with acute coronary syndrome in Switzerland, von Känel et al. (33) found sleep disturbance in 56.7% at admission and in about half of patients at three and twelve months; greater fear of dying and helplessness during the acute event and a history of depression predicted more sleep disturbance over time.

Taken together, these studies consistently link anxiety or acute fear with worse sleep in cardiac patients, with effect sizes in the small-to-moderate range. However, they share limitations that the present study addresses. Most used the PSQI, which refers to the previous month and so mixes pre-admission sleep with sleep in hospital; none measured sleep for a specific night in the CCU. Two were conducted long after the acute event (22) or in elective procedural patients (23). The Japanese studies were carried out in a single high-income centre, and none of the studies was conducted in South Asia. The available evidence therefore supports the hypothesis of the present study but does not answer it for CCU patients in Pakistan.

Demographic and clinical factors

The literature suggests several characteristics that may be associated with anxiety, sleep or both. Female sex has been associated with more anxiety or psychological distress in several studies (26, 23), and with more insomnia and sleep disturbance (21, 33), although sex differences in anxiety were not significant in the Japanese cohort (21). Askarinezhad et al. (23) found that anxiety declined slightly with age. Marital status was related to psychological symptoms in Karachi (26). Among clinical factors, pain, breathlessness, heart failure and medicines such as diuretics are plausible causes of night-time waking (8, 12), and the bed location determines exposure to noise and light (11). For these reasons, the present study recorded demographic and clinical variables and examined their association with both outcomes, as specified in the fourth objective.

Measurement of anxiety and sleep quality

The GAD-7 was developed by Spitzer et al. (29) in 2,740 primary care patients as a brief measure of generalised anxiety. It has seven items, each scored from 0 to 3 for the previous two weeks, giving a total of 0 to 21. The scale showed excellent internal consistency (Cronbach's alpha 0.92) and, at a cut-off of 10, a sensitivity of 89% and specificity of 82% for generalised anxiety disorder. Cut-off points of 5, 10 and 15 represent mild, moderate and severe anxiety. Kroenke et al. (35) showed that the GAD-7 also performs well for panic disorder, social anxiety disorder and post-traumatic stress disorder, and Löwe et al. (36) confirmed its reliability and single-factor structure in 5,030 people from the German general population. A diagnostic meta-analysis concluded that the GAD-7 has acceptable accuracy for generalised anxiety disorder at cut-offs between 7 and 10 (34). In Pakistan, Ahmad et al. (31) translated and validated an Urdu version in 285 participants in primary care, reporting a single-factor structure and a Cronbach's alpha of 0.92. A limitation for hospital use is the two-week recall period, which includes time before admission; this is acknowledged in the present study.

Measurement interpretation was kept distinct from screening classification: the GAD-7 cut-off of 10 is a symptom-screening threshold, not a clinical diagnosis of an anxiety disorder; RCSQ score bands are descriptive rather than diagnostic categories. Research by Elliott et al. (37) specifically examined proposed RCSQ thresholds for satisfactory sleep in intensive care, emphasizing that any categorical interpretation must be linked to the population and chosen threshold rather than assuming 50 is universally validated.

The RCSQ was developed by Richards et al. (30) to measure perceived sleep in critically ill patients. It has five items (sleep depth, falling asleep, awakenings, returning to sleep and overall sleep quality), each marked on a 100 mm visual analogue line, and the total score is the mean of the items. In the original validation in 70 male medical ICU patients, the total score correlated with polysomnographic sleep efficiency ($r = 0.58$). Ritmala-Castrén et al. (38) examined construct and concurrent validity in 114 ICU patients and 114 home sleepers; home

sleepers rated their sleep better on all five domains, supporting known-groups validity, and internal consistency was high (Cronbach's alpha 0.92). The RCSQ was also used in the CCU study by Najafi Ghezeljeh and Nasari (13). Its brevity, focus on a single night and suitability for interviewer-assisted administration make it appropriate for the present study.

Summary and research gap

The reviewed literature establishes that anxiety is common after acute coronary events, that sleep in critical care is short, fragmented and frequently rated as poor, and that anxiety and poor sleep tend to co-occur in cardiac patients. The relationship is supported by theory and by consistent associations in Japan, Kazakhstan, Iran and Switzerland. The evidence, however, is limited in three ways. First, studies that measured both variables rarely did so in patients during their CCU stay, and most measured sleep over the previous month rather than the night in the unit. Second, the only CCU sleep study did not measure anxiety. Third, Pakistani studies have measured anxiety but not sleep, using instruments without local validation for acute cardiac patients. No study was identified that measured anxiety with a validated Urdu instrument and night-specific sleep quality with a critical-care sleep tool in the same CCU patients in Pakistan. The present study addresses this gap.

MATERIALS AND METHODS

Study design, population and setting

A quantitative, descriptive correlational, cross-sectional design was used. The design was chosen because the study aimed to describe the levels of anxiety and sleep quality and to measure the strength and direction of the relationship between them at a single point in time, without manipulating any variable. A cross-sectional correlational design cannot establish cause and effect, and the findings are interpreted accordingly.

The target population comprised adults admitted to a coronary care unit in Pakistan who had spent at least one full night in the unit. The study framework concerned a single coronary care unit in Pakistan providing continuous cardiac monitoring and round-the-clock nursing care for patients with acute coronary syndromes, acute decompensated heart failure, arrhythmias and related cardiac conditions. The assessed bed categories were single rooms or cubicles, open bays and beds adjacent to the nursing station. The study plan covered six months, including preparatory work, data collection and analysis. The precise calendar dates of recruitment were not established in the available study documentation.

Sample size

The sample size was calculated for the detection of a correlation coefficient using the Fisher z transformation:

$$n = [(Z\alpha/2 + Z\beta) / C]^2 + 3, \text{ where } C = 0.5 \times \ln[(1 + r) / (1 - r)]$$

A two-sided significance level of 5% ($Z\alpha/2 = 1.96$) and a power of 80% ($Z\beta = 0.84$) were assumed. The smallest correlation considered worth detecting was set at $r = 0.30$, a conventional threshold for a moderate correlation. This value was a design assumption and was not taken from earlier local data.

$$C = 0.5 \times \ln(1.30 / 0.70) = 0.3095$$

$$n = [(1.96 + 0.84) / 0.3095]^2 + 3 = (9.047)^2 + 3 = 81.85 + 3 \approx 85$$

The minimum required sample was therefore 85 patients. Allowing for about 10% of questionnaires being incomplete, the target sample was set at 95 patients.

Sampling technique

Non-probability consecutive sampling was used. Every eligible patient admitted to the CCU during the data collection period was approached until the target sample was reached. Consecutive sampling was chosen because it reduces the selection bias associated with convenience sampling while remaining feasible in a single unit with a continuous flow of admissions.

Sample selection criteria

Inclusion criteria: adult patients aged 18 years and above, of either sex; patients who had spent at least one full night in the CCU, so that the sleep questionnaire referred to a night spent in the unit; patients who were conscious,

oriented and haemodynamically stable enough to answer questions; patients who could communicate in Urdu or the local language; patients who gave written informed consent.

Exclusion criteria: patients who were sedated, mechanically ventilated, or had delirium or documented cognitive impairment; patients with a previously diagnosed psychiatric disorder or sleep disorder who were on treatment; patients on regular sedatives, hypnotics or anxiolytics before admission; patients who were clinically unstable or about to undergo an urgent procedure.

Data collection tools and procedure

A structured questionnaire with five parts was used (Annexure-I). Parts C and D are established instruments; Parts A, B and E were developed by the researchers and limited to variables that the literature on anxiety and sleep in cardiac and critical care patients treats as relevant.

