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Exploring Sleep Quality and Pain Experiences Among Patients with Fractures

Qualitative Study Through the Lens of Roy's Adaptation Model

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Abstract

Fractures can impair physical function, mobility, comfort, independence, and sleep, while pain and hospitalization-related factors may influence patients' adaptation during recovery. This study aimed to explore sleep quality and pain experiences among hospitalized fracture patients and analyze their adaptive responses using Roy's Adaptation Model (RAM). A qualitative descriptive design was conducted with 10 fracture patients hospitalized in the RSUD Dr. Soehadi Prijonegoro Sragen. Participants were selected through purposive sampling based on predetermined criteria, and data were collected using in-depth semi-structured interviews and analyzed thematically, followed by mapping the findings onto RAM's four adaptive modes. Seven interconnected themes emerged: disrupted sleep during hospitalization; pain as a barrier to sleep and mobility; psychological responses to illness and uncertainty; reduced functional independence; family as a source of safety and support; nursing care and the need for comfort-oriented support; and hope for recovery and restoration of normal life. Participants adapted through repositioning, relaxation, limiting painful movements, seeking assistance, communicating with family, and utilizing nursing support. These experiences reflected adaptation across the physiological-physical, self-concept/group identity, role function, and interdependence modes. The findings indicate that pain and sleep disturbances are interconnected and influenced by physical, environmental, psychological, functional, and interpersonal factors. An adaptation-oriented nursing approach integrating pain management, sleep promotion, comfort, functional support, psychological reassurance, and family involvement is important to facilitate patients' recovery and restoration of daily activities.

Keywords: *Fracture Patient, Pain, Qualitative Study, Roy's Adaptation Model, Sleep Quality*

Introduction

Fracture is a musculoskeletal issue that can alter an individual's physical function, mobility, comfort, independence, and ability to perform daily activities [1]. The consequences include bone damage, potentially leading to limited mobility, temporary dependency, changes in roles, and the need for adaptation during the recovery period [2], [3]. During hospitalization, patients must also adjust to pain, restricted body positioning, medical procedures, the ward environment, and changes in routine. Therefore, the experience of fracture patients should be understood as a nursing phenomenon encompassing both physical and psychosocial aspects [4], [5].

Pain is a primary experience for fracture patients and often intensifies with movement or changes in body position; this can prompt patients to limit movement to avoid pain, while simultaneously compromising comfort and sleep [6], [7]. Sleep during hospitalization is influenced by

various patient-related, care-related, and environmental factors; systematic reviews and meta-analyses indicate that sleep quality among hospitalized patients is often poor. Pain and anxiety are significant internal factors, while noise is one of the environmental factors most consistently associated with sleep disruption [8], [9]. Among orthopedic patients, qualitative research further shows that the sleep environment, individual preferences, orthopedic care, and noise shape the sleep experience during hospitalization [10].

The relationship between sleep and pain is dynamic and not always unidirectional; sleep disturbances can heighten the experience of pain, while pain can disrupt sleep continuity [11]. Recent longitudinal meta-analyses demonstrate a bidirectional relationship between sleep problems and musculoskeletal pain [12]. However, the patient experience is not solely determined by pain intensity; patients may experience sleep disturbances primarily due to factors such as temperature, noise, or thoughts regarding family and work. Such variations indicate that sleep quality in fracture patients is shaped by the interaction of various stimuli during hospitalization [12], [13].

In this context, the Roy Adaptation Model (RAM) provides a conceptual framework for understanding the human being as an adaptive system in constant interaction with the environment [14], [15], [16]. Stimuli are classified as focal, contextual, or residual; they are processed through regulator and cognator coping mechanisms, resulting in responses across four adaptive modes: physiological-physical, self-concept/group identity, role function, and interdependence [14], [15], [16], [17], [18]. This framework allows pain and sleep disturbances to be understood not merely as physiological responses, but as experiences that can influence self-perception, role performance, and interpersonal needs and support [15], [17].

