Abstract

Introduction: Shift work and demanding work schedules contribute to occupational fatigue, negatively affecting patient safety and nurses’ well-being, consequently placing nurses and patients at risk for injury and adverse health outcomes. For preventing fatigue and minimizing its negative consequences, information about its characteristics and associated factors is required.

Objectives: This study aimed to assess occupational fatigue “acute fatigue, chronic fatigue, and inter-shift recovery” among Saudi nurses working 8-h shifts. Further, we explored factors associated with fatigue from nurses’ perspectives.

Methods: We conducted a mixed-method study with a convenience sample of Saudi nurses (N = 282) working in four public hospitals in Saudi Arabia. Data were collected using the nurses’ profile form; the occupational fatigue exhaustion recovery (OFER) scale, for relevant quantitative data; and open-ended questions for qualitative data. We used descriptive and inferential statistics for analysing the quantitative data and content analysis of the qualitative data.

Results: The results showed that Saudi nurses rated themselves moderately fatigued with working 8-h shifts. The inter-shift recovery subscale showed a negative correlation with chronic fatigue and acute fatigue (r = −0.518, r = −0.356, P < 0.001). Sleeping problems, meals per day, and frequency of exercise showed significant relations with chronic fatigue among nurses (p < 0.05). In addition, three categories were derived from the qualitative content analysis. Saudi nurses reported work-related, psychosocial, and individual factors as major contributors to fatigue and recovery.

Conclusion: Occupational fatigue is a multidimensional issue, and nurses and nurse managers are challenged with reducing its prevalence and negative impact on nurses and patients. Our quantitative and qualitative findings suggest the need for a comprehensive approach to fatigue management and mitigation, including organizational support, creative workforce planning, flexible work schedules, and psychosocial support. Fatigue reduction and prevention policies and educational programs are vital strategies to improve nurses’ well-being and inter-shift recovery.

Keywords
inter-shift recovery, occupational fatigue, nurses, rotational shift, work schedules, hospitals

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Background

Nursing is a high-demand career that often necessitates rotational and long shifts to ensure continuity of care in hospitals (Ferri et al., 2016). Shift work is a standard method of professional practice and is unavoidable for nurses working in hospitals (Alsharari et al., 2021; Dall’Ora et al., 2015). Rotational shift work describes a range of work schedules in which shifts rotate or change regularly among nurses. A rotating shift is a combination of a night shift and a day shift in one schedule, covering all hours of the day, with

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Hence, occupational fatigue has become a significant factor for nurses working in hospitals. Nurses’ shift work and demanding work schedules can be stressors that affect their physical and psychological health and well-being, frequently inducing fatigue and subsequently influencing their work performance, thus impacting patient safety and quality of care (Ferri et al., 2016; Hittle, 2019). Actual shift lengths are often unpredictable because of fluctuations in inpatient needs and unanticipated staffing changes. As a result, nurses often must put in unplanned overtime beyond the scheduled shift length. Working shifts that rotate between day and night duty and consecutive or overtime shifts exert pressure on the body and mind, and may lead to difficulties with sleep, ultimately resulting in fatigue (Alahmadi & Alharbi, 2018; Steege & Rainbow, 2017).

**Occupational fatigue** is a multifaceted syndrome characterized by emotional, physiological, cognitive, or mental, and sensory components that develop due to high work demands and inadequate energy restoration (Martínez et al., 2019). It is the third most prevalent symptom associated with poor health in working people in general and is one of the primary factors associated with morbidity (Roelen et al., 2015). Winwood et al. (2005, 2006a) identified three dimensions of occupational fatigue: acute fatigue, chronic fatigue, and stressors that affect their physical and psychological health and well-being, frequently inducing fatigue and subsequently influencing their work performance, thus impacting patient safety and quality of care (Ferri et al., 2016; Hittle, 2019). Actual shift lengths are often unpredictable because of fluctuations in inpatient needs and unanticipated staffing changes. As a result, nurses often must put in unplanned overtime beyond the scheduled shift length. Working shifts that rotate between day and night duty and consecutive or overtime shifts exert pressure on the body and mind, and may lead to difficulties with sleep, ultimately resulting in fatigue (Alahmadi & Alharbi, 2018; Steege & Rainbow, 2017).

