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ASSESSMENT OF BURNOUT, SLEEP QUALITY, AND RESPIRATORY HEALTH AMONG FRONTLINE NURSING AND RESPIRATORY CARE STAFF IN ACUTE CARE SETTINGS: A CROSS-SECTIONAL STUDY IN SAUDI MILITARY HOSPITALS

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ABSTRACT

Background: Frontline healthcare workers in acute care settings face compounding occupational stressors that may simultaneously impair psychological wellbeing, sleep architecture, and respiratory health. Military hospitals in Saudi Arabia operate under distinctive organizational and operational conditions, including hierarchical command structures, high patient acuity, and fluctuating surge-capacity demands, yet remain substantially understudied in the occupational health literature.

Objective: To assess the prevalence and severity of burnout, sleep impairment, and self-reported respiratory health outcomes among frontline nursing and respiratory care staff across three Saudi military hospitals, and to identify independent predictors of high burnout.

Methods: A multi-site cross-sectional survey was conducted from September to December 2024 at Prince Sultan Military Medical City (PSMMC), King Abdulaziz Military Hospital (KAMH), and Armed Forces Hospital-Southern Region (AFH-SR). Stratified random sampling yielded a final analytic sample of 452 participants (267 nurses, 185 respiratory therapists; response rate 83.7%). Burnout was assessed using the Maslach Burnout Inventory–Human Services Survey (MBI-HSS); sleep quality using the Pittsburgh Sleep Quality Index (PSQI); and respiratory health

using a validated self-report respiratory symptom questionnaire and occupational exposure inventory. Multivariable binary logistic regression was employed to identify independent predictors of high burnout (MBI Emotional Exhaustion score ≥ 27).

Results: High burnout was observed in 53% of nurses and 43% of respiratory therapists. Poor sleep quality (PSQI > 5) was prevalent in 85.8% of nurses and 80.5% of respiratory therapists, with mean global PSQI scores of 10.22 (±3.4) and 8.97 (±3.8), respectively. Respiratory symptoms were reported by 51.3% of nurses and 43.8% of respiratory therapists. In multivariable analysis, poor sleep quality (OR = 3.42; 95% CI: 2.11–5.54), lack of institutional support (OR = 3.08; 95% CI: 1.97–4.81), night/rotating shift work (OR = 2.87; 95% CI: 1.74–4.73), and perceived PPE inadequacy (OR = 2.21; 95% CI: 1.38–3.54) were the strongest independent predictors of high burnout. Burnout composite scores were positively and significantly correlated with PSQI global scores ($r = 0.67$, $p < 0.001$) and respiratory symptom burden ($r = 0.48$, $p < 0.001$).

Conclusion: Burnout, poor sleep, and respiratory health impairment co-occur at high rates among frontline nursing and respiratory care staff in Saudi military hospitals and are significantly interconnected. These findings underscore the urgent need for integrated occupational health programs that simultaneously address psychological, sleep-related, and respiratory health risks in this population.

Keywords: Burnout; Maslach Burnout Inventory; Sleep Quality; Pittsburgh Sleep Quality Index; Respiratory Health; Nursing Staff; Respiratory Therapists; Military Hospitals; Saudi Arabia; Occupational Health; Cross-Sectional Study

1. Introduction

Healthcare worker burnout has emerged as a global occupational health crisis with profound consequences for individual wellbeing, patient safety, and healthcare system performance. The construct of burnout, as conceptualized by Maslach and Jackson (1981), encompasses three core dimensions: emotional exhaustion (the progressive depletion of emotional resources), depersonalization (the development of detached or cynical attitudes toward patients), and diminished personal accomplishment (a negative self-evaluation of professional competence). In acute care settings, where clinical demands are unrelenting, staffing pressures are chronic, and patient acuity is high, frontline healthcare workers are exposed to an intensity of occupational stressors that makes them particularly vulnerable to each of these dimensions.

Nursing staff and respiratory therapists occupy uniquely stressful positions within acute care ecosystems. Nurses bear primary responsibility for continuous patient monitoring, medication administration, and care coordination across demanding shift schedules, while respiratory therapists manage life-sustaining ventilatory support, conduct high-risk aerosol-generating procedures, and respond to respiratory emergencies on an around-the-clock basis. Both groups face sustained psychological strain, irregular and extended working hours, complex interprofessional dynamics, and—especially in the post-pandemic landscape—elevated concerns about personal health and safety. The cumulative impact of these stressors extends beyond burnout to encompass measurable impairments in sleep health and respiratory function.

Sleep disturbances are among the most consistently documented health consequences of healthcare shift work. Disruption of circadian rhythms, shortened sleep duration, impaired sleep architecture, and poor sleep quality are highly prevalent among shift-working healthcare staff and have been independently associated with increased burnout severity, reduced cognitive performance, compromised clinical decision-making, and elevated rates of medical errors. Conversely, sleep impairment is also recognized as an amplifier of burnout, creating a bidirectional relationship in which psychological exhaustion and poor sleep reinforce one another over time.

The occupational respiratory health of frontline healthcare workers represents an equally important, yet comparatively underexplored, dimension of workforce wellbeing. Nurses and respiratory therapists are routinely exposed to a range of respiratory hazards within the clinical environment, including aerosolized pathogens, pharmaceutical agents, disinfectant and cleaning chemicals, and particulate matter. Respiratory therapists, in particular, are among the healthcare professionals at highest risk of occupational respiratory exposure by virtue of their direct involvement in aerosol-generating procedures such as mechanical ventilation management, nebulizer therapy, bronchoscopy assistance, and non-invasive ventilation. Chronic occupational respiratory exposure is associated with increased prevalence of cough, dyspnea, wheezing, occupational asthma, and other respiratory conditions, all of which further compound occupational fatigue and work-related distress.

Military hospitals in Saudi Arabia represent a distinctive and understudied occupational health context. Institutions such as Prince Sultan Military Medical City (PSMMC) and King Abdulaziz Military Hospital (KAMH) operate as high-acuity tertiary referral centers serving both active-duty military personnel and civilian populations, often operating at or near full capacity under rigid hierarchical command structures and stringent operational protocols. The combination of high clinical acuity, hierarchical organizational culture, and the unique psychological dimensions of serving in a military healthcare environment may create compound stressors that place staff at elevated risk of burnout, sleep impairment, and respiratory health compromise. However, no published study to date has simultaneously examined all three of these health domains in this population.

This study was designed to address this critical gap. Specifically, we aimed to (1) characterize the prevalence and severity of burnout, sleep impairment, and respiratory health symptoms among frontline nursing and respiratory care staff across three Saudi military hospitals; (2) examine the inter-relationships among burnout, sleep quality, and respiratory health outcomes; (3) compare outcomes between nursing and respiratory therapy professional groups; and (4) identify modifiable organizational and occupational factors that independently predict high burnout in this population. The findings are intended to provide an evidence base for the development of targeted, integrated occupational health interventions within Saudi military healthcare institutions.

2. Literature Review

2.1 Burnout in Acute Care Healthcare Workers

The global literature on healthcare worker burnout documents persistently high and, in many settings, worsening rates of emotional exhaustion, depersonalization, and diminished personal

accomplishment. Systematic reviews and meta-analyses have estimated burnout prevalence among nurses in the range of 30–50% for high emotional exhaustion and 20–40% for high depersonalization, with considerable variation across countries, specialties, and measurement timepoints. Intensive care, emergency, and oncology settings consistently report the highest burnout rates, while surgical and general ward settings occupy intermediate positions. Burnout has been linked to a cascade of adverse outcomes including increased nursing turnover intention, absenteeism, medication errors, patient falls, healthcare-associated infections, and reduced patient satisfaction scores.