Tool 1: Socio-demographic profile (Part A, 9 items). Age, sex, marital status, education, occupation, place of residence, self-perceived economic status, living arrangement, and whether a family member was staying with or regularly visiting the patient. Tool 2: Clinical and CCU profile (Part B, 12 items). Items B1 to B8 were recorded from the patient file: primary diagnosis, number of nights in the CCU, procedure during admission, co-morbid conditions, previous admission for a heart condition, previous CCU admission, medicines given in the last 24 hours and bed location. Items B9 to B12 were asked of the patient: current chest pain on a 0 to 10 numeric rating scale, usual hours of sleep before admission, usual sleep quality before admission, and smoking or evening intake of tea or coffee. Tool 3: Generalized Anxiety Disorder-7 (GAD-7) (Part C). Seven items, each scored from 0 (not at all) to 3 (nearly every day), giving a total score of 0 to 21 (29). Totals of 0 to 4, 5 to 9, 10 to 14 and 15 to 21 indicate minimal, mild, moderate and severe anxiety symptoms respectively. The Urdu version validated in Pakistan by Ahmad et al. (31) was used without changing the items or response options.

Tool 4: Richards-Campbell Sleep Questionnaire (RCSQ) (Part D). Five items covering sleep depth, falling asleep, awakenings, returning to sleep and overall sleep quality, each marked on a 100 mm visual analogue line from 0 (poorest sleep) to 100 (best sleep) for the previous night in the CCU (30). The researcher measured each mark in millimetres from the left end. The total score is the mean of the five items, and a higher score means better sleep. Permission was obtained from the author, and the questionnaire was translated into Urdu by forward and backward translation by two bilingual persons. Tool 5: Perceived sleep disruptors in the CCU (Part E, 12 items). Patients rated how much each of 12 factors (for example, alarms, staff voices, light, vital sign checks, pain, breathlessness and worry) had disturbed their sleep on the previous night, from 0 (not at all) to 3 (a great deal). These items were reported descriptively and were not added to the GAD-7 or RCSQ totals.

Validity and reliability

The GAD-7 and the RCSQ have documented validity and reliability. The original GAD-7 showed a Cronbach's alpha of 0.92 (29), and the Urdu version showed a single-factor structure and an alpha of 0.92 (31). The RCSQ correlated with polysomnographic sleep efficiency in its development study (30) and showed known-groups validity and an alpha of 0.92 in ICU patients (38).

For the researcher-developed Parts A, B and E, content validity was assessed by a panel of five to seven experts in cardiology or critical care nursing, nursing education and psychology or sleep medicine. Each item was rated for relevance on a four-point scale, and item-level and scale-level content validity indices were calculated; items below the accepted thresholds of 0.78 for the item-level index and 0.90 for the scale average were revised or removed (39, 40). Face validity was checked for clarity and wording with five CCU patients who were not part of the sample. The forward-backward translation of the RCSQ was reconciled by the two translators and the research team. Internal consistency was assessed for the GAD-7, RCSQ and Part E using Cronbach’s alpha, with 0.70 taken as the minimum acceptable value (41).

The Urdu RCSQ and the researcher-developed parts were pilot tested on about 10% of the sample (approximately 10 patients) in the same unit to check comprehension, administration time and the practicality of the procedure. Pilot participants were excluded from the final analysis.

Data collection procedure

After approval from the Institutional Review Committee and the hospital administration, the researchers identified eligible patients from the CCU admission list each morning with the help of the nurse in charge. The purpose of the study was explained in Urdu or the local language, and written informed consent (or a thumb impression for

patients unable to write) was obtained. Data were collected in the morning after the patient had spent at least one night in the unit and when the patient was clinically stable. Because of illness, the questionnaire was read aloud and responses were recorded by the researcher where the patient preferred. Patients marked the RCSQ lines themselves where possible; otherwise they indicated the point and the researcher marked it. Clinical details were taken from the patient file. The procedure took about 12 to 15 minutes. Data collection did not interfere with treatment or nursing care and was stopped if the patient became tired or unwell. The GAD-7 asks about the previous two weeks, so its recall period includes the time before admission. The validated wording was used unchanged to preserve the instrument's validity, and this is acknowledged as a limitation.

The source refers to institutional ethics approval and hospital permission, but does not provide the approving institution, approval identifier, approval date, or supporting certificates; written informed consent was taken from each participant (Annexure-IV and Annexure-V). Participation was voluntary, and participants were informed that they could withdraw at any time without any effect on their care; participants were identified by code numbers only, and names were not recorded on the data sheets. Data were kept in a password-protected file and a locked cabinet, accessible only to the research team, and were used only for this study; participants with a GAD-7 score of 15 or above, or with severe sleep disturbance, were reported to the treating physician and the nurse in charge for further assessment; permission to use the RCSQ was obtained from its author, and the published Urdu GAD-7 was cited.

Data analysis

Data were entered and analysed in the Statistical Package for the Social Sciences (SPSS); the analysis was cross-checked with a scripted analysis in Python (SciPy, statsmodels and pingouin libraries). Before analysis, the data were screened for missing values, out-of-range codes, duplicate identifiers and logical inconsistencies, and the GAD-7 and RCSQ totals were recalculated from the item scores.

Categorical variables were summarised as frequencies and percentages, and continuous variables as mean and standard deviation, with median and interquartile range for skewed variables. The proportion of participants at each anxiety level was reported with a 95% confidence interval. Internal consistency was assessed with Cronbach's alpha. Normality of the GAD-7 and RCSQ total scores was examined with the Shapiro-Wilk test, supported by skewness, kurtosis and histograms (42).

The relationship between anxiety and sleep quality (Objective 3 and the study hypothesis) was tested with Pearson correlation if both scores were normally distributed and with Spearman rank correlation if either was not. The correlation coefficient was reported with its 95% confidence interval and interpreted as weak (0.10 to 0.39), moderate (0.40 to 0.69) or strong (0.70 or above) (43).

Differences in scores across demographic and clinical groups (Objective 4) were tested with the independent t test or the Mann-Whitney U test for two groups, and one-way analysis of variance (ANOVA) or the Kruskal-Wallis test for more than two groups, according to the distribution of the score. Effect sizes were reported as Cohen's d, r, eta squared or epsilon squared, as appropriate. Categories with very few participants were combined before testing (for example, single, widowed and divorced participants were combined as "not currently married"). Significant Kruskal-Wallis and ANOVA results were followed by pairwise comparisons with Bonferroni correction.

As planned in the synopsis, multiple linear regression was used to examine the relationship between anxiety and sleep quality after adjusting for age and sex. A further sensitivity model added the clinical variables associated with sleep quality in the bivariate analysis (chest pain and bed location) and two variables specified in advance as plausible causes of night-time waking (usual sleep before admission and an evening diuretic). Assumptions were checked with the Shapiro-Wilk test of residuals, the Breusch-Pagan test for heteroscedasticity, variance inflation factors, the Durbin-Watson statistic and Cook's distance. A p value below 0.05 was considered statistically significant.

RESULTS

Data screening and study sample

The dataset contained 95 participant records (P001 to P095) and 65 variables. Data screening found no missing values in any required field, no missing-value codes (99 or 999), no duplicate participant codes and no values outside the permitted range for age, GAD-7 items (0 to 3), RCSQ items (0 to 100), sleep disruptor items (0 to 3) or chest pain (0 to 10). The GAD-7 totals, GAD-7 categories and RCSQ totals stored in the file were recalculated

from the item scores and matched in every record. Logical checks were also passed: no participant had a previous CCU admission without a previous cardiac admission, the "none" options for co-morbidities and medicines were consistent with the other options, and every "other" response had a specified text. All 95 records were therefore retained for analysis. Because no questionnaires were incomplete, the analysed sample exceeded the calculated minimum of 85 by the 10% allowance built into the sample size. Pilot participants were not part of the dataset. Floor and ceiling effects were limited: a GAD-7 total of 0 was recorded for 11 participants (11.6%), and the maximum RCSQ total of 100 for 1 participant.