**Review of Literature**

Today’s nursing workforce has a substantial need for more flexible shift work schedules because of demographic and socioeconomic changes that demand more time from nursing staff (Alsayed, 2018). In recent years, there has been increasing interest in the Kingdom of Saudi Arabia (KSA) to promote safer and healthier workplace settings that cater to the requirements of employees, particularly in the healthcare sector. The Saudi government envisions this as part of its Vision 2030 plan to implement multi-transformational reforms in the healthcare sector and improve individuals’ lifestyles (Alharbi, 2018; Alsharari et al., 2021). As nurses provide most healthcare services and constitute the country’s largest healthcare workforce, such transformative plans should address all challenges that currently confront nurses and affect nursing service delivery, including shift work and associated fatigue (Alsharari et al., 2021). Therefore, the purpose of the current study was to assess occupational fatigue (acute, chronic, and inter-shift recovery) among Saudi nurses working 8-h shifts in public hospitals. Further, we explored factors associated with nurses’ fatigue from their perspectives.

Empirical research has examined fatigue associated with nurses’ job characteristics (Zhou & Fang, 2015), quality of sleep (Rizky, 2018), psychosocial factors (Alsharari, 2019; Rahman et al., 2016), job conditions, occupational stress, emotional intelligence (Huang et al., 2019), and recovery in 12-h dayshifts (Clendon & Gibbons, 2015). Other studies have reported the adverse effects of night shift work on the physiological status of nurses, including anxiety, musculoskeletal disorders, stress, development of obesity due to poor eating habits (Books et al., 2020; Liu et al., 2018), fatigue, family problems, and decreased job and life satisfaction (Abdulah et al., 2020). Studies conducted in the KSA also investigated the impact of night shift rotations on nurses’ performance, patient safety, psychosocial impact, among nurses (Almajwal, 2016; Alsharari, 2019; Alsharari et al., 2021). However, occupational fatigue and recovery process on rotational shift work remains a significant concern that causes psychological and social difficulties for nurses (Alsharari, 2019; Rahman et al., 2016), especially Saudi nurses.

So far, researchers have not specifically investigated fatigue and its associated factors among nurses working rotational 8-h shifts in Saudi public hospitals. Preventing fatigue and mitigating its negative consequences necessitates a thorough understanding of the various factors that contribute to it (Alahmadi & Alharbi, 2018). Gaining the relevant information and awareness of factors impacting fatigue may enable hospital administrators and nurse managers to adjust these factors to reduce fatigue, benefitting patients as well as healthcare professionals and institutions.

This study aimed to assess occupational fatigue (acute fatigue, chronic fatigue, and inter-shift recovery) among
Saudi nurses working 8-h shifts in public hospitals. Further, we explored factors associated with nurses' fatigue from their perspectives.

**Methods**

**Design**

This study used a mixed-methods design in which the researcher combined the collection and analysis of both quantitative and qualitative data (Creswell & Clark, 2011). Both quantitative and qualitative data were collected to develop a comprehensive understanding of the research phenomena (i.e., fatigue) and influencing factors among nurses. Quantitative data were collected using a questionnaire about occupational fatigue, while qualitative data were collected using two open-ended questions asking about the factors associated with nurses' fatigue from their perspectives. The findings from the qualitative analysis may be of special relevance to practitioners and leaders in developing strategies to address workplace and individual issues that increase nurses' fatigue.

**Setting**

The study was conducted at four governmental hospitals in the northwest region of Saudi Arabia (Hail region). These hospitals provide general health services to the Saudi community and apply an 8-h shift style in distributing nurses' work schedules, as follows: 7:00 am–3:00 pm, 3:00 pm–11:00 pm, and 11:00 pm–7:00 am. Hospital A is the main reference hospital in the Hail region, with a 284-bed capacity. Hospital B provides general health services with a 200-bed capacity. Hospital C provides specialized medical surgery services with a 200-bed capacity. Lastly, Hospital D is a long-term care hospital and medical rehabilitation center with a 35-bed capacity. To meet the job criteria of full-time nurses working in public hospitals, nurses must work approximately 40 h per week. Head nurses in public hospital departments commonly schedule staff nurses for five consecutive workdays, each with an eight-hour shift, followed by two consecutive off-days (Ministry of Health (MOH), 2019; Alsharari et al., 2021).

**Sample**

The total number of Saudi nurses working at the selected hospitals was 439 nurses. All Saudi nurses with at least six months of experience (as an inclusion criterion) in their respective hospitals and willing to participate were eligible and invited to participate in the study (N = 330). They were classified as follows: 110 from hospital A, 114 from hospital B, 65 from hospital C, and 41 from hospital D. The pilot study was conducted with 20 nurses who were excluded from the study. The sample size was determined using the Raosoft sample size calculator using the following parameters: population size 310, margin error 5, confidence interval, 95%; and significance level, \( p = 0.05 \). Therefore, the minimum recommended sample size was 172. To ensure that we obtained the recommended sample and to avoid missing data, all 310 questionnaires were distributed to the nurses. Of these, 282 nurses returned the study questionnaire, with a response rate of 90.97%.