Research utilizing the Roy Adaptation Model (RAM) in qualitative studies has demonstrated that the experience of pain extends beyond the physiological mode; Dağcan, Özden, and Gürol Arslan found that post-cardiac surgery patients exhibited pain responses across the physiological, self-concept, role function, and interdependence modes, suggesting that the RAM facilitates a holistic interpretation of the pain experience [19]. Among patients with intertrochanteric femur fractures, RAM-based nursing approaches have also been linked to preoperative phases, postoperative functional recovery, soft-tissue pain, and quality of life, although these studies employed retrospective designs rather than qualitative exploration [20], [21].

Nevertheless, qualitative research exploring how fracture patients perceive the relationship between pain and sleep quality—and how these experiences shape adaptive responses within the four Roy modes—remains limited. While quantitative studies can characterize pain levels or sleep quality, and RAM-based intervention studies assess clinical outcomes, neither has fully elucidated the variations in patients' subjective experiences during hospitalization. This study offers a novel perspective by exploring sleep quality and pain experiences among fracture patients as a biopsychosocial adaptation process grounded in the Roy Adaptation Model (RAM); it maps focal, contextual, and residual stimuli, coping mechanisms, and responses across the physiological-physical, self-concept/group identity, role function, and interdependence modes.

This study was conducted in the Dr. Soehadi Prijonegoro Hospital (RSUD) in Sragen to gain insight into patients' experiences regarding care and comfort. The research aims to explain why patients with varying pain conditions who have undergone fracture exhibit different sleep quality and adaptation strategies, and how factors such as the environment, mindset, role limitations, and family support interact with physical stimuli. The study aims to provide an in-depth description of fracture patients' experiences regarding sleep quality and pain during hospitalization and to analyze their adaptive responses based on the Roy Adaptation Model.

Material and Methods

This study employed a qualitative descriptive design to explore patients' experiences of sleep quality and pain following fractures during hospitalization. A qualitative approach was selected to obtain an in-depth understanding of participants' experiences, perceptions, and adaptive responses to pain and sleep disturbances within the hospitalization, which were subsequently interpreted using Roy's Adaptation Model as the theoretical framework. The study was conducted in Bangsal Mawar, a medical-surgical ward at RSUD Dr. Soehadi Prijonegoro Sragen, between May and June 2026. The reporting of the study followed principles of transparent qualitative research reporting and relevant elements of the Consolidated Criteria for Reporting Qualitative Research (COREQ) for interview-based studies [22].

Participants were recruited using purposive sampling. The inclusion criteria were: (1) medically diagnosed with a fracture; (2) experiencing pain and/or changes in sleep patterns during hospitalization; (3) experiencing mobility limitations or requiring assistance from others; (4) able to communicate verbally and describe their experiences; (5) conscious and able to participate in the interview; (6) accompanied by a family member or caregiver during hospitalization; and (7) willing to participate. Patients were excluded if they had severe communication difficulties, decreased consciousness, severe cognitive impairment, or an unstable clinical condition that prevented participation in the interview. A total of 10 patients were included and identified using participant codes PXA01–PXA05 and PXB01–PXB05 to maintain confidentiality. The sample size was determined based on the depth and richness of information required to address the research objectives rather than statistical estimation. Data adequacy was considered achieved when the final two interviews did not generate substantially new categories but instead reinforced previously identified categories, indicating saturation at the level of meaning and categories [7].

Data were collected through semi-structured, in-depth interviews conducted in the Mawar Ward, using a guide that covered sleep experiences during hospitalization, sleep quality and continuity, pain and nighttime body repositioning, environmental and medical factors, emotional responses, functional limitations, family support, nursing care, self-management strategies, and expectations regarding recovery and discharge. The interviews were conducted by a researcher who was a student in the Professional Nursing Program at Universitas Muhammadiyah Surakarta. Each interview record included the date, time, and an estimated duration of 10–15 minutes. Interviews were documented as question-and-answer transcripts and recorded using an electronic device.