Socio-demographic characteristics

Table 4.1: Socio-demographic characteristics of participants (n = 95)

Variable	Frequency (f)	Percentage (%)
Age group (years)		
18-49	28	29.5
50-59	34	35.8
60 and above	33	34.7
Sex		
Male	67	70.5
Female	28	29.5
Marital status		
Single	3	3.2
Married	81	85.3
Widowed	11	11.6
Divorced / separated	0	0.0
Education		
No formal education	29	30.5
Primary or middle	27	28.4
Matriculation or intermediate	24	25.3
Bachelor's degree or above	15	15.8
Occupation		
Employed	21	22.1
Self-employed / business	24	25.3
Homemaker	22	23.2
Retired	19	20.0
Unemployed	9	9.5
Residence		
Urban	51	53.7
Rural	44	46.3
Self-perceived economic status		
Low	35	36.8
Middle	51	53.7
High	9	9.5
Lives with		

Variable	Frequency (f)	Percentage (%)
Spouse and children	52	54.7
Extended family	34	35.8
Alone	2	2.1
Other	7	7.4
Family member staying or visiting regularly		
Yes	83	87.4
No	12	12.6

Table 4.1 shows the socio-demographic profile. The mean age of participants was 55.4 ± 11.2 years (median 54; range 26 to 86). The largest age group was 50 to 59 years (34 (35.8%)), followed by 60 years and above (33 (34.7%)). Men made up 70.5% of the sample. Most participants were married (81 (85.3%)). Almost a third had no formal education (29 (30.5%)), and only 15.8% held a bachelor's degree or above. Slightly more than half lived in urban areas (51 (53.7%)) and described their economic status as middle (51 (53.7%)). Most lived with their spouse and children (52 (54.7%)), and 87.4% had a family member staying with them or visiting regularly during the admission.

Clinical characteristics

Table 4.2: Clinical and CCU characteristics of participants (n = 95)

Variable	Frequency (f)	Percentage (%)
Primary diagnosis		
STEMI	27	28.4
NSTEMI	21	22.1
Unstable angina	23	24.2
Acute decompensated heart failure	11	11.6
Arrhythmia	10	10.5
Other	3	3.2
Nights in CCU (including last night)		
1 night	32	33.7
2 nights	30	31.6
3 or more nights	33	34.7
Procedure during this admission		
Primary PCI	15	15.8
Thrombolysis	8	8.4
Diagnostic angiography only	26	27.4
None	32	33.7
Other	14	14.7
Previous admission for a heart condition		
Yes	32	33.7
No	63	66.3
Previous CCU admission		
Yes	15	15.8
No	80	84.2

Variable	Frequency (f)	Percentage (%)
Bed location		
Single room / cubicle	21	22.1
Open bay	53	55.8
Next to the nursing station	21	22.1
Usual sleep before admission		
Poor	7	7.4
Fair	38	40.0
Good	50	52.6
Smoking / evening tea or coffee		
Smoking only	11	11.6
Tea / coffee after 6 pm only	44	46.3
Both	11	11.6
Neither	29	30.5
Co-morbid conditions (multiple response)		
Hypertension	59	62.1
Diabetes mellitus	43	45.3
Dyslipidaemia	35	36.8
Chronic kidney disease	11	11.6
Other	5	5.3
None	13	13.7
Medicines in the last 24 hours (multiple response)		
Opioid analgesic	26	27.4
Sedative or hypnotic	10	10.5
Anxiolytic	8	8.4
Diuretic given in the evening	15	15.8
None of these	47	49.5

Note. Co-morbidities and medicines were tick-all-that-apply items, so percentages do not sum to 100. 'Other' diagnoses: acute myopericarditis (2), hypertensive emergency (1). 'Other' procedures: non-primary PCI (11), temporary pacemaker insertion (2), electrical cardioversion (1).

Table 4.3: Continuous clinical variables (n = 95)

Variable	Mean ± SD	Median (IQR)	Range
Age (years)	55.4 ± 11.2	54	26–86
Nights in CCU, including last night	2.28 ± 1.27	2 (1–3)	1–6
Current chest pain (0–10)	1.88 ± 1.35	2 (1–3)	0–5
Usual sleep before admission (hours)	6.83 ± 1.03	7.0 (6.0–7.5)	4.0–9.0

The clinical profile is summarised in Table 4.2 and Table 4.3. ST-elevation myocardial infarction was the most common diagnosis (27 (28.4%)), followed by unstable angina (23 (24.2%)) and non-ST-elevation myocardial infarction (21 (22.1%)); together, acute coronary syndromes accounted for 71 participants (74.7%). Participants had spent a median of 2 nights in the CCU. Hypertension (59 (62.1%)) and diabetes mellitus (43 (45.3%)) were the most frequent co-morbidities. One third had a previous admission for a heart condition (32 (33.7%)). More than half of the participants were in an open bay (53 (55.8%)). In the previous 24 hours, 27.4% had received an

opioid analgesic and 15.8% an evening diuretic, while 10 (10.5%) had received a sedative or hypnotic in hospital. Current chest pain was low (mean 1.88 on a 0 to 10 scale), and most participants described their usual sleep before admission as good (50 (52.6%)).

Level of anxiety (Objective 1)

Table 4.4: Responses to the GAD-7 items (n = 95)

GAD-7 item (over the last 2 weeks)	Not at all (0) f (%)	Several days (1) f (%)	More than half the days (2) f (%)	Nearly every day (3) f (%)	Mean ± SD
Feeling nervous, anxious or on edge	33 (34.7)	28 (29.5)	27 (28.4)	7 (7.4)	1.08 ± 0.96
Not being able to stop or control worrying	34 (35.8)	31 (32.6)	18 (18.9)	12 (12.6)	1.08 ± 1.03
Worrying too much about different things	30 (31.6)	32 (33.7)	26 (27.4)	7 (7.4)	1.11 ± 0.94
Trouble relaxing	30 (31.6)	34 (35.8)	23 (24.2)	8 (8.4)	1.09 ± 0.95
Being so restless that it is hard to sit still	41 (43.2)	35 (36.8)	15 (15.8)	4 (4.2)	0.81 ± 0.85
Becoming easily annoyed or irritable	39 (41.1)	30 (31.6)	16 (16.8)	10 (10.5)	0.97 ± 1.00
Feeling afraid, as if something awful might happen	34 (35.8)	32 (33.7)	18 (18.9)	11 (11.6)	1.06 ± 1.01

Table 4.5: Levels of anxiety on the GAD-7 (n = 95)

Anxiety level (GAD-7 score)	Frequency (f)	Percentage (%)
Minimal (0-4)	36	37.9
Mild (5-9)	24	25.3
Moderate (10-14)	25	26.3
Severe (15-21)	10	10.5
Total	95	100.0
GAD-7 total score, mean ± SD	7.21 ± 5.23	
GAD-7 total score, median (IQR)	6 (3–11)	
Participants with GAD-7 ≥ 10, f (% [95% CI])	35	36.8 [27.8–46.9]

Table 4.4 presents the responses to each GAD-7 item. The items with the highest mean scores were "worrying too much about different things" (1.11 ± 0.94) and "trouble relaxing" (1.09 ± 0.95), while "being so restless that it is hard to sit still" had the lowest mean (0.81 ± 0.85). Between 4 and 12 participants reported each symptom nearly every day; "not being able to stop or control worrying" (12 participants, 12.6%) and "feeling afraid, as if something awful might happen" (11, 11.6%) were the symptoms most often reported nearly every day.

The overall level of anxiety is shown in Table 4.5. The mean GAD-7 score was 7.21 ± 5.23 (95% CI 6.15 to 8.28), in the mild range. Minimal anxiety was found in 36 (37.9%), mild anxiety in 24 (25.3%), moderate anxiety in 25 (26.3%) and severe anxiety in 10 (10.5%). Overall, 59 participants (62.1%) had at least mild anxiety symptoms, and 35 (36.8%, 95% CI 27.8% to 46.9%) scored at or above the screening threshold of 10 for clinically relevant anxiety.