**Inclusion /Exclusion Criteria**

The inclusion criteria were Saudi registered full-time nurses who engaged in rotational shift work, with at least six months of experience in the hospital. Exclusion criteria incorporated any nurse who worked only in the morning shift and had less than six months of experience.

**Study Instruments**

**Questionnaire composed of Two sections: quantitative data.**

**Section 1: The nurses’ profile questionnaire** was developed by the researchers and included 12 questions encompassing gender, age, educational level, marital status, number of children, years of experience, pre-existing health conditions/chronic disease, sleep problems, sleep hours per day, meals per day, exercise, and exercise frequency. Responses are presented in frequencies and percentages.

**Section 2: The Occupational Fatigue Exhaustion Recovery (OFER) scale** (Winwood et al., 2005, 2006a) consists of 15 items with three subscales: chronic fatigue/exhaustion, acute fatigue, and inter-shift recovery, with five items for each subscale. Responses were measured on a 7-point Likert scale ranging from 0 (strongly disagree) to 6 (strongly agree). The scores ranged from 0–90. The OFER has been validated to measure work-related fatigue in several populations including nurses (Winwood et al., 2005; Winwood et al., 2006a, 2006b). The original authors reported reliability with Cronbach’s \( \alpha \) coefficient of 0.85.

**Factors influencing nurses’ fatigue: qualitative data.** The researchers introduced two open-ended questions to ask nurses about the perceived factors influencing or contributing to their fatigue from their perspectives:

1. What work-related factors are influencing or contributing to fatigue from your perspective?
2. What other factors (unrelated to work) are influencing or contributing to fatigue from your perspective?

Based on the content analysis of the responses, the factors were presented in frequencies and percentages.
Validity and Reliability

The questionnaire was administered in English. Content validity was tested by three expert academic members and proved to be valid for use. The final copy of the questionnaire was considered to have face and content validity by experts. Subsequently, a pilot study was conducted on 20 nurses who met the inclusion criteria but were not included in the current data set to ensure clarity and applicability of the tools. The pilot study resulted in minor changes, including word choice, font size, and rephrasing of one item. Additionally, the reliability coefficient (Cronbach’s alpha) of the OFER scale was 0.892, indicating a good level of internal consistency.

Ethical Considerations

Ethical approval was obtained from the Review Board Committee, College of Nursing at University of Ha’il. Participants were informed about the study aims, and informed consent was obtained for all surveys from all nurses. The privacy and confidentiality of the nurses and hospital units were maintained. Given the anonymity of the participants and hospitals, codes were used instead of names, and no personal identifying data were collected. The researchers assured that all data and questionnaire copies were stored and accessed only by the research team. Participants were granted the right to withdraw from the study at any time.

Data Collection

After receiving administrative approval to access the four hospitals and collect data from the participating units, the authors arranged an appointment with the respective unit managers to introduce them to the study, address any concerns, and set up a convenient time for data collection. Hospitals were anonymised and coded (A, B, C, and D) for reporting to comply with the approval conditions during data collection. No work disruptions were noted, and nurses completed the questionnaires at their convenience. A designated box was placed in the hospital units to collect responses from nurses. Additional copies of the questionnaires were also provided in each unit, with a post placed on the notice board, as a friendly reminder, three days after posting the notices. A total of 282 completed questionnaires were collected over two months (January–February 2020).

Data Analysis

Quantitative data were coded by the researchers and entered the Statistical Package for the Social Sciences computer software (SPSS for Mac, Version 22.0) for analyses. Data on nurses’ general characteristics were summarized using frequencies and percentages. For the OFER subscale, mean scores and standard deviations (SD) were added. T-tests and variance analyses were used to investigate the relations between occupational fatigue and nurses’ characteristics. The correlation between inter-shift recovery and acute and chronic fatigue was tested using the Pearson correlation coefficient (r). The significance threshold was set at p < 0.05. For the qualitative data, the researchers analysed participants’ responses to the open-ended questions using content analysis. Finally, categories of the responses were ranked according to their frequencies and percentages.

Results

Nurses’ Characteristics

The general characteristics of the participants shows that all nurses worked in rotational shifts. Most nurses (96.1%) were female, with an average age of 30.58 ± 6.33 years (min: 21, max: 59). The majority (78.4%) had a bachelor’s degree, while 21.6% had a high school diploma. The nurses’ mean experience was 6.36 ± 4.53 (min: 1.0, max: 38.0) years. About one-quarter of the nurses (25.18%) had sleeping problems, compared to 78.4% who reported no sleeping problems. Most nurses (89.01%) slept for more than four hours per day. More than half of the nurses consumed three meals per day (58.5%) and engaged in exercise (54.3%), most exercised once per week (52.3%). See supplementary Table 1 for additional demographic information.