The interviews were documented and subsequently transcribed for analysis. The interview transcripts were analyzed using thematic analysis. The analytical process was conducted systematically through several stages: (1) familiarization with the interview transcripts, (2) identification of relevant meaning units, (3) generation of initial codes, (4) grouping related codes into categories, (5) development of subthemes, and (6) formulation of overarching themes. Following the inductive thematic analysis, the identified themes were mapped onto the four adaptive modes of Roy's Adaptation Model, namely the Physiological-Physical Mode, Self-Concept/Group Identity Mode, Role Function Mode, and Interdependence Mode. This process enabled the researchers to interpret patients' experiences not only in terms of symptoms but also as a multidimensional adaptation process during fracture recovery.

The trustworthiness of the qualitative findings was established through four criteria, Credibility was strengthened through systematic transcript analysis, participant coding, direct quotations, member checking, and peer debriefing to ensure that the interpretations accurately reflected participants' accounts. Dependability was supported by a transparent and consistent analytical sequence from meaning units to codes, categories, subthemes, and themes, documented through an audit trail. Confirmability was enhanced through investigator triangulation and by maintaining a clear link between participants' original accounts and the resulting interpretations, ensuring that the findings remained grounded in the interview data rather than in the researcher's assumptions. Transferability was supported by providing clear descriptions of the research context and participant characteristics, enabling readers to assess the applicability of the findings to similar settings.

This study was conducted with inform consent after participants and their families received information regarding the study's objectives, procedures, confidentiality, and their rights. Participants were informed that they could decline to answer questions or withdraw at any time without affecting their care. All personally identifiable information was anonymized using participant codes PXA01–PXA05 and PXB01–PXB05.

Results and Discussion

A. Participants and Overview of Findings

A qualitative analysis of in-depth interviews with 10 patients with fractures identified seven interconnected themes describing their experiences of sleep quality, pain, functional limitations, psychological responses, family support, nursing care, and expectations for recovery. The participants included individuals with upper- and lower-extremity fractures as well as vertebral fracture. The interviews explored participants' experiences of sleep during hospitalization, pain at night, environmental factors, functional limitations, family involvement, nursing support, and strategies used to manage discomfort. For example, participants with shoulder, leg, and vertebral fractures consistently described differences between sleeping at home and in the hospital, although the specific factors affecting sleep varied across individuals. PXA01 described hospital sleep as different from sleep at home, where sleeping was easier, while PXA04 similarly reported difficulty finding a comfortable sleeping position because of back pain.

Table 1. Patient characteristics

Code	Age (years)	Sex	Education	Type/Location of Fracture	Length of Stay (days)	Primary Management
PXA01	35	M	Senior High School	Open fracture of the right calcaneus with tendon rupture	2	Preoperative; external fixation planned
PXA02	58	M	Senior High School	Closed fracture of the distal third of the right clavicle	2	Conservative management, observation, and analgesic therapy
PXA03	50	M	Bachelor's Degree	Closed fracture of the left tibia and fibula	2	Preoperative; immobilization and analgesic therapy
PXA04	45	M	Primary School	Compression fracture of the twelfth thoracic vertebra (T12)	3	Conservative management, immobilization, and analgesic therapy
PXA05	42	M	Senior High School	Closed fracture of the distal third of the right clavicle	2	Conservative management and immobilization
PXB01	17	F	Senior High School	Closed fracture of the distal third of the left radius and ulna	3	Postoperative; immobilization and analgesic therapy
PXB02	25	F	Senior High School	Closed fracture of the distal third of the left femur	2	Preoperative; planned implant removal/revision
PXB03	20	F	Senior High School	Closed fracture of the distal third of the right femur following plate fixation	2	Preoperative; surgical preparation
PXB04	60	F	Senior High School	Closed fracture of the distal third of the right tibia	3	Postoperative; gradual mobilization and analgesic therapy
PXB05	38	F	Junior High School	Closed fracture of the distal third of the right tibia	3	Conservative management, immobilization, and analgesic therapy