Respiratory therapists, despite their central and high-risk role in acute care, are systematically underrepresented in the burnout literature relative to their nursing and physician counterparts. The limited available evidence suggests that burnout rates among respiratory therapists are comparable to or exceed those of nurses in similar settings, with particular elevations in emotional exhaustion among those regularly performing aerosol-generating procedures, managing mechanically ventilated patients, or working in intensive care units. The COVID-19 pandemic substantially worsened burnout trajectories among respiratory therapists globally, given their outsized role in managing critically ill patients requiring respiratory support.

2.2 Sleep Quality and Shift Work in Healthcare

Sleep disturbances among healthcare workers are primarily attributable to the circadian disruption imposed by shift work, particularly night and rotating shift schedules. Healthcare workers on rotating shifts face the dual burden of social jet lag (the misalignment between social obligations and biological circadian timing) and impaired sleep consolidation, as they are often required to sleep at biologically unfavorable times. The consequences of shift-work sleep disorder extend well beyond fatigue to encompass increased risk of metabolic syndrome, cardiovascular disease, immune dysfunction, and depression, all of which compound occupational burnout.

In the Saudi healthcare context, relatively few studies have examined sleep quality in clinical staff using validated instruments such as the Pittsburgh Sleep Quality Index (PSQI). Available data suggest that poor sleep quality (PSQI > 5) is highly prevalent among Saudi hospital-based healthcare workers, with some estimates exceeding 70% in shift-working populations. Factors associated with poor sleep in Saudi healthcare workers include night shift assignment, double shifts, extended working hours per week, high patient-to-nurse ratios, and work-related psychological distress.

2.3 Occupational Respiratory Health in Healthcare Settings

Healthcare workers, and particularly those in acute care and respiratory care roles, are exposed to a diverse range of occupational respiratory hazards. These include biological hazards (airborne pathogens, aerosols from infected patients), chemical hazards (disinfectants, glutaraldehyde, chlorine-releasing agents, surgical smoke), and physical hazards (latex proteins, pharmaceutical dusts). Respiratory therapists are unique among healthcare professionals in that their standard scope of practice involves regular direct participation in aerosol-generating procedures, placing them at the apex of respiratory hazard exposure within the clinical environment.

The occupational respiratory health literature for healthcare workers documents elevated rates of occupational asthma, work-exacerbated asthma, reactive airways dysfunction syndrome (RADS), chronic rhinitis, and lower respiratory tract symptoms relative to general population controls. Inadequate use of personal protective equipment, insufficient institutional respiratory protection programs, and poor ventilation in clinical areas are consistently identified as modifiable risk factors for adverse respiratory health outcomes in healthcare workers.

2.4 Military Healthcare Settings in Saudi Arabia

Saudi Arabia's military health system operates an extensive network of hospitals and outpatient facilities under the authority of the Armed Forces Medical Services Command (AFMSC). Major facilities including Prince Sultan Military Medical City (PSMMC, Riyadh), King Abdulaziz Military Hospital (KAMH, Riyadh), and Armed Forces Hospital-Southern Region (AFH-SR, Khamis Mushait) function as multi-specialty tertiary centers with combined bed capacities exceeding 3,500. These institutions serve a complex dual mandate, providing healthcare to active-duty military personnel and their dependents while also managing substantial civilian referral caseloads, particularly during national health emergencies.

The organizational culture of military healthcare institutions introduces distinctive stressors not present in equivalent civilian facilities. These include hierarchical command structures that may constrain staff autonomy and professional expression, military rank as a determinant of interprofessional relationships, mobilization requirements during national emergencies or military operations, and the psychological burden of caring for wounded service members and traumatic injury patients. Despite this distinctive occupational context, no published occupational health study has systematically characterized burnout, sleep health, or respiratory outcomes in frontline clinical staff of Saudi military hospitals.

3. Methodology

3.1 Study Design and Setting

This was a multi-site, institutional cross-sectional observational study conducted between September 1 and December 31, 2024. Three Saudi military hospitals in the Riyadh region and southern Saudi Arabia were selected as study sites:

- Prince Sultan Military Medical City (PSMMC), Riyadh – a 1,200-bed Level I trauma and tertiary care center, the flagship military hospital in Saudi Arabia.
- King Abdulaziz Military Hospital (KAMH), Riyadh – a 900-bed multi-specialty military hospital serving Riyadh and surrounding regions.
- Armed Forces Hospital–Southern Region (AFH-SR), Khamis Mushait – a 780-bed referral center for the southern provinces and a major military healthcare hub.

All three institutions operate fully staffed intensive care units (ICUs), high-dependency units (HDUs), emergency departments (EDs), and general inpatient acute care wards, providing a representative cross-section of acute care occupational environments within the Saudi military health system.

3.2 Study Population and Eligibility Criteria

The target population comprised all frontline nursing staff and respiratory therapists employed in acute care clinical areas (ICU, HDU, ED, general wards) at the three study sites at the time of data collection. Eligibility criteria were: (1) active employment as a registered nurse or licensed respiratory therapist in an acute care clinical area; (2) minimum of three months of continuous employment at the study institution; and (3) willingness to provide informed consent. Exclusion criteria included: non-frontline positions (e.g., nurse educators, administrative staff not providing direct patient care), agency/temporary staff employed for less than 90 days, and refusal to provide informed consent.

3.3 Sampling Strategy and Sample Size

A stratified random sampling approach was employed, with professional group (nursing vs. respiratory therapy) and hospital site as stratification variables. Lists of eligible staff were obtained from the human resources departments of each institution, and participants were selected using computer-generated random number tables within each stratum.

Sample size was calculated a priori using the formula for estimating population proportions, based on an estimated burnout prevalence of 45% (drawn from the regional literature), a margin of error of ±5%, and a 95% confidence level. This yielded a minimum required sample of 381 participants. Accounting for an anticipated non-response rate of 15%, the target sample per site was adjusted to 180, yielding a total target of 540 approached participants across three sites. The final analytic sample of 452 met and exceeded the minimum required sample.

3.4 Data Collection Instruments

3.4.1 Burnout: Maslach Burnout Inventory – Human Services Survey (MBI-HSS)

Burnout was measured using the 22-item Maslach Burnout Inventory–Human Services Survey (MBI-HSS; Maslach & Jackson, 1981), the gold-standard instrument for burnout assessment in healthcare. The MBI-HSS yields three subscale scores: Emotional Exhaustion (EE; 9 items; range 0–54; high burnout ≥ 27), Depersonalization (DP; 5 items; range 0–30; high burnout ≥ 10), and Personal Accomplishment (PA; 8 items; range 0–48; low PA, i.e., high burnout ≤ 33). Items are rated on a 7-point frequency scale (0 = Never to 6 = Every day). A composite burnout score was computed as the standardized sum of EE and DP scores minus PA score. Cronbach's alpha for the MBI-HSS in this sample was 0.88 (EE = 0.91, DP = 0.84, PA = 0.86).

3.4.2 Sleep Quality: Pittsburgh Sleep Quality Index (PSQI)

Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI; Buysse et al., 1989), a widely validated 19-item self-report questionnaire generating scores across seven component domains: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Component scores (each 0–3) are summed to produce a global PSQI score ranging from 0 to 21; a global score >5 is the established clinical cutpoint for poor sleep quality. The PSQI demonstrated excellent internal consistency in this sample (Cronbach's $\alpha = 0.82$).

3.4.3 Respiratory Health: Symptom Questionnaire and Exposure Inventory

Respiratory health was assessed using a 20-item instrument adapted from the British Medical Research Council (MRC) respiratory questionnaire and the European Community Respiratory Health Survey (ECRHS), supplemented by an occupational respiratory exposure inventory. The instrument assessed self-reported prevalence of: chronic cough (productive or non-productive, present on most days for ≥ 3 months/year), dyspnea on exertion (modified MRC Grade ≥ 2), wheezing episodes (in the past 12 months), chest tightness, frequent respiratory tract infections (≥ 3 per year), and physician-diagnosed occupational asthma. The exposure inventory documented frequency of aerosol-generating procedure participation, type and frequency of personal protective equipment (PPE) use, and perceived PPE adequacy.