Mean Score of Occupational Fatigue and Exhaustion Recovery among Nurses

Overall occupational fatigue and exhaustion recovery among the nurses was moderate (53.29 ± 11.07) (Table 1). The mean score indicated that nurses experienced more acute fatigue (57.01 ± 17.12) compared to chronic fatigue (52.27 ± 23.19) and inter-shift recovery state (50.60 ± 13.08). There was no significant difference among the four study hospitals in terms of overall occupational fatigue and the three subscales (F = 0.832, P = 0.436).

Correlation Between Inter-Shift Recovery State and Fatigue Types

Table 2 reveals a significant negative correlation between inter-shift recovery state (RC) and chronic fatigue (r = −0.518, P < 0.001) as well as acute fatigue (r = −0.356, P < 0.001).

Relationship Between Occupational Fatigue and Exhaustion Recovery and Nurses’ Profiles

Table 3 shows that some nurses characteristics had significant correlations with specific fatigue subscale or overall
Table 1. Mean Score of Experience of Occupational Fatigue and Exhaustion Recovery among Nurses.

| Occupational Fatigue and Exhaustion Recovery | Total (N=282) | Hospital A (n=100) | Hospital B (n=93) | Hospital C (n=49) | Hospital D (n=40) |
|---------------------------------------------|---------------|-------------------|------------------|------------------|------------------|
|                                             | Mean ± SD     | Mean ± SD         | Mean ± SD        | Mean ± SD        | Mean ± SD        |
| Chronic fatigue                             | 52.27 ± 23.19 | 55.40 ± 25.20     | 53.87 ± 22.12    | 47.76 ± 22.49    | 46.25 ± 19.76    |
| Acute fatigue                                | 57.01 ± 17.12 | 56.73 ± 20.54     | 57.31 ± 16.05    | 59.12 ± 14.54    | 54.42 ± 12.62    |
| Inter-shift recovery                         | 50.60 ± 13.08 | 49.93 ± 12.62     | 48.75 ± 13.74    | 51.70 ± 10.89    | 55.25 ± 14.26    |
| Overall                                      | 53.29 ± 11.07 | 54.02 ± 12.95     | 53.31 ± 10.29    | 52.86 ± 10.05    | 51.97 ± 8.89     |

F: significance of the F test at the 0.05 level.

Table 2. Correlation Between Inter-Shift Recovery, Chronic, and Acute Fatigue.

| Type of fatigue | Inter-Shift Recovery (RC) | r     | p    |
|-----------------|---------------------------|-------|------|
| Chronic fatigue (CF) | -0.518 <0.001*          |       |      |
| Acute fatigue (AF)   | -0.356 <0.001*           |       |      |

r: Pearson’s correlation *: Statistically significant at p ≤ 0.05.

OFER. A significant relationship was found between working years and inter-shift recovery subscale (F = 3.119, p = 0.027); between sleeping problems and each of chronic fatigue subscale (t = 3.742, P < 0.001), and the overall OFER (t = 2.046, P < 0.008); between sleeping hours, and chronic fatigue subscale (t = 2.727, P = 0.05). Also, there is a significant relationship between the number of meals per day and chronic fatigue subscale (F = 3.736, P = 0.006), as well as the overall OFER (F = 2.567, P = 0.039), and between performing exercise and the overall OFER (t = 2.173, P = 0.048). More specifically, nurses with more than 15 years of experience had a higher mean inter-shift recovery (60.0 ± 18.18). Nurses who showed a high level of chronic fatigue and 14.26% had a higher inter-shift recovery mean (P = 0.008). The rest of the characteristics were not statistically significantly correlated with overall OFER or its subscales (see Supplementary Table 2).

Discussion

The integration of quantitative and qualitative findings is a key process in mixed-method studies. This integration enhanced the researchers’ awareness of occupational fatigue in Saudi nurses and associated factors. The discussion section will start with quantitative findings describing fatigue levels and nurses’ characteristics that demonstrated significant relationships with fatigue subscales, followed by the qualitative findings from the open-ended questions related to factors associated with fatigue from the nurses’ perspectives.