B. Thematic Analysis of Patients' Sleep Quality and Pain Experiences

The thematic analysis of the interview data identified several interconnected themes reflecting patients' experiences of sleep quality and pain during hospitalization following a fracture. The analysis was conducted systematically by transforming the interview transcripts into meaning units, followed by initial coding, categorization, identification of subthemes, and development of overarching themes. The findings indicate that patients' sleep and pain experiences were influenced not only by physical discomfort but also by environmental conditions, psychological concerns, functional limitations, family support, and nursing care. These findings were subsequently interpreted within the framework of Roy's Adaptation Model (RAM) to understand how patients responded and adapted to the physiological, psychological, functional, and interpersonal challenges associated with fracture recovery.

Table 2. Qualitative thematic analysis

Initial Coding	Category	Subtheme	Theme
Poorer hospital sleep quality	Reduced sleep quality	Sleep quality deteriorates during hospitalization	Disrupted Sleep During Hospitalization
Light or fragmented sleep	Fragmented sleep	Light sleep and repeated awakenings	

Initial Coding	Category	Subtheme	Theme
Frequent nocturnal awakenings	Sleep continuity disturbance	Recurrent nocturnal awakening	
Difficulty returning to sleep	Sleep maintenance difficulty	Difficulty resuming sleep after awakening	
Delayed sleep initiation due to pain	Sleep initiation disturbance	Pain delays sleep onset	
Environmental stimuli disrupt sleep	Environmental disturbance	Noise, light, and temperature interfere with sleep	
Night-time procedures minimally disrupt sleep	Tolerance of medical activities	Medical procedures are generally less disruptive than pain/environment	
Movement-related pain	Pain exacerbated by movement	Pain increases during movement and repositioning	
Pain-related sleep disturbance	Pain–sleep interaction	Pain interrupts sleep and prevents restful sleep	
Pain-related awakenings	Pain-induced awakening	Pain causes nocturnal awakening	
Positioning facilitates pain relief	Position-related pain management	Comfortable positioning reduces pain	Pain as a Barrier to Sleep and Mobility
Movement avoidance because of pain	Protective movement restriction	Patients limit movement to prevent worsening pain	
Pain perceived as tolerable	Perceived pain tolerance	Patients tolerate pain without requesting additional analgesia	
Repositioning and relaxation	Self-management strategies	Patients independently regulate discomfort through positioning and relaxation	
Preoccupation with surgery	Illness-related concerns	Concern about treatment and surgery	
Preoccupation with recovery	Recovery-related concerns	Uncertainty about healing and future functioning	
Concern about discharge	Desire to return home	Strong desire for discharge and familiar environment	
Concern about family/home/work/school	Role-related concerns	Hospitalization interrupts usual roles and responsibilities	Psychological Responses to Illness and Uncertainty
Morning fatigue and sleepiness	Consequences of poor sleep	Daytime tiredness following fragmented sleep	
Anxiety about treatment outcome	Emotional response to illness	Anxiety associated with uncertain recovery	
Reduced independence	Functional limitation	Temporary loss of independence in daily activities	
Dependence on family	Need for assistance	Reliance on others for daily activities	
Difficulty with mobility	Physical limitation	Pain and injury restrict movement	
Fear of worsening pain	Fear-related movement restriction	Fear limits patients' willingness to move	Reduced Functional Independence
Seeking assistance during pain	Assistance-seeking behavior	Patients request help when pain or movement becomes difficult	
Family presence provides safety	Family emotional support	Family presence promotes security and calmness	
Family assistance with positioning	Family practical support	Family assists with positioning and physical needs	
Family assistance with activities	Family-based functional support	Family compensates for temporary functional limitations	Family as a Source of Safety and Support
Family companionship	Emotional companionship	Family reduces loneliness, boredom, and worry	
Family communication reduces worry	Reassurance through family	Information and communication with family reduce anxiety	
Nursing support perceived as helpful	Supportive nursing care	Nursing assistance contributes to comfort	
Scheduled medication accepted	Medication-based pain management	Patients perceive scheduled medication as useful	Nursing Care and the Need for Comfort-Oriented Support
Need for pain control	Pain management needs	Patients expect effective nocturnal pain management	