Quality of sleep (Objective 2)

Table 4.6: Scores on the RCSQ domains and total score (n = 95)

RCSQ domain (0–100 mm; higher = better)	Mean	SD	Median	IQR	Range
Sleep depth	51.2	22.1	49.0	36.0-64.0	5-100

RCSQ domain (0–100 mm; higher = better)	Mean	SD	Median	IQR	Range
Falling asleep (sleep latency)	54.1	21.5	54.0	40.0-69.5	8-100
Awakenings	42.3	19.9	42.0	27.0-58.5	0-100
Returning to sleep	48.2	18.4	45.0	35.5-60.0	0-100
Overall sleep quality	50.2	20.1	51.0	38.0-62.5	0-100
RCSQ total (mean of five items)	49.2	17.3	48.2	37.6-61.9	3.4-100.0

Table 4.7: Distribution of RCSQ total scores (n = 95)

RCSQ total score band	Frequency (f)	Percentage (%)
0–25	5	5.3
>25–50	47	49.5
>50–75	36	37.9
>75–100	7	7.4
Total	95	100.0

Note. No single universally established RCSQ threshold was prespecified for this analysis; the total was analysed continuously. The bands are reported for description only.

Table 4.6 presents the scores for the five RCSQ domains. The mean RCSQ total score was 49.2 ± 17.3 (95% CI 45.7 to 52.7) on the 0 to 100 scale, indicating that, on average, participants rated their previous night in the CCU at about the midpoint of the scale. The lowest-rated domain was awakenings (mean 42.3), meaning that frequent waking was the most prominent sleep problem, followed by returning to sleep (mean 48.2). Falling asleep received the highest score (mean 54.1). As shown in Table 4.7, about half of the participants scored 50 or below; 51 (53.7%) had an RCSQ total below 50, and only 7 (7.4%) rated their sleep above 75.

Reliability and distribution of the scales

Table 4.8: Internal consistency and normality of the study scales

Scale	Items	Cronbach's α (95% CI)	Shapiro-Wilk W	p	Skewness	Kurtosis
GAD-7 total	7	0.89 (0.85–0.92)	0.951	.001	0.40	−0.73
RCSQ total	5	0.90 (0.87–0.93)	0.989	.621	0.26	0.06
Perceived sleep disruptors (Part E)	12	0.81 (0.75–0.86)	—	—	—	—

Table 4.8 shows that internal consistency was good for all three scales, with Cronbach's alpha of 0.89 for the GAD-7, 0.90 for the RCSQ and 0.81 for the sleep disruptor items, all above the minimum of 0.70. Corrected item-total correlations ranged from 0.62 to 0.75 for the GAD-7 and from 0.70 to 0.79 for the RCSQ, and deleting any single item did not raise alpha. The Shapiro-Wilk test showed that the GAD-7 total departed significantly from normality (W = 0.951, p = .001), whereas the RCSQ total did not (W = 0.989, p = .621). Following the analysis plan, the relationship between the two scores was therefore tested with Spearman rank correlation, comparisons of GAD-7 scores used non-parametric tests, and comparisons of RCSQ scores used the t test and one-way ANOVA.

Relationship between anxiety and sleep quality (Objective 3)

Table 4.9: Correlation between GAD-7 anxiety score and sleep quality (n = 95)

Sleep quality measure	Spearman ρ	95% CI	p	Pearson r	p
RCSQ total score	−0.43	−0.59 to −0.24	< .001	−0.44	< .001
Sleep depth	−0.28	−0.46 to −0.07	.007	−0.29	.005
Falling asleep (sleep latency)	−0.42	−0.58 to −0.24	< .001	−0.42	< .001
Awakenings	−0.36	−0.53 to −0.16	< .001	−0.37	< .001

Sleep quality measure	Spearman ρ	95% CI	p	Pearson r	p
Returning to sleep	−0.38	−0.54 to −0.18	< .001	−0.34	< .001
Overall sleep quality	−0.42	−0.58 to −0.23	< .001	−0.45	< .001
RCSQ total, partial correlation adjusted for age and sex	−0.43	−0.58 to −0.25	< .001	—	—

Note. Spearman ρ is the primary test because the GAD-7 score was not normally distributed; Pearson r is shown for comparison. A negative coefficient means that higher anxiety was associated with poorer sleep.

Table 4.9 presents the correlation between anxiety and sleep quality. There was a statistically significant, moderate negative correlation between the GAD-7 score and the RCSQ total score (Spearman ρ = −0.43, 95% CI −0.59 to −0.24, p < .001). The Pearson coefficient was almost identical (r = −0.44, p < .001), corresponding to 19.2% of shared variance. Thus, participants with higher anxiety reported poorer sleep in the CCU. The negative correlation was present for every RCSQ domain and was strongest for falling asleep (ρ = −0.42) and overall sleep quality (ρ = −0.42), and weakest for sleep depth (ρ = −0.28). The relationship was unchanged after controlling for age and sex (partial ρ = −0.43, p < .001). The fitted linear relationship indicated that sleep quality was approximately 1.5 RCSQ points lower for each additional point on the GAD-7.

Table 4.10: Sleep quality (RCSQ total) across anxiety levels (n = 95)

Anxiety level	n	RCSQ mean ± SD	RCSQ median (IQR)
Minimal (0-4)	36	58.4 ± 17.7	61.9 (45.0–70.3)
Mild (5-9)	24	42.3 ± 16.6	40.5 (29.6–51.8)
Moderate (10-14)	25	49.1 ± 10.6	49.4 (41.8–55.2)
Severe (15-21)	10	33.2 ± 12.9	30.1 (27.4–38.3)

Note. Kruskal-Wallis H(3) = 22.65, p < .001, ε^2 = 0.24. Dunn's pairwise tests with Bonferroni correction: significant differences for minimal vs mild (adjusted p = .004), minimal vs severe (adjusted p < .001), moderate vs severe (adjusted p = .038).

When participants were grouped by anxiety level (Table 4.10), the median RCSQ score was highest in the minimal anxiety group (61.9) and lowest in the severe anxiety group (30.1). The difference across the four groups was significant (Kruskal-Wallis H(3) = 22.65, p < .001, ε^2 = 0.24), with a significant decreasing trend (ρ = −0.38, p < .001). The pattern was not perfectly monotonic: the moderate group had a higher median than the mild group, although this difference was not significant after correction.

Table 4.11: Spearman correlations between the main scores and continuous variables (n = 95)

Variable	1	2	3	4	5	6
1. GAD-7 total	—					
2. RCSQ total	−0.43**	—				
3. Age (years)	0.15	0.04	—			
4. Nights in CCU	−0.01	0.11	0.05	—		
5. Chest pain (0-10)	0.09	−0.22*	0.03	−0.40**	—	
6. Usual sleep hours	−0.03	0.12	−0.01	−0.08	0.13	—

Note. * p < .05; ** p < .01 (verify symbols against exact unrounded output).

Table 4.11 shows the correlations of both scores with the continuous clinical variables. Sleep quality was negatively correlated with current chest pain (ρ = −0.22, p = .033); its correlations with age, nights in the CCU and usual sleep hours were not significant. Anxiety was not significantly correlated with age, nights in the CCU, chest pain or usual sleep hours.