Factors Influencing Nurses’ Fatigue from Their Perspectives

The number of nurses who answered the open-ended questions about perceived factors influencing fatigue was 184 (65.25%) out of the quantitative sample (N = 282). Three major categories were derived from qualitative content analysis. Saudi nurses reported that work-related factors, psychosocial factors, and individual characteristics could affect or contribute to fatigue and recovery. Twenty-eight sub-factors were derived through the content analysis and classified into these three categories. All respondents (n = 184,100.0%) identified work-related factors including staffing (adequacy or shortage), workload (bed capacity, number of assigned patients and tasks), shift variables (inter-shift recovery, length of shift, night shift), work demands (physical, mental, and emotional), and layout. Most nurses (n = 165, 89.67%) reported other psychosocial factors in the workplace, such as quality of leadership (supportive managers, managerial care, and justice), support (social support and networking, teamwork), and job motivators (job satisfaction or dissatisfaction, respect or bullying, violence, autonomy, meaningfulness at work, rewards, and recognition). In addition, 137 nurses (74.46%) reported individual characteristics and factors such as gender, experience, marital status, parenting or family care (number of dependents, work-family role conflict), individual lifestyle (sleep, diet, exercise, recreation), and health conditions. See Figure 1 for the major factors and Supplementary Table 3 for the percentages of each factor.

Perceived Fatigue among Nurses

This study found that most nurses experienced moderate overall fatigue levels, including acute, chronic, and inter-shift recovery states. The experience of acute fatigue was found to be relatively higher among the nurses in this study compared with chronic fatigue. Perceived fatigue levels in this study may be attributed to the nurses’ workload with the rotational shift arrangement. Previous studies revealed that rotating shift work is typically adopted to reduce the amount of night work as much as possible, as it
may impact the well-being of employees (Khan et al., 2021). Although there are a few advantages of rotating shifts over constant night shifts, including more stable circadian rhythms and longer sleep times, they have been shown to impact a range of health and safety outcomes (Ganesan et al., 2019; Khan et al., 2021). For example, rotating shift workers reported significantly higher insomnia and excessive daytime sleepiness compared to standard day workers (Chatterjee & Ambekar, 2017). Furthermore, nurses working in rotating rosters reported more stress than nurses working in fixed rosters (Lin et al., 2015). In addition, shift rotation has been linked to poorer mental health, particularly depression and anxiety (Kalmbach et al., 2015). This result is consistent with Huang et al. (2019), who illustrated an average chronic fatigue score of the nurses in their study, and Chen et al. (2014), who reported moderate to high levels of acute fatigue and moderate levels of chronic fatigue among nurses.

### Table 3. Relationship Between Occupational Fatigue, Exhaustion Recovery and the Nurses’ Profiles (Significant Factors).

| Nurses’ demographic profile | Occupational Fatigue | Exhaustion Recovery | Inter-shift recovery | Overall |
|-----------------------------|----------------------|----------------------|----------------------|---------|
|                             | Chronic fatigue      | Acute fatigue        | Inter-shift recovery | Overall |
| **No of years of experience** |                      |                      |                      |         |
| <5                          | 53.56 ± 23.70        | 57.54 ± 18.92        | 49.58 ± 12.23        | 53.56 ± 11.87 |
| 5–<10                       | 52.44 ± 21.90        | 57.31 ± 14.85        | 50.16 ± 11.27        | 53.30 ± 10.56 |
| 10–<15                      | 52.02 ± 23.33        | 56.43 ± 15.39        | 51.01 ± 16.04        | 53.15 ± 9.98 |
| ≥15                         | 42.29 ± 26.77        | 52.71 ± 21.71        | 60.0 ± 18.18         | 51.67 ± 11.75 |
| **F(p)**                    | 1.115 (0.343)        | 0.398 (0.754)        | **3.119 (0.027)**    | 0.139 (0.937) |
| **Sleeping problems**       |                      |                      |                      |         |
| Yes                         | 60.55 ± 18.11        | 59.78 ± 13.80        | 48.20 ± 11.39        | 56.17 ± 9.03 |
| No                          | 49.98 ± 23.94        | 56.24 ± 17.88        | 51.27 ± 13.45        | 52.50 ± 11.46 |
| **t(p)**                    | **3.742 (<0.001)**   | 1.655 (0.100)        | **1.628 (0.105)**    | **2.646 (0.008)** |
| **Sleep hours day**         |                      |                      |                      |         |
| Less than 4 h               | 62.78 ± 23.42        | 59.72 ± 14.97        | 48.19 ± 6.95         | 56.90 ± 11.95 |
| More than 4 h               | 51.29 ± 22.82        | 56.67 ± 17.35        | 50.69 ± 13.34        | 52.88 ± 10.97 |
| **t(p)**                    | **2.727 (0.05)**     | 0.457 (0.634)        | 0.947 (0.389)        | 1.621 (0.200) |
| **Meals day**               |                      |                      |                      |         |
| 1                           | 66.67 ± 22.55        | 69.63 ± 14.95        | 50.0 ± 12.02         | 52.10 ± 9.85 |
| 2                           | 58.33 ± 23.41        | 58.04 ± 19.18        | 48.41 ± 13.42        | 54.93 ± 11.82 |
| 3                           | 48.38 ± 22.31        | 55.72 ± 16.07        | 51.98 ± 12.78        | 52.03 ± 10.54 |
| 4                           | 50.24 ± 23.30        | 58.57 ± 15.18        | 49.52 ± 15.52        | 52.78 ± 10.04 |
| 5                           | 50.83 ± 24.55        | 53.33 ± 14.14        | 48.33 ± 7.93         | 50.83 ± 12.32 |
| **F(p)**                    | **3.736 (0.006)**    | 1.629 (0.167)        | 1.152 (0.332)        | **2.567 (0.039)** |
| **Exercises programs**      |                      |                      |                      |         |
| Yes                         | 53.49 ± 23.16        | 58.80 ± 16.83        | 51.18 ± 13.40        | 54.49 ± 10.97 |
| No                          | 50.83 ± 23.23        | 54.88 ± 17.28        | 49.92 ± 12.71        | 51.88 ± 11.06 |
| **t(p)**                    | 0.959 (0.338)        | 1.924 (0.055)        | 0.802 (0.423)        | **2.983 (0.048)** |