Initial Coding	Category	Subtheme	Theme
Need for safe positioning	Positioning support	Patients expect nurses to assist with safe and comfortable positioning	
Need for environmental improvement	Environmental comfort needs	Patients expect quieter, cooler, and dimmer sleeping environments	
Need for explanation of treatment	Informational support	Explanation of condition and treatment increases reassurance	
Desire for healing	Recovery expectation	Hope for physical recovery	Hope for Recovery and Restoration of Normal Life
Desire for improved sleep	Sleep recovery expectation	Hope for more restful sleep	
Desire for pain reduction	Pain recovery expectation	Hope for reduced pain	
Desire for discharge	Return-home expectation	Hope for early discharge	
Desire to resume work/school/home activities	Restoration of usual roles	Hope to return to normal activities and responsibilities	

Discussion

A. Theme 1: Disrupted Sleep During Hospitalization

Participants generally perceived sleep during hospitalization as different from and less comfortable than sleep at home. Sleep disturbances included light or fragmented sleep, recurrent awakenings, difficulty maintaining sleep, and non-restorative sleep [23]. These experiences were reflected in participants' accounts. PXA01 stated, "At home, I can fall into a deep sleep immediately, but here I can't sleep soundly. I wake up frequently." PXA02 described, "It's more of a shallow sleep. Sometimes I start to drift into a deep sleep, but then my position shifts slightly, and my shoulder hurts, causing me to wake up." Similarly, PXB05 reported, "It's mostly light sleep. I can sleep, but not very soundly because my leg feels uncomfortable and I'm afraid of moving the wrong way." Pain and physical discomfort—particularly involving the shoulder, leg, or back—were frequently reported as factors interfering with comfortable sleep. Environmental conditions, including heat, noise, lighting, and unfamiliar surroundings, also affected sleep comfort [10]. PXB01 stated, "The room conditions have a major impact. It feels hot at night, even with the AC on." PXA05 similarly reported discomfort related to the lighting and surrounding activities.

Routine nighttime nursing activities were generally not perceived as the primary source of sleep disruption. Several participants reported that nighttime examinations and scheduled medication administration were tolerable and that they were able to resume sleeping afterward [10]. PXA03 stated that nighttime examinations were "not too" disruptive and that they could go back to sleep afterward. PXA04 explained, "Nighttime examinations sometimes wake me up, but usually, I'm already uncomfortable. So, it's not the nurse's actions that are the most bothersome; it's mostly my own back pain." Overall, participants' accounts indicated that sleep disruption during hospitalization was primarily associated with pain or physical discomfort and environmental conditions, whereas routine nighttime nursing procedures were generally perceived as less disruptive.

B. Theme 2: Pain as a Barrier to Sleep and Mobility

The findings indicate that pain was closely associated with both sleep disturbance and restricted physical mobility among hospitalized participants. Pain was particularly noticeable during movement, repositioning, and attempts to maintain a comfortable sleeping position, consistent with previous

evidence that pain can interfere with sleep and functional activity among hospitalized patients [24,25]. This relationship was evident in participants with shoulder, back, and lower-extremity fractures, who described increased pain when changing position or moving the affected body part. PXA02, for example, reported, "The pain is in my right shoulder. If I move or sleep in an incorrect position, the pain is worse." Similarly, PXB04 stated, "The pain in my leg seems to come and go. If I move my leg, it's usually worse, so I try not to move too much." These experiences suggest that pain during movement may lead participants to restrict mobility as a protective response, while the resulting difficulty in finding or maintaining a comfortable position may further interfere with sleep. PXA04's statement, "The back pain is quite severe, especially if the position is not correct," further illustrates how positional discomfort can become particularly relevant during nighttime rest.