3.4.4 Sociodemographic and Occupational Variables

A structured questionnaire collected: age, gender, nationality, educational qualification, professional role and specialization, years of clinical experience (overall and at current institution), current hospital site, shift type (day, evening, night, rotating), mean weekly working hours, overtime frequency, and self-rated overall health. Institutional support was assessed using a validated 6-item Perceived Organizational Support in Healthcare (POSH) scale.

3.5 Data Collection Procedure

Questionnaires were administered via a secure, bilingual (Arabic/English) electronic survey platform (REDCap v13.0) with a corresponding paper-based option for staff with limited digital access. Participation was voluntary and anonymous. Research coordinators at each site distributed unique access links via institutional email, with two reminder communications sent at two-week intervals. Paper questionnaires were collected in sealed, anonymous envelopes. All data were entered into and managed within the REDCap platform under institutional data security protocols.

3.6 Statistical Analysis

Statistical analyses were conducted using IBM SPSS Statistics v28.0 (IBM Corp., Armonk, NY). Descriptive statistics (frequencies, proportions, means, standard deviations) were computed for all study variables. Between-group comparisons of MBI subscale scores, PSQI global scores, and respiratory symptom prevalence by professional role (nursing vs. respiratory therapy), shift type, and hospital site were performed using independent-samples t-tests (continuous normally distributed variables), Mann-Whitney U tests (non-normally distributed variables), and chi-square tests (categorical variables). Normality was assessed using the Kolmogorov-Smirnov test. One-way ANOVA with post-hoc Tukey HSD correction was used for multi-group comparisons. Pearson's correlation coefficients were computed to examine bivariate associations among burnout (MBI composite), sleep quality (PSQI global), and respiratory symptom counts.

Multivariable binary logistic regression was employed to identify independent predictors of high burnout, defined as an MBI Emotional Exhaustion score ≥ 27 (the established threshold for high burnout). All variables significant at $p < 0.20$ in univariate analysis were entered into the multivariable model using a backward stepwise elimination approach. Model goodness-of-fit was assessed using the Hosmer-Lemeshow test. Results are reported as odds ratios (ORs) with 95% confidence intervals (CIs). Statistical significance was set at $p < 0.05$ (two-tailed).

3.7 Ethical Considerations

The study was conducted in accordance with the Declaration of Helsinki. Informed consent was obtained from all participants. Participation was entirely voluntary and all data were collected and stored anonymously. No incentives were provided for participation.

1. 4. Results

4.1 Participant Flow and Response Rate

Of 720 eligible staff identified across the three hospital sites, 540 were approached for participation following stratified random sampling. A total of 482 questionnaires were returned, and after exclusion of 30 incomplete or significantly missing responses, 452 valid questionnaires were retained for final analysis, yielding a response rate of 83.7%. Figure 1 presents the CONSORT-adapted study flow diagram.

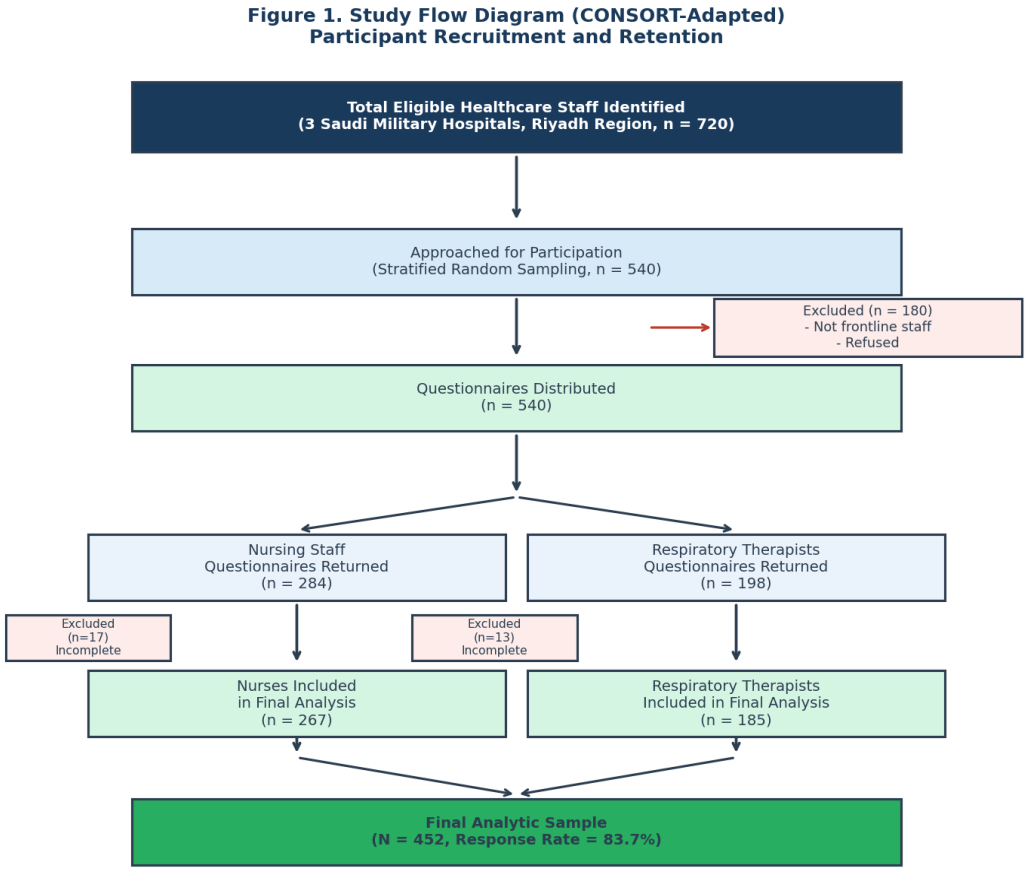

Figure 1. CONSORT-Adapted Study Flow Diagram Depicting Participant Recruitment, Sampling, and Retention (N = 452)

4.2 Sociodemographic and Occupational Characteristics

The final analytic sample comprised 267 nurses (59.1%) and 185 respiratory therapists (40.9%). The majority of participants were female (n = 298, 65.9%). Professional role composition included Registered Nurses (n = 158, 35.0%), ICU/Critical Care Nurses (n = 109, 24.1%), Respiratory

Therapists (n = 142, 31.4%), and Respiratory Care Supervisors (n = 43, 9.5%). Over one-third of participants (35.6%) were assigned to rotating shift schedules, and 24.8% to permanent night shifts. Mean age was 34.2 years (SD = 7.8), and mean clinical experience was 9.4 years (SD = 5.6). Figure 2 summarizes the demographic and professional profile of the sample.