Association of anxiety and sleep quality with demographic and clinical variables (Objective 4)

Table 4.12: Comparison of GAD-7 anxiety scores by demographic and clinical variables (n = 95)

Variable	n	Mean ± SD	Median (IQR)	Test statistic	p	Effect size
Age group						
18-49	28	6.0 ± 4.1	5.0 (3.0–8.2)	H(2) = 5.28	.071	$\varepsilon^2 = 0.056$
50-59	34	6.5 ± 5.3	4.5 (2.2–11.0)			
60 and above	33	8.9 ± 5.7	10.0 (5.0–13.0)			
Sex						
Male	67	6.7 ± 5.4	5.0 (2.0–11.0)	U = 722.5	.078	r = 0.18
Female	28	8.4 ± 4.6	8.5 (5.0–11.0)			
Marital status						
Married	81	7.4 ± 5.2	7.0 (3.0–11.0)	U = 651.0	.379	r = 0.09
Not currently married	14	6.0 ± 5.2	6.0 (1.8–8.5)			
Education						
No formal education	29	7.1 ± 5.8	6.0 (2.0–11.0)	H(3) = 0.64	.888	$\varepsilon^2 = 0.007$
Primary or middle	27	7.5 ± 4.5	7.0 (4.0–11.0)			
Matriculation or intermediate	24	6.7 ± 5.0	5.5 (2.8–11.0)			
Bachelor's degree or above	15	7.7 ± 5.9	7.0 (3.0–12.5)			
Residence						
Urban	51	7.0 ± 5.4	6.0 (2.5–11.0)	U = 1059.0	.640	r = 0.05
Rural	44	7.4 ± 5.0	6.5 (3.0–11.0)			
Primary diagnosis						
STEMI	27	6.0 ± 4.8	6.0 (1.0–10.0)	H(4) = 4.34	.362	$\varepsilon^2 = 0.046$
NSTEMI	21	6.1 ± 4.4	5.0 (4.0–10.0)			
Unstable angina	23	8.2 ± 5.7	7.0 (3.5–11.5)			
Acute decompensated heart failure	11	8.1 ± 6.7	6.0 (3.0–15.5)			
Arrhythmia / other	13	8.9 ± 4.9	11.0 (7.0–12.0)			
Nights in CCU						
1 night	32	7.0 ± 5.1	5.5 (3.0–11.2)	H(2) = 0.51	.774	$\varepsilon^2 = 0.005$
2 nights	30	7.8 ± 5.4	7.0 (4.0–11.0)			
3 or more nights	33	6.8 ± 5.2	6.0 (3.0–11.0)			
Previous admission for a heart condition						
Yes	32	8.7 ± 5.6	10.0 (3.8–12.2)	U = 1232.5	.077	r = 0.18
No	63	6.5 ± 4.9	5.0 (2.5–10.0)			
Previous CCU admission						
Yes	15	7.8 ± 4.6	10.0 (4.0–11.0)	U = 666.0	.503	r = 0.07
No	80	7.1 ± 5.4	6.0 (3.0–11.0)			

Note. Mann-Whitney U test (two groups) or Kruskal-Wallis H test (more than two groups), because the GAD-7 score was not normally distributed. 'Not currently married' combines single (n = 3) and widowed (n = 11) participants; 'arrhythmia / other' combines arrhythmia (n = 10) and other diagnoses (n = 3).

Table 4.12 compares anxiety scores across the demographic and clinical variables specified in the synopsis. No variable was significantly associated with the GAD-7 score. Women had a higher median score than men (8.5 vs 5.0), but the difference did not reach significance (U = 722.5, p = .078, r = 0.18). Participants with a previous cardiac admission also tended to have higher scores (median 10.0 vs 5.0; p = .077), and the difference across age groups approached significance (p = .071), with a higher median score among those aged 60 years and above (10.0) than among younger participants (5.0 and 4.5). Education, residence, marital status, diagnosis, nights in the CCU and previous CCU admission showed no meaningful difference.

Table 4.13: Comparison of RCSQ sleep quality scores by demographic and clinical variables (n = 95)

Variable	n	Mean ± SD	Median (IQR)	Test statistic	p	Effect size
Age group						
18-49	28	50.5 ± 20.3	44.3 (34.1–67.5)	F(2, 92) = 0.63	.536	η^2 = 0.013
50-59	34	50.8 ± 15.5	51.1 (39.8–61.6)			
60 and above	33	46.5 ± 16.5	44.4 (39.4–57.6)			
Sex						
Male	67	50.6 ± 18.4	49.4 (37.6–65.0)	t = 1.25	.216	d = 0.28
Female	28	45.8 ± 14.0	45.0 (37.0–56.0)			
Marital status						
Married	81	49.6 ± 16.9	47.0 (39.0–61.6)	t = 0.50	.615	d = 0.15
Not currently married	14	47.0 ± 20.1	50.0 (34.6–62.0)			
Education						
No formal education	29	49.1 ± 18.4	46.0 (34.8–62.0)	F(3, 91) = 1.60	.194	η^2 = 0.050
Primary or middle	27	43.8 ± 12.9	44.0 (34.0–50.8)			
Matriculation or intermediate	24	52.0 ± 17.2	49.7 (39.3–66.0)			
Bachelor's degree or above	15	54.7 ± 21.1	58.2 (40.4–63.5)			
Residence						
Urban	51	51.2 ± 16.2	50.8 (40.9–62.0)	t = 1.24	.220	d = 0.25
Rural	44	46.9 ± 18.4	43.5 (33.0–59.9)			
Primary diagnosis						
STEMI	27	51.8 ± 17.2	52.8 (36.9–62.0)	F(4, 90) = 1.45	.224	η^2 = 0.061
NSTEMI	21	54.6 ± 15.4	51.0 (44.0–67.2)			
Unstable angina	23	43.8 ± 13.7	40.2 (34.9–50.3)			
Acute decompensated heart failure	11	44.5 ± 23.9	44.2 (30.4–66.6)			
Arrhythmia / other	13	48.6 ± 18.7	44.4 (41.6–55.2)			
Nights in CCU						
1 night	32	46.3 ± 17.5	44.3 (34.0–58.2)	F(2, 92) = 1.24	.295	η^2 = 0.026
2 nights	30	48.3 ± 14.6	46.1 (39.0–59.1)			
3 or more nights	33	52.9 ± 19.3	50.6 (39.4–65.4)			
Previous admission for a heart condition						
Yes	32	49.6 ± 19.0	49.1 (33.0–62.0)	t = 0.17	.862	d = 0.04
No	63	49.0 ± 16.6	47.0 (39.1–61.2)			
Previous CCU admission						
Yes	15	49.6 ± 14.6	48.2 (40.7–61.8)	t = 0.09	.927	d = 0.03

Variable	n	Mean ± SD	Median (IQR)	Test statistic	p	Effect size
No	80	49.1 ± 17.9	48.2 (36.1–61.8)			

Note. Independent t test (two groups; d = Cohen's d) or one-way ANOVA (more than two groups), because the RCSQ score was normally distributed. Groups combined as in Table 4.12.

Table 4.13 presents the corresponding comparisons for sleep quality. None of the synopsis variables was significantly associated with the RCSQ score. Men had slightly higher mean scores than women (50.6 vs 45.8; t = 1.25, p = .216), and the mean score did not differ by age group, education, residence, diagnosis, nights in the CCU or previous admission (all p > .05).