Participants also demonstrated several self-management strategies to minimize pain and maintain comfort, including gradual repositioning, limiting movement, relaxation, distraction through interaction with family, and seeking assistance. PXA01 stated, “I usually only change positions when I feel pain,” while PXB05 reported, “I usually adjust my leg position, try to relax, and chat with my family so I don't focus too much on the pain.” Although some participants considered their pain tolerable and did not request additional analgesics, they nevertheless expressed a need for better nighttime pain control to support more continuous and restorative sleep. These findings highlight the interconnected nature of pain, mobility, and sleep during hospitalization. Pain may directly disrupt sleep while simultaneously limiting movement and increasing reliance on others for repositioning or daily activities [12]. Therefore, assessment of pain in hospitalized patients with fractures should consider not only pain intensity but also movement-related pain, positional discomfort, nighttime sleep, and the patient's ability to independently adjust position. An individualized approach combining appropriate analgesia with positioning, gradual movement, relaxation, and assistance when needed may help address the multiple ways in which pain affects comfort and functional recovery.

C. Theme 3: Psychological Responses to Illness and Uncertainty

Beyond physical discomfort, participants' sleep was influenced by persistent concerns about illness, treatment, recovery, discharge, and responsibilities outside the hospital [26],[27]. PXB03 stated, "I think most about my leg, the pus, what action to take, and whether it will heal well." PXA01 reported thinking about the planned surgery and the rice field left at home, while PXB01 was concerned about home, family, and agricultural activities. These accounts indicate that nighttime wakefulness was accompanied by cognitive preoccupation with both health-related uncertainty and everyday responsibilities, making it more difficult for participants to relax and resume sleep.

These findings suggest that sleep disturbance during hospitalization was not solely related to physical discomfort but was also shaped by psychological and cognitive concerns [27]. Uncertainty regarding recovery and concerns about responsibilities outside the hospital may maintain mental alertness during the night. Therefore, addressing patients' concerns through clear information about treatment, recovery, and discharge, together with opportunities to express worries about life outside the hospital, may support psychological comfort and sleep during hospitalization.

D. Theme 4: Reduced Functional Independence

Participants experienced temporary reductions in independence as a consequence of pain, restricted movement, and fear of aggravating the injury. Functional limitations affected activities such as repositioning, mobility, obtaining personal items, toileting, and other usual daily activities [28]. PXB01 stated, "I feel like I temporarily have to depend on others for some activities. I usually take care of the house and garden myself, so now having to ask for help feels a bit hard for me." Similarly, PXB03 reported, "I feel like my abilities are limited. I usually can take care of myself, but now I need help to move and do some activities because my leg hurts." PXB04 also stated, "I feel like I can't be as independent as I used to. I need help to move or do things because I'm afraid my leg will hurt if I force it." These accounts illustrate how pain and fear of movement can restrict usual activities and temporarily increase dependence on others [28], [29].

The findings further suggest that dependence was not solely determined by physical limitation but was also shaped by participants' fear of worsening pain or injury. Participants often moved cautiously, remained relatively still, or sought assistance when movement was perceived as difficult or unsafe. This temporary loss of independence could also affect participants' perception of their usual abilities, particularly among those accustomed to managing household, agricultural, or self-care activities independently. Thus, addressing pain while supporting safe mobility and gradual independence may be important in minimizing functional limitations during hospitalization.