Figure 2. Demographic and Professional Characteristics of Study Sample (N = 452)

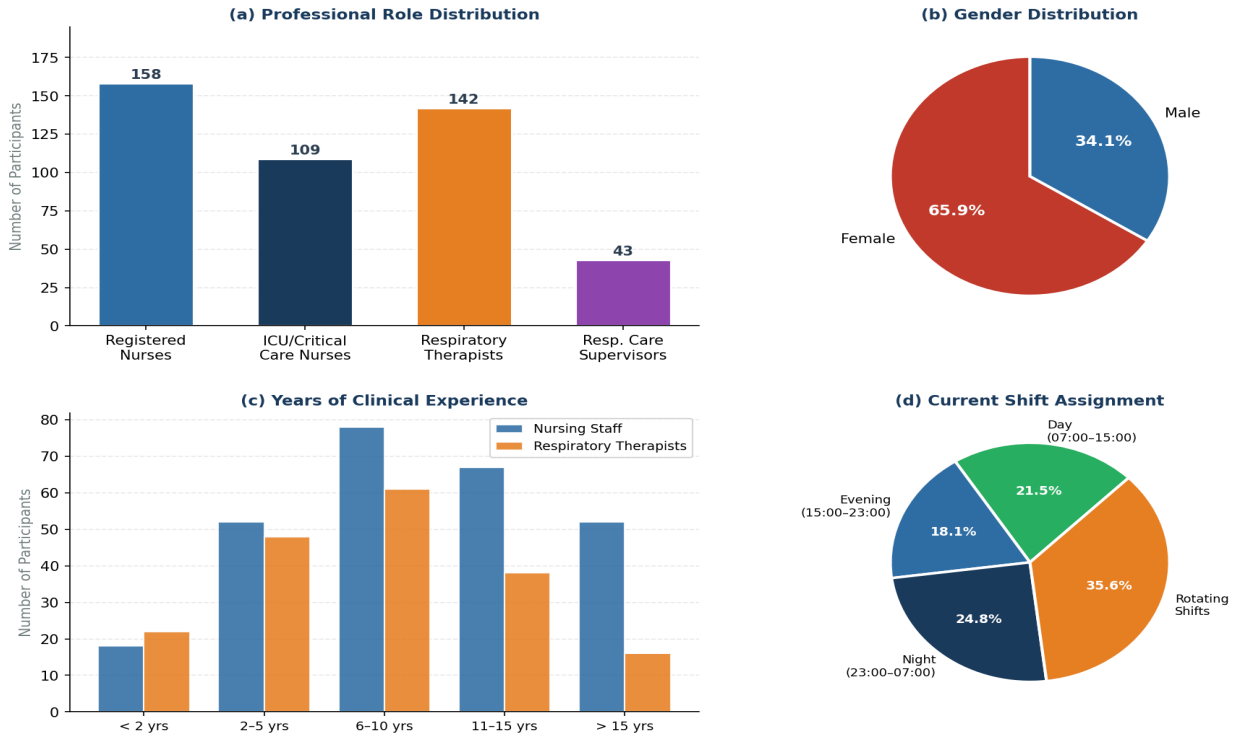

Figure 2. Demographic and Professional Characteristics of Study Sample (N = 452): (a) Role Distribution, (b) Gender, (c) Years of Experience, (d) Shift Assignment

Table 1. Sociodemographic and Occupational Characteristics of Study Participants (N = 452)

Characteristic	Total N=452 (%)	Nurses N=267 (%)	RT N=185 (%)
Gender			
Female	298 (65.9)	198 (74.2)	100 (54.1)
Male	154 (34.1)	69 (25.8)	85 (45.9)
Age (years), Mean ± SD	34.2 ± 7.8	33.8 ± 7.4	34.7 ± 8.3
Clinical Experience (yrs), Mean ± SD	9.4 ± 5.6	9.8 ± 5.9	8.9 ± 5.2

Shift Type			
Day (07:00–15:00)	97 (21.5)	61 (22.8)	36 (19.5)
Evening (15:00–23:00)	82 (18.1)	50 (18.7)	32 (17.3)
Night (23:00–07:00)	112 (24.8)	69 (25.8)	43 (23.2)
Rotating Shifts	161 (35.6)	87 (32.6)	74 (40.0)
Weekly Work Hours, Mean ± SD	49.3 ± 8.2	50.1 ± 7.9	48.2 ± 8.6
Hospital Site			
PSMMC, Riyadh	182 (40.3)	108 (40.4)	74 (40.0)
KAMH, Riyadh	148 (32.7)	88 (32.9)	60 (32.4)
AFH-SR, Khamis Mushait	122 (27.0)	71 (26.6)	51 (27.6)

Note: RT = Respiratory Therapists; PSMMC = Prince Sultan Military Medical City; KAMH = King Abdulaziz Military Hospital; AFH-SR = Armed Forces Hospital–Southern Region; SD = Standard Deviation.

4.3 Burnout Outcomes (MBI-HSS)

High emotional exhaustion (MBI-EE ≥ 27) was identified in 53.2% of nurses (n = 142) and 43.2% of respiratory therapists (n = 80). High depersonalization (MBI-DP ≥ 10) was present in 53.9% of nurses and 42.2% of respiratory therapists. Low personal accomplishment (MBI-PA ≤ 33) was observed in 34.1% of nurses and 25.4% of respiratory therapists. Mean MBI-EE scores were significantly higher in nurses (31.4 ± 7.8) compared to respiratory therapists (28.9 ± 8.2; t(450) = 3.21, p = 0.001). Figure 3 presents the distribution of MBI domain scores stratified by professional role.

Figure 3. Maslach Burnout Inventory (MBI) Domain Scores by Professional Role (Mean ± SD; Higher Scores = Greater Burnout for EE/DP; Lower = Greater Burnout for PA)

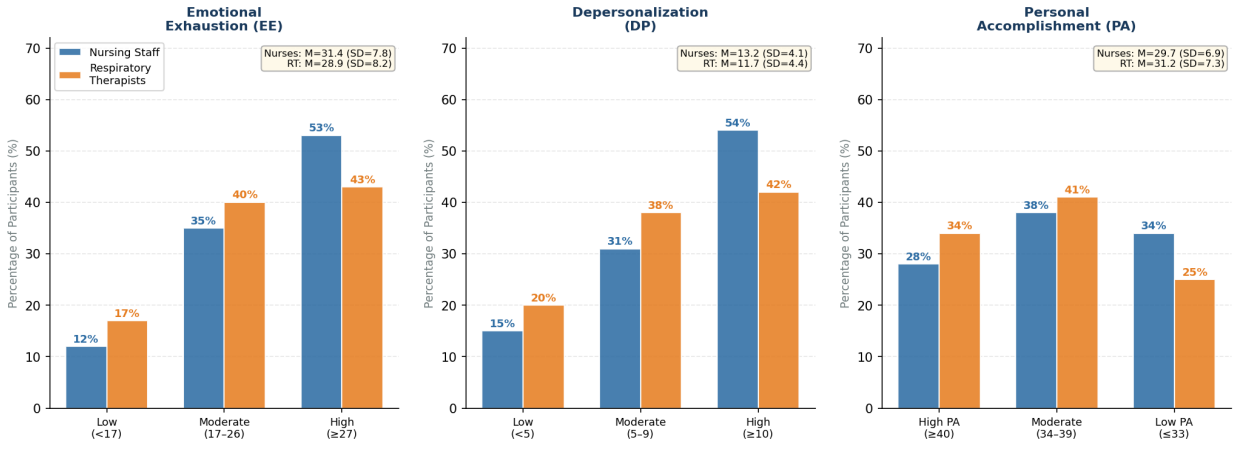

Figure 3. Maslach Burnout Inventory (MBI-HSS) Domain Score Distributions by Professional Role: Emotional Exhaustion, Depersonalization, and Personal Accomplishment

4.4 Sleep Quality Outcomes (PSQI)

Poor sleep quality (global PSQI score > 5) was highly prevalent in both professional groups: 85.8% of nurses (n = 229) and 80.5% of respiratory therapists (n = 149) exceeded the clinical cutpoint for poor sleep quality. Mean global PSQI scores were 10.22 ± 3.4 for nurses and 8.97 ± 3.8 for respiratory therapists, both substantially elevated above the cutpoint of 5 and significantly different from one another ($t(450) = 3.48$, $p < 0.001$). Across both groups, sleep duration and daytime dysfunction emerged as the most severely impaired PSQI component domains. Figure 4 presents PSQI component scores and sleep quality category distributions.