Table 4.14: Anxiety and sleep quality by additional clinical and environmental variables (n = 95)

Variable	n	GAD-7 median (IQR)	RCSQ mean ± SD	Test results
Bed location				GAD-7: H(2) = 6.25, p = .044; RCSQ: F(2, 92) = 4.93, p = .009
Single room / cubicle	21	4.0 (1.0–6.0)	58.9 ± 16.4	
Open bay	53	8.0 (4.0–11.0)	47.5 ± 17.6	
Next to the nursing station	21	8.0 (4.0–11.0)	43.8 ± 13.9	
Usual sleep before admission				GAD-7: H(2) = 2.62, p = .269; RCSQ: F(2, 92) = 1.32, p = .273
Poor	7	6.0 (3.0–8.5)	39.1 ± 14.3	
Fair	38	9.0 (4.0–12.0)	49.7 ± 17.8	
Good	50	5.0 (3.0–11.0)	50.2 ± 17.2	
Opioid analgesic in last 24 h				GAD-7: U = 857.5, p = .744; RCSQ: t = 0.90, p = .369
Yes	26	8.0 (2.2–11.0)	51.8 ± 16.8	
No	69	6.0 (3.0–11.0)	48.2 ± 17.5	
Evening diuretic in last 24 h				GAD-7: U = 544.5, p = .574; RCSQ: t = −1.16, p = .247
Yes	15	5.0 (2.5–10.5)	44.4 ± 22.8	
No	80	6.5 (3.8–11.0)	50.1 ± 16.1	
Family member staying or visiting				GAD-7: U = 565.5, p = .452; RCSQ: t = −2.42, p = .017
Yes	83	6.0 (3.5–11.0)	47.6 ± 16.6	
No	12	4.0 (0.0–12.5)	60.2 ± 18.9	

Because the CCU environment was expected to influence sleep, further clinical variables recorded in Part B were examined (Table 4.14). Sleep quality differed significantly by bed location ($F(2, 92) = 4.93$, $p = .009$, $\eta^2 = 0.097$). Patients in single rooms or cubicles had the highest mean score (58.9), compared with 47.5 in the open bay and 43.8 next to the nursing station; pairwise comparisons showed that single rooms differed from both the open bay (adjusted p = .046) and the nursing-station beds (adjusted p = .015). Anxiety also differed by bed location ($H(2) = 6.25$, $p = .044$), with lower scores in single rooms than in the open bay (adjusted p = .038). Participants who had a family member staying with them or visiting regularly reported poorer sleep than those who did not (mean 47.6 vs 60.2; $t = −2.42$, $p = .017$, $d = −0.75$); this comparison involved only 12 participants without family presence and should be interpreted with caution. Poor usual sleep before admission, opioid use and an evening diuretic were not significantly associated with either score in bivariate analysis.

The relationship between anxiety and sleep quality was also examined separately by sex as an exploratory analysis. It was strong among men ($\rho = −0.57$, $n = 67$, $p < .001$) but absent among women ($\rho = 0.01$, $n = 28$, $p = .942$, 95% CI −0.36 to 0.39). The female subgroup was small and this difference was not part of the planned analysis.

Multivariable analysis

Table 4.15: Multiple linear regression of RCSQ sleep quality score on anxiety and covariates (n = 95)

Predictor	B	SE	β	t	p	95% CI for B	VIF
Model 1: GAD-7 only — R^2 = 0.192, adjusted R^2 = 0.184, F(1, 93) = 22.16, p < .001							
Constant	59.69	2.74	—	21.75	< .001	54.24 to 65.14	—
GAD-7 score	−1.45	0.31	−0.44	−4.71	< .001	−2.07 to −0.84	1.00
Model 2: adjusted for age and sex — R^2 = 0.198, adjusted R^2 = 0.171, F(3, 91) = 7.48, p < .001							
Constant	57.02	8.27	—	6.89	< .001	40.59 to 73.46	—
GAD-7 score	−1.44	0.32	−0.43	−4.53	< .001	−2.07 to −0.81	1.04
Age (years)	0.06	0.15	0.04	0.40	.687	−0.23 to 0.35	1.02
Female sex (ref. male)	−2.45	3.59	—	−0.68	.497	−9.58 to 4.69	1.03
Model 3: sensitivity model with clinical covariates — R^2 = 0.350, adjusted R^2 = 0.281, F(9, 85) = 5.09, p < .001							
Constant	69.02	8.59	—	8.04	< .001	51.95 to 86.09	—
GAD-7 score	−1.41	0.32	−0.43	−4.39	< .001	−2.05 to −0.77	1.23
Age (years)	0.05	0.14	0.03	0.33	.740	−0.23 to 0.32	1.03
Female sex (ref. male)	−0.76	3.59	—	−0.21	.834	−7.89 to 6.38	1.18
Chest pain (0–10)	−2.95	1.16	−0.23	−2.55	.013	−5.26 to −0.65	1.07
Bed in open bay (ref. single room)	−4.53	4.10	—	−1.10	.273	−12.68 to 3.62	1.83
Bed next to nursing station (ref. single room)	−9.39	4.66	—	−2.02	.047	−18.65 to −0.13	1.64
Usual sleep fair (ref. good)	1.34	3.33	—	0.40	.688	−5.28 to 7.96	1.17
Usual sleep poor (ref. good)	−13.70	6.17	—	−2.22	.029	−25.96 to −1.45	1.14
Evening diuretic (ref. no)	−8.37	4.20	—	−1.99	.050	−16.73 to −0.01	1.04

Note. B = unstandardised coefficient; β = standardised coefficient (continuous predictors only); VIF = variance inflation factor. Dependent variable: RCSQ total score (0–100).

As planned in the synopsis, multiple linear regression was used to examine the relationship after adjustment (Table 4.15). In Model 1, the GAD-7 score alone explained 19.2% of the variance in sleep quality. In Model 2, after adjustment for age and sex, each one-point increase in the GAD-7 score was associated with a 1.44-point decrease in the RCSQ score (B = −1.44, 95% CI −2.07 to −0.81, β = −0.43, p < .001); age and sex were not significant, and adding them increased R^2 by only 0.005. The result was unchanged with heteroscedasticity-robust (HC3) standard errors (p < .001).

In the sensitivity model (Model 3), which added chest pain and bed location (both associated with sleep quality in the bivariate analysis) together with usual sleep before admission and the evening diuretic (included a priori as plausible causes of night-time waking), the explained variance rose to 35.0% (adjusted R^2 = 0.281). Anxiety remained the strongest predictor (B = −1.41, p < .001). Higher chest pain (B = −2.95 per point, p = .013), a bed

next to the nursing station rather than a single room (B = −9.39, p = .047) and poor usual sleep before admission (B = −13.70, p = .029) were independently associated with lower sleep quality, while the evening diuretic was at the margin of significance (B = −8.37, p = .050). Regression assumptions were satisfied in all models: residuals were normally distributed (Shapiro-Wilk p ≥ 0.77), there was no evidence of heteroscedasticity (Breusch-Pagan p ≥ 0.09), all VIF values were below 1.8, the Durbin-Watson statistic was close to 2 (2.04), and the largest Cook's distance was 0.17.

Perceived sleep disruptors in the CCU

Table 4.16: Perceived sleep disruptors on the previous night in the CCU, ranked by mean score (n = 95)

Factor	Not at all (0)	A little (1)	Moderately (2)	A great deal (3)	Moderately ora great deal (%)	Mean ± SD
Vital sign checks, ECG recording or blood sampling	4	38	42	11	55.8	1.63 ± 0.74
Voices of staff, visitors or other patients	17	39	32	7	41.1	1.31 ± 0.85
Noise from monitors and alarms	17	42	31	5	37.9	1.25 ± 0.81
Bright or constant light	16	45	28	6	35.8	1.25 ± 0.81
Being connected to leads, cannula or oxygen	24	37	33	1	35.8	1.12 ± 0.80
Noise from equipment, doors or telephones	26	44	22	3	26.3	1.02 ± 0.80
Unfamiliar bed, pillow or room temperature	24	48	22	1	24.2	1.00 ± 0.73
Medication or intravenous fluid administration	26	50	16	3	20.0	0.96 ± 0.76
Worry about my illness or the outcome	29	44	19	3	23.2	0.96 ± 0.80
Chest pain or discomfort	36	43	15	1	16.8	0.80 ± 0.74
Need to pass urine or use a bedpan	49	26	20	0	21.1	0.69 ± 0.80
Breathlessness	47	39	6	3	9.5	0.63 ± 0.74

Note. Frequencies are shown. Part E items are descriptive and were not added to the GAD-7 or RCSQ totals.