*: Statistically significant at $p \leq 0.05$.  

**Figure 1.** Factors associated with occupational fatigue and exhaustion recovery from nurses’ perspectives.
Some studies have compared fatigue levels between 8-h and 12-h shifts, but the findings have been contradictory (Chen et al., 2014). Yu et al. (2019) showed that more than half of the nurses working 12-hour shifts studied had low to moderate fatigue levels. Martin (2015) found that 8-hours shifts, compared to 12 h, showed an increase in fatigue levels. Hazzard et al. (2013) surveyed 47 nurses working 12-hours shifts and found that nurses could recover between shifts sufficiently and did not suffer high fatigue levels. In contrast, other studies have found that 12-h shifts increase fatigue among nurses. Estryn-Béhar and Van der Heijden (2012) examined an extensive database compiled from 25,924 European nurses. Compared to nurses working 8-h shifts, they found those working 12-h shifts had higher fatigue, burnout ratings, and a lower workability index. Also, Han and colleagues evaluated 175 full-time female 12-h shift nurses in the United States and discovered that nurses who worked variable and unexpected shift patterns were more fatigued than those who worked regular fixed shifts (Han et al., 2014). Given these findings, the impact of 8- or 12-h shifts on nurse fatigue is inconsistent.

Studies conducted in the KSA mainly reported a negative impact of the night shift on nurses’ performance, patient safety, and psychosocial well-being (Almajwal, 2016; Alsharari, 2019; Alsharari et al., 2021). In this respect and given that no cited study investigated the difference in fatigue level according to shift hours in the Saudi context, further investigation is needed to determine whether fatigue and recovery are different among 8-hours and 12-h shifts and influencing factors among Saudi nurses.

The present study revealed that the variable of inter-shift recovery state showed a significant negative correlation with chronic fatigue and acute fatigue; this may indicate that low inter-shift recovery may lead to high fatigue levels, and vice versa. This result may be related to the reduced break or sleep time between shift rotations. Likewise, previous studies have revealed that nurses’ fatigue can be affected by inter-shift recovery (Sonnenstag, 2018; Winwood et al., 2006a). Short intervals between shift rotations and insufficient inter-shift recovery are also believed to give nurses less time to rest and recover between shifts, not giving them adequate time to restore their energy. This results in the worker returning to work the next day in a sub-optimal state, such that they need to invest additional compensatory effort to perform adequately at work, consequently resulting in fatigue (Dahlgren et al., 2021; Khan et al., 2021; Sonnenstag, 2018).

Regarding nurses’ characteristics, the results showed that nurses with more experience reported a higher inter-shift recovery mean than nurses with fewer years of experience. This finding may be explained by the fact that experienced nurses mainly depend on their familiarity with managing various nursing situations, handling work-related stress, and overcoming workload challenges. They may also have a lower risk of fatigue from working night shifts than inexperienced or young nurses. Similarly, Rahman et al. (2016) and Winwood et al. (2006b) found that senior nurses were less likely to develop fatigue than their younger colleagues, and that higher age was associated with better recovery and lower chronic fatigue. In contrast, Chen et al. (2014) discovered that older nurses were more likely to experience acute fatigue than younger nurses.