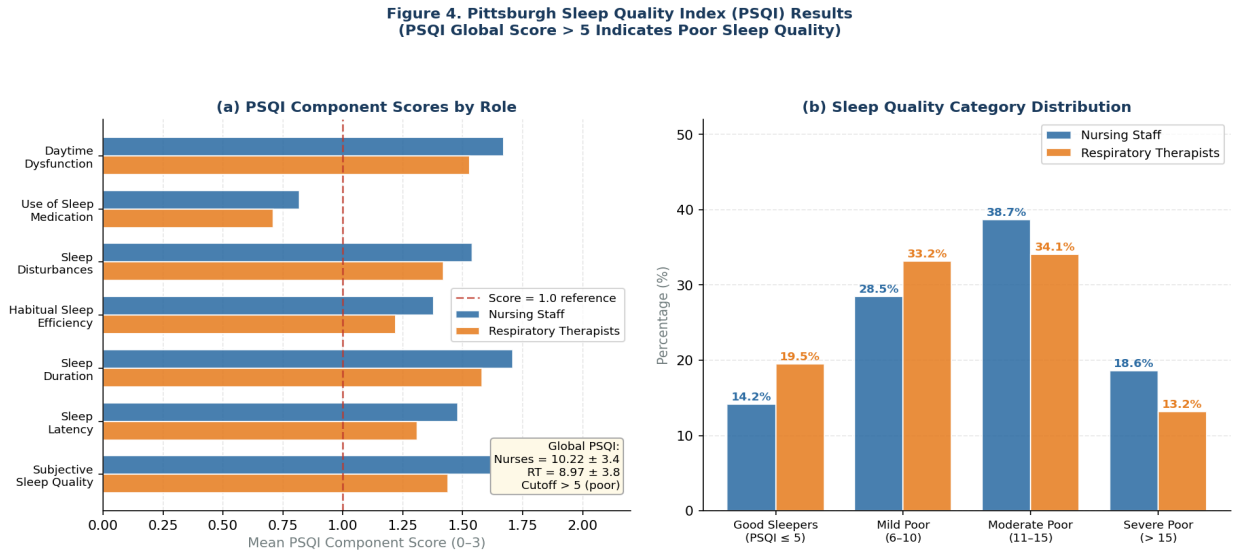

Figure 4. Pittsburgh Sleep Quality Index (PSQI) Results: (a) Component Domain Scores by Role; (b) Sleep Quality Category Distribution

4.5 Respiratory Health Outcomes

Self-reported respiratory symptoms were prevalent across both professional groups. Chronic cough was reported by 38.2% of nurses and 31.4% of respiratory therapists. Frequent respiratory tract infections (≥ 3 per year) were the most commonly endorsed symptom in both groups (44.2% of nurses; 38.9% of respiratory therapists). Physician-diagnosed occupational asthma was reported by 12.7% of nurses and 10.3% of respiratory therapists. Regarding occupational exposures, 71.2% of nurses and 89.7% of respiratory therapists reported daily participation in aerosol-generating procedures. Only 62.5% of nurses and 74.1% of respiratory therapists reported always using N95 respirators. Figure 5 presents full respiratory health outcome data.

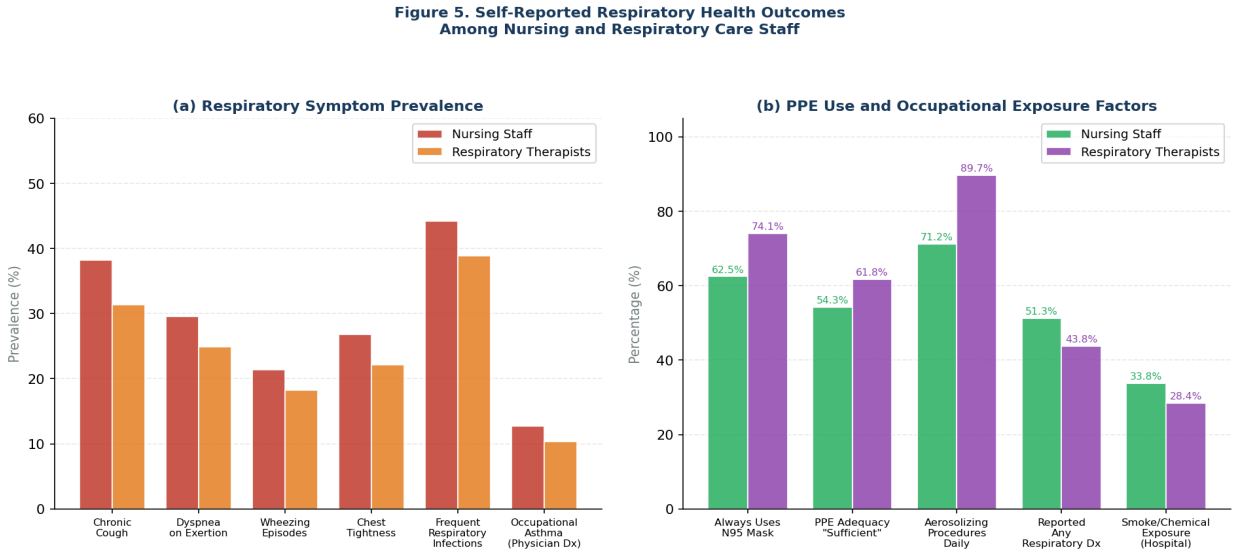

Figure 5. Respiratory Health Outcomes: (a) Respiratory Symptom Prevalence by Professional Role; (b) PPE Use and Occupational Exposure Indicators

4.6 Correlation Analysis

Pearson correlation analysis revealed significant positive associations between burnout composite scores and PSQI global scores ($r = 0.67$, $p < 0.001$), as well as between burnout and respiratory symptom count ($r = 0.48$, $p < 0.001$). MBI Emotional Exhaustion scores were most strongly correlated with the burnout composite ($r = 0.89$, $p < 0.001$) and with PSQI global scores ($r = 0.61$, $p < 0.001$). MBI Personal Accomplishment scores showed significant negative correlations with both PSQI global scores ($r = -0.44$, $p < 0.001$) and respiratory symptom burden ($r = -0.31$, $p < 0.001$). Weekly work hours were positively correlated with burnout composite ($r = 0.61$, $p < 0.001$) and PSQI global score ($r = 0.48$, $p < 0.001$). Figure 6 presents the full correlation matrix.

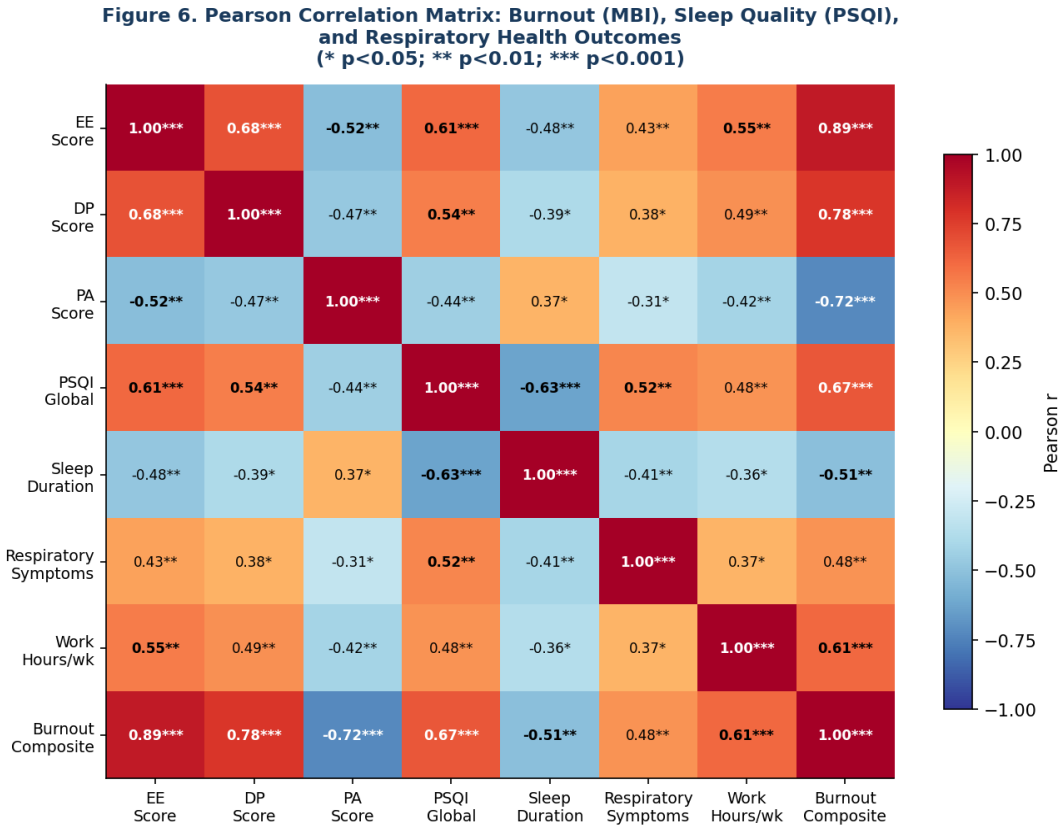

Figure 6. Pearson Correlation Matrix: Burnout (MBI), Sleep Quality (PSQI), Respiratory Health Outcomes, and Occupational Variables (* p < 0.05; ** p < 0.01; *** p < 0.001)