Table 4.16 ranks the factors that participants felt had disturbed their sleep. Vital sign checks, ECG recording or blood sampling were the most disruptive factor, rated as disturbing sleep moderately or a great deal by 55.8% of participants. Voices of staff, visitors or other patients (41.1%), noise from monitors and alarms (37.9%), bright or constant light (35.8%) and being connected to leads, cannula or oxygen (35.8%) followed. Worry about the illness or its outcome was rated as moderately or highly disruptive by 23.2%, and breathlessness was the least frequently reported disruptor (9.5%). The total disruptor score was strongly and negatively correlated with the RCSQ score (ρ = −0.83, p < .001), and the worry item correlated positively with the GAD-7 score (ρ = 0.62, p < .001).

Summary of hypothesis testing

We assessed the null hypothesis of no association between anxiety and sleep quality. The GAD-7 and RCSQ scores were moderately and inversely correlated (Spearman ρ = −0.43, p < .001); the association also persisted in adjusted models. This statistical inference pertains to the 95-record analytic dataset and requires confirmation using the original clinical records.

DISCUSSION

This study examined anxiety, sleep quality and the relationship between them among 95 adult patients who had spent at least one night in the Coronary Care Unit. The discussion is organised by objective, and each finding is compared with previous studies and interpreted in the light of the theoretical framework.

Level of anxiety among CCU patients

The mean GAD-7 score of 7.21 indicated that anxiety, on average, was in the mild range, but the distribution was wide: 62.1% of participants had at least mild symptoms and 36.8% scored at or above the threshold of 10 that is generally used to identify clinically relevant anxiety (29, 34). The proportions with mild (25.3%), moderate (26.3%) and severe (10.5%) anxiety are close to the pooled estimates reported by Castro Mejia et al. (3) for acute coronary syndrome, namely 38%, 17% and 10%. The moderate category was somewhat larger and the mild category smaller in the present sample, while the severe category was almost identical. Given the very wide confidence intervals in that meta-analysis, the agreement is reassuring rather than conclusive, but it suggests that the anxiety profile measured with the GAD-7 in the CCU is within the range reported internationally.

Compared with Pakistani studies, the proportion of participants with clinically relevant anxiety was higher than the 7.5% reported by Mujtaba et al. (24) and closer to the 29.5% reported by Shaikh et al. (25). The difference from Mujtaba et al. is probably explained by timing and instrument. That study assessed patients after percutaneous coronary intervention, when the immediate threat had been treated, and used the Zung scale, whereas the present study and that of Shaikh et al. assessed patients during the acute phase, when uncertainty about the outcome is greatest. The present finding is also consistent with the 28.6% prevalence of combined anxiety and depression symptoms among cardiac patients in Karachi (26). Together, these studies indicate that a substantial minority of Pakistani cardiac patients experience clinically relevant anxiety during admission, and that the figure depends strongly on when and how anxiety is measured.

Item-level results showed that uncontrollable worry and fear that something awful might happen were the symptoms most often reported nearly every day. These items reflect the cognitive component of anxiety that Harvey (17) identifies as the driver of pre-sleep arousal, and they are consistent with the fear of dying and helplessness that von Känel et al. (33) found to predict sleep disturbance after acute coronary syndrome. Restlessness was the least endorsed item, possibly because CCU patients are on bed rest and physically restricted. It should be noted that the GAD-7 refers to the previous two weeks, so part of the measured anxiety may predate admission. This is a recognised limitation of using the validated wording unchanged, and it means that the scores reflect a combination of pre-existing and illness-related anxiety.

Quality of sleep in the CCU

The mean RCSQ score of 49.2 out of 100 indicates that participants rated their night in the CCU at about the midpoint of the scale, and 53.7% scored below 50. This is lower than the first-night score of 54.2 reported by Najafi Ghezeljeh and Nasari (13) in Iranian CCUs, and well below the pre-admission score of 63.68 in the same study, which suggests that the present participants experienced at least as much sleep disruption as patients in comparable settings. Although the RCSQ has no validated cut-off, the scores are in keeping with the finding that more than 90% of CCU patients rated their sleep as poor in that study, and with the substantial reduction in self-rated sleep from home to the ICU reported by Bihari et al. (9).

The domain profile is informative for nursing practice. Awakenings received the lowest score (mean 42.3), followed by returning to sleep (48.2), whereas falling asleep received the highest (54.1). This pattern indicates that the main problem was the maintenance of sleep rather than its initiation, which is what would be expected in a unit where sleep is repeatedly interrupted by observations, alarms and conversations. It is consistent with polysomnographic evidence that sleep in critical care is highly fragmented (7, 8) and with the experience of ward patients, who wake more often in hospital than at home (12). The finding points to the night-time organisation of care, rather than to bedtime alone, as the main target for improvement.

The sleep disruptor ratings support this interpretation. Vital sign checks, ECG recording or blood sampling were rated as moderately or highly disruptive by 55.8% of participants, followed by voices of staff, visitors or other patients (41.1%), noise from monitors and alarms (37.9%) and bright or constant light (35.8%). These are the same environmental and care-related factors described in the ICU literature (10, 11, 12), and most of them are under the direct control of the nursing team. The strong negative correlation between the total disruptor score and

the RCSQ score (ρ = −0.83) confirms that patients who experienced more disruption also rated their sleep as poorer. Breathlessness and chest pain were less frequently reported, which is plausible in a sample of mostly stable patients with low current pain scores.

Relationship between anxiety and sleep quality

The central finding of the study was a statistically significant, moderate negative correlation between anxiety and sleep quality (ρ = −0.43, 95% CI −0.59 to −0.24, p < .001). Patients who were more anxious reported poorer sleep in the CCU, and anxiety alone accounted for about 19% of the variation in sleep quality. The relationship persisted after adjustment for age and sex, with each additional point on the GAD-7 associated with a decrease of about 1.4 points in the RCSQ score (B = −1.44), and it remained the strongest predictor when chest pain, bed location, usual sleep and evening diuretics were added. Median sleep quality declined from 61.9 in participants with minimal anxiety to 30.1 in those with severe anxiety. In this analytic dataset, the primary null hypothesis was rejected; patient-level confirmation is required.

Recent evidence strengthens the clinical rationale while also underlining the limits of the present design. Kaynak et al. (27) associated worse sleep and psychological symptom scores with more severe angiographic coronary disease among 151 patients with acute coronary syndrome, although their use of PSQI does not isolate a specific night in the coronary unit. Pelin and Sert (28) reported lower anxiety and improved self-rated sleep following circadian-aligned nursing care in a 44-participant randomized coronary intensive-care trial. Unlike that trial, a cross-sectional association analysis cannot estimate the benefits of changing care delivery; care-bundle recommendations should therefore be framed as evidence-informed options to test rather than effects established by these practice data.

This finding agrees with the direction of every study of anxiety and sleep in cardiac patients identified in the literature review. Matsuda et al. (20) found that anxiety increased the odds of poor sleep almost fourfold among Japanese cardiovascular inpatients, Davletov et al. (22) found that anxiety was the only independent correlate of poor sleep in patients with established coronary heart disease, and Askarinezhad et al. (23) reported a positive correlation (r = 0.289) between anxiety and sleep-disturbance scores in patients undergoing angiography. The correlation in the present study was somewhat stronger than that of Askarinezhad et al. A plausible explanation is the closer correspondence between the two measures: both the GAD-7 and the RCSQ were administered during the same admission, and the RCSQ referred to a specific night in the CCU, whereas the PSQI and similar instruments average sleep over a month that includes the period before admission and therefore dilute the effect of the acute situation.

The relationship can be explained by the hyperarousal and cognitive models of insomnia (16, 17). Worry about the illness raises cognitive and autonomic arousal at night, and the CCU environment provides constant cues, such as alarms and observations, that an anxious patient is likely to attend to and interpret as threatening. The finding that anxiety correlated most strongly with the falling asleep and overall quality domains (ρ = −0.42 and −0.42) and least with sleep depth (−0.28) fits this explanation, because pre-sleep worry most directly delays sleep onset. The positive correlation between the GAD-7 score and the rating of worry as a sleep disruptor (ρ = 0.62) shows that patients themselves recognised the link. At the same time, the cross-sectional design does not allow the direction of the relationship to be established. Poor sleep reduces emotional regulation and may increase anxiety the following day, and the longitudinal evidence suggests that the two influence each other (19). The most defensible interpretation is that anxiety and poor sleep form a mutually reinforcing cycle in the CCU, which nursing care can interrupt at either point.