Moreover, the current study revealed a significant relationship between chronic fatigue and sleep problems. Nurses who reported sleep problems exhibit other associated factors that may affect the quality of their sleeping patterns, such as: (1) sleeping less than 4 h per day, (2) eating only one meal per day, and (3) exercising. Research findings have shown that sleep is a critical factor in maintaining a healthy life, and when nurses’ sleep decreases, their fatigue increases. Similarly, Ganesan et al. (2019), Chatterjee and Ambekar (2017), and Khan et al. (2021) found that rotating shifts impact a range of health and safety outcomes, including higher insomnia and excessive daytime sleepiness, and increased risk of fatigue, accidents, stress, depression, and chronic ailments. Morelock (2016) reported that poor sleep quality, short sleep duration, and sleep latency increased nurses’ fatigue and reduced work efficiency. To rectify this, more flexible scheduling approaches and awareness strategies are believed to be required to enhance the sleep quality and recovery of nurses between shifts.

Factors Influencing Fatigue from Nurses’ Perspectives

Saudi nurses reported that work-related factors, psychosocial factors, and individual characteristics/factors could affect or contribute to their fatigue and recovery states.

Fatigue and organizational factors. Most nurses reported during qualitative data collection that their fatigue was primarily affected by various work-related and organizational factors. Work-related factors such as shortage of staff, increased workload in terms of assigned patients and tasks, and increased physical, mental, and emotional demands on nurses affect their fatigue and recovery, especially in public hospitals. This result is compatible with other studies that reported an association between health organization-related factors and the type of fatigue experienced by nurses. A Saudi study conducted by Alahmadi and Alharbi (2018) found that nurses experience increased workload in the healthcare environment, which explains the variance relative to nurses’ fatigue and poor recovery processes. The growth in demand for nurses, bed capacities, insufficient individuals joining the nursing profession, overtime shifts and decreased staffing could all be factors contributing to nurses’ increased workload. Huang et al. (2019) and Dall’Ora et al. (2015) also found that long weekly work times, night shifts, and
dissatisfaction with the nurse-patient relationship were related to fatigue. Moreover, Jung and Lee (2015) demonstrated that both acute and chronic fatigue are strongly related to nursing job demands (mental and physical). Appropriate and fair distribution of rotational shifts (day–night) and fair work assignments are necessary strategies to mitigate nurses’ fatigue.

**Fatigue and individual factors.** Like quantitative findings, nurses reported that their lifestyle (sleep, diet, exercise, recreation) can affect or contribute to their fatigue. In addition, the qualitative data indicated that parenting and family care (number of dependents, work-family role conflict) and adverse health conditions may contribute to the development of fatigue. One possible reason may be that nurses work hard in public hospitals to provide care services and simultaneously undertake housework, care for their children, and support the elderly at home (e.g., parents-in-law). Therefore, the demands of balancing work-family time may contribute to additional fatigue. Supporting this finding, Huang et al. (2019) and Chen et al. (2014) stated that married nurses experienced difficulties reconciling the demands of their jobs with their personal lives. Nurses rarely get enough sleep or rest, even when they are not on duty, because of their tasks at home. In addition, Rahman et al. (2016) highlighted that work-family conflict is always associated with a high level of chronic and acute fatigue that may negatively affect nurses’ coping and recovery time. Likewise, in the Saudi context, studies have reported that long shift work among nurses causes fatigue, poor eating habits, family problems, and decreased job and life satisfaction which negatively impact their performance (Abdulah et al., 2020; Almajwal, 2016). Therefore, adopting work-life-friendly policies within the workplace and including flexible working hours and schedules may help distressed nurses adapt and eventually become less fatigued.

**Fatigue and psychosocial factors.** Psychosocial factors that influence job satisfaction have also been identified as drivers of exhaustion and fatigue in public hospitals. Saudi nurses in the current study reported that supportive, encouraging, and fair managers and colleagues promote teamwork and job satisfaction, which could improve their recovery and reduce fatigue. On the contrary, lack of support, appreciation, and strained relationships with co-workers can lead to job dissatisfaction, contributing to fatigue. Similarly, a recent study in the KSA showed that most hospital nurses experienced a psychosocial impact due to long shift work and unsupportive management (Alsharari, 2019). Correspondingly, in an evidence-based investigation, Rahman et al. (2016) highlighted that many psychological factors contribute to acute and chronic fatigue among nurses, such as bullying, burnout, commitment to the workplace, emotional demands, job satisfaction, justice, respect, the meaning of work, violence, quality of leadership, reward, self-rated health, stress, social support, threats of violence, trust in management, and work-family conflict. Consistent with our findings, Zhou and Fang (2015) found that having more social support and teamwork are both protective factors against fatigue. In contrast, a lack of social support from nurse supervisors and co-workers may contribute to the development of acute and chronic fatigue (Jung & Lee, 2015; Zhou & Fang, 2015).