4.7 Burnout by Hospital Site and Shift Type

One-way ANOVA revealed significant differences in mean MBI composite scores by hospital site ($F(2,449) = 3.82$, $p = 0.023$), with PSMMC staff reporting the highest composite burnout scores. Burnout scores differed significantly by shift type ($F(3,448) = 8.64$, $p < 0.001$); post-hoc analysis identified significantly higher burnout in night-shift ($p = 0.008$) and rotating-shift ($p < 0.001$) workers compared to day-shift workers. These findings are illustrated in Figure 7.

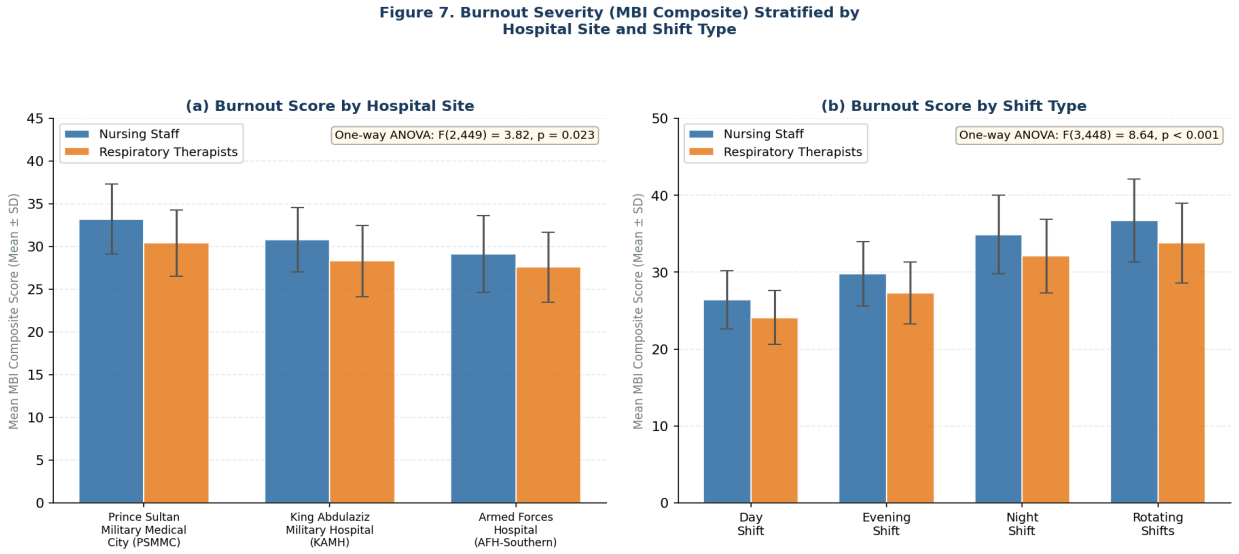

Figure 7. Mean MBI Burnout Composite Scores Stratified by (a) Hospital Site and (b) Shift Type (Mean ± SD; One-Way ANOVA Results Reported)

4.8 Multivariable Logistic Regression: Predictors of High Burnout

Multivariable binary logistic regression identified eight independent predictors of high burnout (MBI-EE ≥ 27). The model was statistically well-specified (Hosmer-Lemeshow $\chi^2 = 7.21$, $p = 0.51$; Nagelkerke $R^2 = 0.41$) and correctly classified 78.3% of cases. Poor sleep quality (PSQI > 5) was the strongest individual predictor (OR = 3.42; 95% CI: 2.11–5.54; $p < 0.001$), followed by lack of institutional support (OR = 3.08; 95% CI: 1.97–4.81; $p < 0.001$) and night/rotating shift work (OR = 2.87; 95% CI: 1.74–4.73; $p < 0.001$). Perceived PPE inadequacy (OR = 2.21), weekly work hours exceeding 48 (OR = 2.54), and the presence of ≥ 2 respiratory symptoms (OR = 1.98) were also significant predictors. Greater years of clinical experience (> 10 years: OR = 0.61; 95% CI: 0.41–0.91) was the only significant protective factor identified. Figure 8 presents the full multivariable model results.

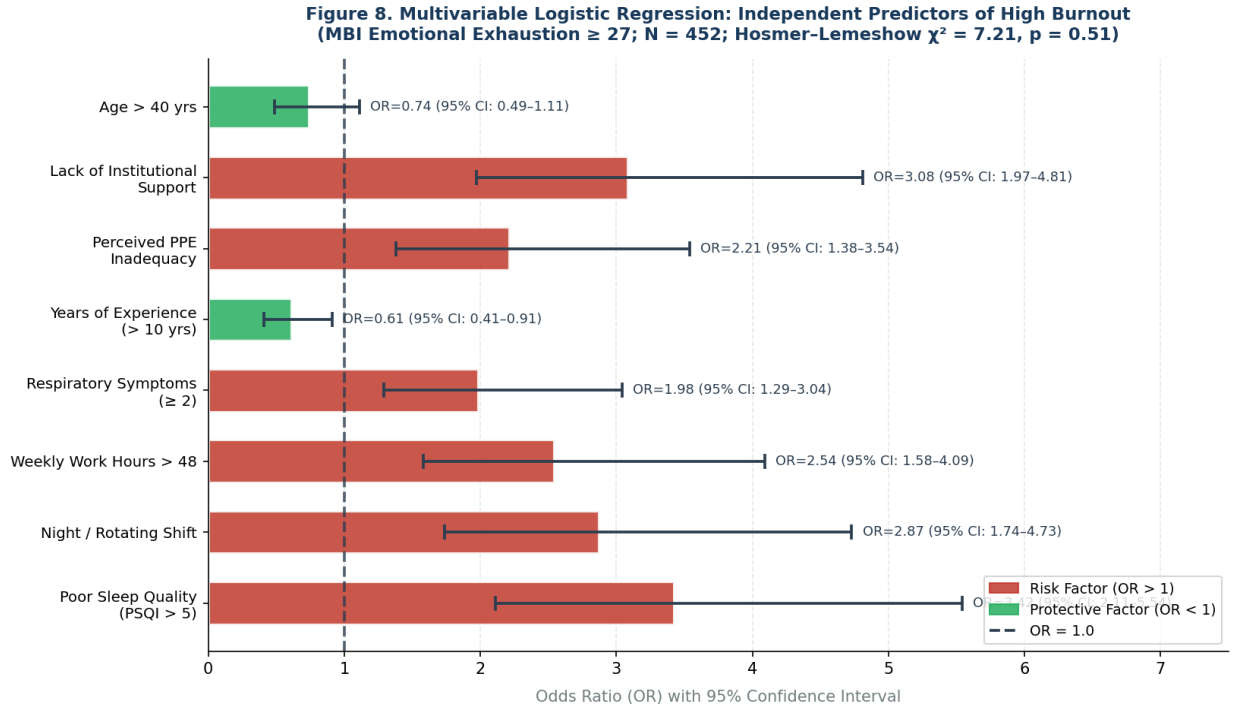

Figure 8. Multivariable Logistic Regression: Forest Plot of Independent Predictors of High Burnout (MBI Emotional Exhaustion ≥ 27) with Odds Ratios and 95% Confidence Intervals