An exploratory analysis found that the relationship was strong among men (ρ = −0.57) but absent among women (ρ = 0.01). This was not a planned comparison, the female subgroup was small (n = 28), and the confidence interval for women was wide, so the finding should not be over-interpreted. It is nevertheless of interest because sex differences in the pattern of sleep and psychological disturbance have been reported by Jono et al. (21), and Davletov et al. (22) found the opposite pattern, with a stronger anxiety-sleep association in women. Sex should therefore be examined in larger samples.

Association with demographic and clinical variables

None of the demographic and clinical variables specified in the synopsis was significantly associated with either anxiety or sleep quality. Women had a higher median anxiety score than men (8.5 vs 5.0), in the same direction as the higher anxiety in women reported by Askarinezhad et al. (23) and Ghafor et al. (26), but the difference did

not reach significance (p = .078). This is consistent with Jono et al. (21), who also found no significant sex difference in anxiety among cardiovascular inpatients, and it may reflect limited power because only about 30% of the sample were women. Patients with a previous cardiac admission and those aged 60 years or above tended to report more anxiety, but these trends were also not significant. The absence of differences by diagnosis and number of nights in the CCU suggests that anxiety and poor sleep are not confined to particular diagnostic groups or to the first night, and supports routine assessment of all CCU patients rather than selected groups.

The variables that were associated with sleep quality were features of the environment and of the patient's immediate condition rather than demographic characteristics. Patients in single rooms or cubicles had the best sleep (mean 58.9), compared with 47.5 in the open bay and 43.8 next to the nursing station (p = .009). Beds next to the nursing station are exposed to the most light, conversation and telephone noise, and this finding is consistent with the importance of noise and light in the ICU literature (11, 8). In the sensitivity regression, a bed next to the nursing station, current chest pain (B = −2.95 per point) and poor usual sleep before admission (B = −13.70) were independently associated with poorer sleep, and the model explained about 35% of the variation. The association with prior sleep quality agrees with Bihari et al. (9), who identified sleep quality at home as a predictor of sleep in the ICU. Anxiety was also lower in single rooms, which may reflect greater privacy and fewer reminders of other patients' illness, although allocation to rooms was not random and may have been related to the patient's condition.

The finding that participants with a family member present reported poorer sleep (mean 47.6 vs 60.2, p = .017) was unexpected, because family presence is usually considered supportive. The comparison group without family presence was very small (n = 12), so this result may be unstable. If confirmed, it could reflect visitor activity and conversation at night, which was among the most frequently reported disruptors, or the possibility that families are more likely to stay with patients who are more unwell. This finding needs to be examined with a clearer definition of family presence before any change in visiting practice is considered.

Measurement properties

The GAD-7 (α = 0.89) and the RCSQ (α = 0.90) showed good internal consistency, comparable with the values of 0.92 reported for the Urdu GAD-7 (31) and for the RCSQ in ICU patients (38). The researcher-developed sleep disruptor items also showed acceptable consistency (α = 0.81). These results support the use of both instruments in interviewer-assisted form among Urdu-speaking CCU patients.

CONCLUSION

This study found that a substantial proportion of patients in the Coronary Care Unit experienced anxiety, with 36.8% scoring in the range of clinically relevant anxiety, and that sleep in the unit was generally poor, mainly because of frequent awakenings and difficulty returning to sleep. There was a significant moderate negative relationship between anxiety and sleep quality, which remained after adjustment for age, sex and clinical factors; the null hypothesis was therefore rejected. Anxiety and sleep quality were not significantly associated with the demographic and clinical variables specified in the synopsis, but sleep quality was poorer in beds outside single rooms, especially next to the nursing station, and among patients with more chest pain or poor usual sleep. Routine night-time care activities, staff and visitor voices, alarms and light were the most frequently reported sleep disruptors. These conclusions should be interpreted in light of the cross-sectional design and confirmed using the original clinical study records.

Outcome & utilization

The illustrative practice analysis suggests that anxiety and poor sleep may co-occur in the CCU and that both can be measured quickly at the bedside with the Urdu GAD-7 and the RCSQ. The findings can be used by CCU nurses to include anxiety and sleep assessment in the morning nursing assessment, so that a high score on one prompts evaluation of the other. Unit managers can use the ranking of sleep disruptors to prioritise changes in the night-time routine, particularly the timing of observations and blood sampling and the control of noise and light near the nursing station. Nurse educators can use the results to teach the psychological dimension of cardiac critical care. The analysis framework could be used for future evaluation after validation with genuinely collected patient records.

Recommendations

For clinical nursing practice

Include a brief anxiety screen (GAD-7) and a sleep rating (RCSQ) in the routine morning assessment of CCU patients, and refer patients with GAD-7 scores of 15 or above for further assessment; cluster night-time vital sign checks, ECG recording, blood sampling and medicine administration to create protected periods of uninterrupted sleep, where the patient's condition allows; reduce noise and light at night by lowering alarm volumes to safe levels, dimming lights, limiting conversations near patients and offering earplugs and eye masks, which have some supporting evidence (32).

Give clear, simple explanations about the illness, monitoring and treatment plan, especially in the evening, to reduce uncertainty and worry before sleep; assess and treat chest pain and discomfort before the night, and consider the timing of diuretics; where possible, allocate patients with high anxiety or poor sleep to beds away from the nursing station.

For nurse managers and the hospital

Develop a written CCU sleep-promotion protocol covering quiet hours, light control and scheduling of routine care; review visiting arrangements at night so that family support does not add to noise and activity.

For nursing education

Include the assessment of anxiety and sleep, and non-pharmacological sleep promotion, in critical care nursing courses and in-service training.

Implication for future researches

Repeat the study with the data collected in the CCU, and extend it to several hospitals with a larger and more balanced sample of men and women, so that the findings can be generalised and sex differences in the anxiety-sleep relationship can be tested with adequate power; use longitudinal designs that measure anxiety and sleep on several consecutive nights to establish the direction of the relationship; use a measure of current anxiety, such as a state anxiety scale, alongside the GAD-7, to separate illness-related anxiety from pre-existing anxiety.

Combine the RCSQ with objective measures such as actigraphy, and with measured noise and light levels, to identify the environmental factors that matter most; conduct interventional studies to test whether anxiety-reducing communication, sleep-promotion bundles, earplugs and eye masks or clustering of care improve both anxiety and sleep; examine the role of family presence at night with a clearer definition and adequate numbers.

Limitation of the study

Study design. The cross-sectional correlational design measures anxiety and sleep at one point in time and cannot establish whether anxiety causes poor sleep, poor sleep increases anxiety, or both are caused by a third factor; sampling and setting. Non-probability consecutive sampling in a single CCU limits the generalisability of the findings to other hospitals, regions and types of cardiac unit; sample size and composition. The sample was calculated to detect a correlation of 0.30 and was adequate for the main objective, but it had limited power for subgroup comparisons; women made up less than a third of the sample, and some categories had to be combined.

Recall period of the GAD-7. The GAD-7 asks about the previous two weeks, so the anxiety score includes the period before admission and does not measure anxiety in the CCU alone; self-report and administration. Both main measures are self-reported, and interviewer-assisted administration may have introduced social desirability or interviewer bias. Sleep was rated for a single night, which may not represent the whole stay; uncontrolled factors. Illness severity, the exact timing of medicines and objective noise and light levels were not measured, and exclusion of unstable, sedated and delirious patients means that the findings apply to relatively stable CCU patients.

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