In this context, many authors emphasized the importance of a supportive, fair, and respectful work environment that conveys appreciation and gratitude toward the nurses’ work and effort as a popular strategy that promotes positive work attitudes and well-being among nurses. Likewise, creating the culture of wellness and implementing shared governance programs may strengthen individual work engagement and empowerment, enhance job satisfaction, and ultimately reduce fatigue (Abd-EL Aliem & Abou Hashish, 2021; Abou Hashish, 2020; Abou Hashish & Farghaly, 2021).

**Strengths and Limitations**

The present study has some strengths and limitations. This study is one of the first efforts to identify factors associated with fatigue among Saudi nurses. Understanding the factors that outline fatigue among Saudi nurses working in a hospital setting and determining the relationship between various variables and acute and chronic fatigue could open the gateway for future in-depth qualitative studies. Another strength is recruiting Saudi nurses from multiple units and public hospitals in the northern region of the KSA. Nevertheless, working conditions may differ between types of hospitals and thus limit extrapolation to nurses who work in other types of clinical facilities. The descriptive self-reporting nature of the study and open-ended questions limit the generalisability of the findings.

**Implications of the Study**

**Recommendation and Implication for Practice**

Through our findings in this study, our recommendations are as follows:

- There is a need to enhance organizational awareness of the impact of working shifts and fatigue on nurses’ and patients’ outcomes and quality of care. Hence, educational programs on the importance of recovery, fatigue prevention, and fatigue-reducing lifestyle habits, enhancing inter-shift recovery would benefit nurse managers, administrators, and clinical nurses. These programs should include sleep hygiene and other restorative habits, resilience, stress reduction, and a healthy lifestyle (diet, exercise, weight maintenance).

- Creating and implementing institution-wide fatigue reduction and prevention policies and risk management programs
and putting them into practice at the unit level is essential in reducing nurse fatigue.

- Hospital administrators and unit managers share the responsibility to enhance in-between shift recovery in nurses and promote a safer work environment for all. Allowing nurses to have a more flexible schedule and developing health-promoting scheduling to guarantee adequate recovery time and support at work may reduce stress and exhaustion.

- Hospitals can establish more reward mechanisms for nurses, including higher compensation and opportunities for career advancement and further education, which could bolster their professional identity and job satisfaction. Counseling sessions may be suggested to identify and tackle critical challenges, especially in junior nurses.

Recommendations for Future Research

Longitudinal research is needed to investigate the causal linkages among the factors that contribute to nursing fatigue. We recommend using the qualitative data in this study to develop nurses’ fatigue questionnaires and examine influencing factors. In addition, we recommended a comparable study with Saudi nurses working 12-h shift schedules to compare the type and level of fatigue among them. Moreover, we recommend conducting an interventional study on fatigue reduction and examining its effect on nurses’ fatigue. Finally, a qualitative study is recommended to obtain a more in-depth understanding of fatigue phenomena among nurses and their causes, associated factors, and mitigating factors.

Conclusion

Shift work is an inevitable part of nursing. Fatigue among nurses in acute care settings is a multifaceted problem, and reducing its prevalence is a challenge that managers and nurses must address. The current study concluded that Saudi nurses rated themselves moderately fatigued with working 8-h shifts. Short inter-shift recovery was negatively associated with increased acute and chronic fatigue among nurses in the current study. Additionally, sleep problems and poor eating habits were associated with chronic fatigue among nurses. The qualitative data revealed that many work-related, psychosocial, and individual factors may affect or contribute to nurses’ fatigue and recovery. Hospital work environments present the greatest number of job stressors and demands that may contribute to nurses’ fatigue. Our findings suggest the need for a comprehensive approach to fatigue management and mitigation, including organizational support, creative workforce planning, flexible work schedules, and psychosocial support. Fatigue reduction and prevention policies and educational programs are vital strategies to improve nurses’ well-being and inter-shift recovery.

Conflict of Interest

The authors declared no potential conflicts of interest.

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Author Contributions

All authors (Alsayed S, Abou Hashish E, Alshammari F) have substantial contributions to Conceptualization, Methodology, Software, Data curation, Writing – Original draft preparation. All authors discussed the results and contributed to the final manuscript. Abou Hashish E: final manuscript draft and correspondence.

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Supplemental Material

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