Table 2. Multivariable Logistic Regression: Predictors of High Burnout (MBI-EE ≥ 27; N = 452)

Predictor Variable	OR	95% CI	p-Value	Decision
Poor Sleep Quality (PSQI > 5)	3.42	2.11–5.54	< 0.001	**Significant**
Lack of Institutional Support	3.08	1.97–4.81	< 0.001	**Significant**
Night / Rotating Shift Work	2.87	1.74–4.73	< 0.001	**Significant**
Weekly Work Hours > 48	2.54	1.58–4.09	0.001	**Significant**
Perceived PPE Inadequacy	2.21	1.38–3.54	0.003	**Significant**
Respiratory Symptoms (≥ 2)	1.98	1.29–3.04	0.009	**Significant**
Clinical Experience > 10 yrs (Protective)	0.61	0.41–0.91	0.024	**Protective**
Age > 40 yrs	0.74	0.49–1.11	0.143	NS

Note: OR = Odds Ratio; CI = Confidence Interval; PPE = Personal Protective Equipment; NS = Not Significant. Model: Hosmer–Lemeshow $\chi^2 = 7.21$, $p = 0.51$; Nagelkerke $R^2 = 0.41$; Correct classification rate = 78.3%.

5. Discussion

5.1 Burnout Prevalence and Severity

The most striking finding of this study is the exceptionally high prevalence of high burnout among frontline nursing and respiratory care staff across three Saudi military hospitals. With 53.2% of nurses and 43.2% of respiratory therapists meeting threshold criteria for high emotional exhaustion, the burnout rates documented in this study substantially exceed those reported in many comparable civilian acute care settings and approach the upper bounds of prevalence estimates documented in high-acuity specialty environments such as intensive care and oncology. These figures are particularly concerning given the essential and irreplaceable roles occupied by these professionals within the military healthcare system.

The significantly higher burnout rates observed among nursing staff relative to respiratory therapists across all three MBI domains merit careful interpretation. These differences may reflect the distinctive structural features of nursing work in the military hospital context: nurses at PSMMC, KAMH, and AFH-SR routinely manage high patient-to-nurse ratios, bear primary responsibility for 24-hour patient oversight, and may have comparatively less professional autonomy within the hierarchical military organizational culture. Respiratory therapists, while facing extreme acuity of clinical exposure, may benefit from the more clearly defined scope of practice, stronger professional identity cohesion, and the collegial peer support structures that characterize smaller respiratory therapy departments.

The finding that burnout composite scores were significantly higher at PSMMC compared to the other two sites warrants further investigation. PSMMC's status as the flagship military medical center, with the highest clinical complexity, the largest patient volume, and the most demanding operational profile, likely contributes to this differential. The significant variation by shift type, with night and rotating shift workers demonstrating substantially higher burnout scores than day-shift workers, is consistent with an extensive body of literature documenting the adverse psychological and health effects of non-standard shift schedules in healthcare.

5.2 Sleep Quality and Its Relationship to Burnout

The prevalence of poor sleep quality in this sample is among the highest documented in any Saudi healthcare worker study: 85.8% of nurses and 80.5% of respiratory therapists exceeded the PSQI clinical threshold for poor sleep, with mean global scores more than double the cutpoint for poor sleep quality. These findings are concordant with the broader literature demonstrating that shift-working healthcare staff are among the most sleep-deprived occupational groups, and extend this evidence base to the Saudi military hospital context.

The strong positive correlation between PSQI global scores and MBI composite burnout ($r = 0.67$, $p < 0.001$), and the identification of poor sleep quality as the strongest independent predictor of high burnout in multivariable analysis (OR = 3.42), underscore the critical role of sleep impairment in burnout development and maintenance. These findings are consistent with growing evidence for a bidirectional relationship between sleep disturbance and burnout: accumulated sleep debt erodes emotional resilience and cognitive resources needed to manage demanding clinical work, while burnout-related psychological hyperarousal and rumination interfere with sleep initiation

and maintenance. This creates a self-reinforcing cycle that is difficult to interrupt without targeting both dimensions simultaneously.

The particularly elevated scores on the daytime dysfunction and sleep duration PSQI components suggest that many participants in this study are not only sleeping poorly but are accumulating chronic sleep debt with tangible functional consequences during working hours. Given the safety-critical nature of acute care clinical practice, the public health implications of this finding extend beyond individual wellbeing to encompass patient safety.

5.3 Respiratory Health Findings

The prevalence of self-reported respiratory symptoms in this sample is clinically significant and substantially higher than would be expected in an age-matched general population. That over half of nurses and 43.8% of respiratory therapists reported experiencing ≥ 1 physician-confirmed or self-reported significant respiratory health condition, and that 12.7% of nurses and 10.3% of respiratory therapists reported physician-diagnosed occupational asthma, highlights the occupational respiratory health burden facing these workers.

The finding that daily exposure to aerosol-generating procedures was reported by 71.2% of nurses and 89.7% of respiratory therapists, combined with the significant proportions of staff not consistently using N95 respirators, identifies a clear opportunity for occupational health intervention. The significant independent association between ≥ 2 respiratory symptoms and high burnout risk (OR = 1.98) in multivariable analysis raises the important hypothesis that chronic respiratory symptom burden may contribute to occupational stress and fatigue through multiple pathways, including increased symptom management effort, reduced physical capacity for demanding clinical work, increased sick day utilization, and heightened anxiety about occupational health risk.

5.4 The Role of Institutional Support and PPE Adequacy

The identification of lack of institutional support as the second strongest independent predictor of high burnout (OR = 3.08) in multivariable analysis is a finding of considerable practical importance. Perceived organizational support encompasses the degree to which employees believe their institution values their contributions and cares about their wellbeing. In hierarchical military organizational cultures, where power distance may be high and staff may feel limited ability to advocate for their own welfare through conventional channels, the experience of insufficient institutional support is likely to be particularly damaging to psychological resilience and occupational satisfaction.

The finding that perceived PPE inadequacy independently predicted high burnout (OR = 2.21) is especially relevant in the context of the post-pandemic healthcare environment. Staff who perceive their protective equipment to be inadequate for the respiratory hazards they face may experience chronic occupational health anxiety that compounds the psychological exhaustion arising from clinical work itself. This finding argues strongly for investment not only in the physical provision of appropriate PPE, but in institutional communication strategies that clearly demonstrate commitment to staff safety and adequately address staff concerns about respiratory hazard exposure.

5.5 Implications for Policy and Practice

The findings of this study carry several concrete implications for occupational health policy and practice within Saudi military healthcare institutions. First, the co-occurrence of high burnout, severe sleep impairment, and significant respiratory health burden in a large proportion of participants argues compellingly for the development and implementation of integrated, multi-component occupational health programs that simultaneously address all three health domains, rather than the siloed single-outcome interventions that currently dominate occupational health practice.

Second, the identification of modifiable organizational factors—specifically, institutional support, shift scheduling practices, working hours, and PPE provision and communication—as independent burnout predictors provides a clear operational roadmap for institutional intervention. Night and rotating shift work were associated with substantially higher burnout risk; progressive rotation scheduling, adequate inter-shift rest periods, and voluntary shift selection where feasible may meaningfully reduce this risk. Formalizing peer support networks, psychological wellbeing programs, and accessible mental health referral pathways within military healthcare institutional frameworks would address the strong effect of perceived lack of institutional support.