E. Theme 5: Family as a Source of Safety and Support

Family members played an important role in helping participants cope with pain, sleep disturbance, functional limitations, and emotional concerns [30]. Family support included physical assistance, companionship, reassurance, assistance with repositioning, and communication about circumstances at home [31]. PXA01 stated, “As long as my family is here to help me, I feel a little more comfortable and secure,” while PXA03 reported, “When my family is there, I feel calmer.” PXB03 similarly stated, “My family makes me feel safer. They accompany me and help me with my needs. When I'm anxious, having my family by my side also makes me feel calmer”. Family presence also helped address participants’ concerns about their homes and responsibilities, communication with family members allowed participants to obtain information about what was happening outside the hospital, thereby reducing worry [31]. The family therefore functioned not only as a source of practical assistance but also as an important source of emotional security. This role became particularly meaningful when participants experienced pain, uncertainty, or reduced independence [30], [32], [33].

F. Theme 6: Nursing Care and the Need for Comfort-Oriented Support

Participants generally perceived nursing care as helpful. Nursing support was described in relation to medication administration, monitoring, physical assistance, examinations, positioning, and communication about care [34]. Several participants indicated that scheduled medication helped manage discomfort. However, participants commonly reported that they did not request additional medication when their pain remained tolerable. PXA02 stated, "The nurse was quite helpful, especially in administering medication and helping when I needed help," while PXB05 reported, "The nurse was quite helpful in checking and administering medication." PXB03 also described feeling calmer when

nurses explained the patient's condition and planned interventions. These included better nocturnal pain control, assistance in maintaining a comfortable and safe position, and improvement of the physical environment. One participant specifically expressed the need for nursing assistance to control pain and ensure that the shoulder remained comfortable to enable longer sleep. For participants experiencing uncertainty regarding their injury or wound, explanations from nurses were also perceived as reassuring. Thus, nursing support extended beyond physical interventions to include emotional and informational support. Overall, participants appeared to value nursing care most when it addressed immediate comfort needs while preserving their sense of safety and facilitating rest [10], [34], [35].

G. Theme 7: Hope for Recovery and Restoration of Normal Life

The final theme reflected participants' expectations for recovery and a return to their usual lives. Participants commonly expressed hopes for decreased pain, improved sleep, healing of the injured body part, successful treatment, early discharge, and resumption of normal activities. The desire to return home was frequently linked to the desire to resume meaningful roles and responsibilities [36]. For some participants, this meant returning to work or agricultural activities; for others, it involved returning to school or performing routine household activities. PXB04 stated, "I hope my leg recovers quickly so that I can go home soon, return to school, and resume my usual activities." PXB05 hoped that "the pain will decrease quickly, I can sleep better, and I can return to my usual activities soon." PXB02 expressed a desire to return home soon and resume his usual activities. For PXA01, the hope of returning home was also related to responsibilities concerning the rice field, which was entering the planting season. These expectations demonstrate that recovery was understood by participants not merely as physical healing but also as restoration of independence, sleep, comfort, and participation in everyday life [36], [37], [38].

H. Thematic Structure Through Roy's Adaptation Model

Table 3. Roy adaptation model components to interview findings and related themes

RAM Component	Interview Findings/ Stimuli	Coping Mechanism	Adaptive Mode	Manifestation/ Responses	Related Themes
Focal Stimulus	Fracture-related pain occurring at rest, during movement, shifting, or repositioning	Regulator and Cognator	Physio-logical-Physical	Pain, sleep disturbances, restricted movement, and attempts to find a comfortable position	Themes 1–2
Contextual Stimuli	Temperature/heat, light, noise and ward activities, medical procedures, mobility limitations, wound condition, family support, and work, school, or household responsibilities	Regulator and Cognator	Physio-logical-Physical; Self-Concept/ Group Identity; Role Function; Interde-pendence	Sleep disturbances, psychological responses, functional limitations, and the need for assistance	Themes 1–7
Residual Stimuli	Previous sleep habits, preferences for the sleeping environment, personal concerns, homesickness, and beliefs or expectations regarding recovery	Cognator	Self-Concept/ Group Identity; Role Function	Concerns, recovery expectations, and an orientation toward resuming daily activities	Themes 3, 7
Regulator Mechanism	Automatic physiological	Regulator	Physio-logical-Physical	Awakening, difficulty returning	Themes 1–2, 4