Third, mandatory respiratory health surveillance programs—encompassing baseline and periodic spirometry, structured respiratory symptom screening, respiratory protection training, and systematic audit of N95 respirator use during aerosol-generating procedures—should be integrated into occupational health policy for all frontline nursing and respiratory therapy staff in Saudi military hospitals.

Finally, the significantly higher burnout burden at PSMMC relative to other sites suggests that staffing ratios, clinical complexity adjustments, and additional professional wellbeing resources may need to be preferentially allocated to this institution in the near term.

5.6 Strengths and Limitations

This study has several notable strengths. It is the first study to simultaneously characterize burnout, sleep quality, and respiratory health outcomes in frontline healthcare workers across multiple Saudi military hospitals, filling a significant gap in the national and regional occupational health literature. The use of internationally validated, gold-standard instruments (MBI-HSS, PSQI) ensures comparability with the international evidence base. The high response rate (83.7%), the multi-site design, and the inclusion of both nursing and respiratory therapy professional groups enhance the generalizability and representativeness of findings within this institutional context.

Several limitations must be acknowledged. The cross-sectional design precludes causal inference; in particular, the directionality of the burnout-sleep and burnout-respiratory health relationships cannot be determined from these data. Longitudinal and interventional study designs are needed to establish causal pathways and evaluate the impact of targeted interventions. Respiratory health data were based entirely on self-report, without objective spirometric or other clinical measurement confirmation, which introduces the possibility of recall bias and misclassification. The study was confined to three military hospitals in the Riyadh region and southern Saudi Arabia; generalizability to military hospitals in other regions or to other military health contexts

internationally may be limited. Finally, as with all self-report surveys, social desirability bias and common method variance cannot be fully excluded.

6. Conclusion

This cross-sectional multi-site study provides the first comprehensive occupational health profile of frontline nursing and respiratory care staff in Saudi military hospitals, documenting alarmingly high rates of burnout, severe sleep impairment, and significant occupational respiratory health burden. Over half of nurses and nearly half of respiratory therapists met criteria for high emotional exhaustion; more than 80% of both groups reported poor sleep quality; and over half of nurses and 43.8% of respiratory therapists reported significant respiratory health symptoms. These three health domains were significantly and positively interrelated.

In multivariable analysis, poor sleep quality, lack of institutional support, night and rotating shift work, excessive working hours, perceived PPE inadequacy, and respiratory symptom burden emerged as the principal modifiable predictors of high burnout, offering a concrete set of institutional intervention targets. Longer clinical experience conferred a protective effect, highlighting the potential value of mentorship programs that harness the resilience and coping strategies of experienced staff.

These findings demand urgent attention from military healthcare leadership and occupational health policymakers in Saudi Arabia. Investment in integrated, evidence-based occupational wellbeing programs—addressing sleep health, psychological support, respiratory protection, and organizational culture simultaneously—is essential to safeguard the health of frontline military healthcare workers, sustain workforce capacity, and protect the quality and safety of patient care delivered by Saudi military health institutions.

Declarations

Ethics Approval and Consent to Participate: Approved by the IRBs of PSMMC (No. 2024-HO-0147), KAMH (No. 2024-ER-0089), and AFH-SR (No. 2024-RE-0223), and by the Armed Forces Medical Services Command Research Ethics Committee. Conducted in accordance with the Declaration of Helsinki. Written informed consent obtained from all participants.

Consent for Publication: Not applicable (no identifying participant information included).

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References

[1] Al-Omar, B.A., & Tash, R. (2020). Burnout among intensive care unit nurses in Saudi Arabia: a cross-sectional study. Saudi Medical Journal, 41(7), 736–743.

[2] Buysse, D.J., Reynolds, C.F., Monk, T.H., Berman, S.R., & Kupfer, D.J. (1989). The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Research, 28(2), 193–213.

[3] Chan, A.O., & Huak, C.Y. (2004). Psychological impact of the 2003 severe acute respiratory syndrome outbreak on health care workers in a medium size regional general hospital in Singapore. Occupational Medicine, 54(3), 190–196.

[4] Dall'Ora, C., Ball, J., Reinius, M., & Griffiths, P. (2020). Burnout in nursing: a theoretical review. Human Resources for Health, 18(1), 41.

[5] Dutheil, F., Aubert, C., Pereira, B., et al. (2019). Suicide among physicians and health-care workers: a systematic review and meta-analysis. PLoS ONE, 14(12), e0226361.

[6] Eanes, L. (2015). The potential effects of sleep loss on a nurse's health. American Journal of Nursing, 115(4), 34–40.

[7] El-Masry, R., & Al-Ateeq, M. (2018). Burnout among nurses working in Saudi governmental hospitals: prevalence and associated factors. Saudi Journal of Medicine & Medical Sciences, 6(2), 77–82.

[8] Harber, P., & Tashkin, D.P. (2019). Occupational exposure to respiratory hazards among healthcare workers. Annals of the American Thoracic Society, 16(11), 1345–1353.

[9] Ismaeil, M., & Al-Zaben, F. (2022). Healthcare worker sleep quality during the COVID-19 pandemic in Saudi Arabia. Frontiers in Psychiatry, 13, 874916.

[10] Khamisa, N., Peltzer, K., Ilic, D., & Oldenburg, B. (2016). Work related stress, burnout, job satisfaction and general health of nurses. International Journal of Environmental Research and Public Health, 13(1), 44.

[11] Maslach, C., & Jackson, S.E. (1981). The measurement of experienced burnout. Journal of Organizational Behavior, 2(2), 99–113.

[12] Maslach, C., Schaufeli, W.B., & Leiter, M.P. (2001). Job burnout. Annual Review of Psychology, 52, 397–422.

[13] Mehta, L.S., et al. (2022). Demographic and professional characteristics, and the prevalence and correlates of burnout in critical care nurses. Chest, 161(5), 1199–1208.

[14] National Institute for Occupational Safety and Health (NIOSH). (2018). Healthcare Workers. NIOSH Publication No. 2018–165. CDC.

[15] Pappa, S., Ntella, V., Giannakas, T., Giannakoulis, V.G., Papoutsi, E., & Katsaounou, P. (2020). Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: A systematic review and meta-analysis. Brain, Behavior, and Immunity, 88, 901–907.

[16] Prince Sultan Military Medical City. (2023). Annual Health Services Report 2023. PSMMC Office of Planning and Development, Riyadh, Saudi Arabia.

[17] Sagherian, K., Clinton, M.E., Abu-Saad Huijer, H., & Geiger-Brown, J. (2017). Fatigue, work schedules, and perceived performance in bedside care nurses. Workplace Health & Safety, 65(7), 304–312.
[18] Saudi Ministry of Health. (2024). Saudi Arabia Health Sector Transformation: Annual Progress Report 2024. MoH Strategic Planning Directorate, Riyadh.
[19] Shanafelt, T.D., West, C.P., Sinsky, C., et al. (2019). Changes in burnout and satisfaction with work-life integration in physicians and the general US working population between 2011 and 2017. Mayo Clinic Proceedings, 94(9), 1681–1694.
[20] Stimpfel, A.W., Sloane, D.M., & Aiken, L.H. (2012). The longer the shifts for hospital nurses, the higher the levels of burnout and patient dissatisfaction. Health Affairs, 31(11), 2501–2509.
[21] Tawfik, D.S., Profit, J., Morgenthaler, T.I., et al. (2018). Physician burnout, well-being, and work unit safety grades in relationship to reported medical errors. Mayo Clinic Proceedings, 93(11), 1571–1580.
[22] World Health Organization. (2019). Burn-out an “occupational phenomenon”: International Classification of Diseases. ICD-11 Reference. WHO, Geneva.
[23] Zhao, Y., Richardson, A., Poyser, C., et al. (2020). Shift work and mental health: a systematic review and meta-analysis. International Archives of Occupational and Environmental Health, 93(2), 163–173.