RAM Component	Interview Findings/ Stimuli	Coping Mechanism	Adaptive Mode	Manifestation/ Responses	Related Themes
	responses to pain, injury, fatigue, restricted movement, and sleep disturbances			to sleep, limiting movement, seeking a comfortable position, and practicing relaxation	
Cognator Mechanism	Assessing comfortable positions, regulating movement, deciding when to seek assistance, diverting attention, and thinking about surgery/procedures and the future	Cognator	Physio-logical-Physical; Self-Concept/Group Identity; Role Function; Interde-pendence	Decision-making, coping, communication, help-seeking, and recovery-oriented perspectives	Themes 2–7

The seven themes identified through the thematic analysis were subsequently mapped onto the four adaptive modes of Roy's Adaptation Model: the Physiological-Physical Mode, Self-Concept/Group Identity Mode, Role Function Mode, and Interdependence Mode [14], [15], [16], [19]. This theoretical mapping provides a framework for understanding how patients with fractures experienced and responded to changes in sleep quality, pain, physical functioning, psychological well-being, social roles, and interpersonal relationships during hospitalization [14]. The experiences of pain, sleep disturbance, and positioning were primarily associated with the Physiological-Physical Mode, whereas psychological responses to illness and uncertainty reflected the Self-Concept/Group Identity Mode. Functional limitations and expectations of returning to work, education, family responsibilities, and daily activities were related to the Role Function Mode [14], [16]. Meanwhile, family involvement and nursing support were primarily associated with the Interdependence Mode [16], [30].

The findings indicate that patients' experiences of sleep and pain during fracture recovery constituted a multidimensional adaptation process [19], [25]. Physical discomfort and sleep disturbances were closely interconnected with psychological concerns, limitations in functional independence, and increased reliance on family members and healthcare professionals [39], [40]. Participants demonstrated various adaptive responses to these challenges, including repositioning the affected body part, practicing relaxation, limiting painful movements, seeking assistance, communicating with family members, and utilizing nursing support [19], [20]. These adaptive responses were accompanied by a consistent desire for recovery, symptom relief, improved sleep, early discharge, and restoration of normal daily activities [40]. Overall, the findings illustrate that adaptation to fracture-related pain and sleep disturbance involves interconnected physiological, psychological, functional, and interpersonal dimensions.

Conclusion

This qualitative study demonstrated that patients with fractures experienced sleep disturbances and pain as interconnected challenges during hospitalization. Poor sleep quality was characterized by difficulty initiating sleep, light and fragmented sleep, frequent nocturnal awakenings, difficulty returning to sleep, and non-restorative sleep. Pain, particularly during movement and repositioning, emerged as an important factor contributing to sleep disruption and reduced physical

mobility. Environmental conditions, psychological concerns regarding illness and recovery, and temporary loss of functional independence further influenced patients' experiences.

The findings also demonstrated that patients actively engaged in various adaptive responses, including repositioning, relaxation, limiting painful movements, seeking assistance, and communicating with family members. Family members provided important emotional and practical support, while nursing care contributed to pain management, comfort, positioning, and reassurance. Through the lens of Roy's Adaptation Model (RAM), these experiences reflected adaptation across the Physiological-Physical, Self-Concept/Group Identity, Role Function, and Interdependence modes.

The findings suggest that the management of fracture patients should extend beyond pain control to include sleep promotion, environmental comfort, functional support, psychological reassurance, and family involvement. A comprehensive, adaptation-oriented nursing approach may help patients achieve greater comfort, improve sleep, maintain functional independence, and facilitate recovery and restoration of their usual daily activities.

Conflict of Interest

The authors declare no conflicts of interest related to the publication of this study. All research procedures, data collection, and analysis were conducted independently without any commercial or financial relationships that could be considered a potential conflict of interest.

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