

**ORIGINAL RESEARCH:
EMPIRICAL RESEARCH - QUANTITATIVE**

Did rest breaks help with acute fatigue among nursing staff on 12-h shifts during the COVID-19 pandemic? A cross-sectional study

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Abstract

Aim: This study aimed to explore whether 30-min rest breaks were as effective at lowering acute fatigue among 12-h shift hospital nursing staff who cared for patients with COVID-19 as among those who did not.

Design: The study was cross-sectional in design.

Methods: Data from the SAFE-CARE study collected online between May and June 2020 were used. A subsample ($N = 338$) comprised of nursing staff who reported working 12-h shifts, and providing direct patient care in hospitals was used in this study. Data on socio-demographics, work and rest breaks, and subjective measures of fatigue, psychological distress, sleep and health were used. Hierarchical multiple linear regression followed by stratified analyses was conducted to explore the relationships between rest breaks and acute fatigue among nursing staff groups with and without COVID-19 patient care.

Results: The sample, on average, had high acute fatigue. Around 72% reported providing care to patients with COVID-19, and 71% reported taking rest breaks 'sometimes', 'often' or 'always'. In the group that cared for patients with COVID-19, there was no significant relationship between rest breaks and acute fatigue ($p = .507$). In the group that cared for patients hospitalized for other reasons, rest breaks were associated with lower acute fatigue ($p = .010$).

Conclusion: Our findings showed both the importance and inadequacy of rest breaks in reducing acute fatigue. The process of within-work recovery is complex, and routine rest breaks should be facilitated by nursing management on hospital units during and after the COVID-19 pandemic.

Impact: Rest breaks may present an effective strategy in lowering fatigue. Although rest breaks were not associated with less fatigue among staff caring for patients with COVID-19, other co-workers experienced some fatigue recovery. For frontline nursing staff, routine rest breaks are encouraged, and a systematic evaluation pertaining the sufficiency of rest breaks during high work demands in future research is needed.

KEYWORDS

breaks, COVID-19, fatigue, nurses, recovery, rest

1 | INTRODUCTION

Since its declaration in March 2020, the COVID-19 pandemic has imposed hardship and out of the ordinary working conditions and amplified work-related fatigue among hospital nursing staff worldwide (International Council of Nurses, 2020; Maben & Bridges, 2020). Although some degree of fatigue is expected and normal during work hours, fatigue becomes a safety risk when it persists at high levels over a working shift. More than two decades of research on nurses from different hospital care units has found that work-related fatigue increases the incidence of missed care and medical errors (Barker & Nussbaum, 2011; Olds & Clarke, 2010; Rogers et al., 2004). Work-related fatigue also predicts nurses' long-term sickness absences from work (Roelen et al., 2013; Sagherian et al., 2017) and nurses' intention to leave the workplace or the profession (Søbstad et al., 2020; Tei-Tominaga & Miki, 2010).

In the midst of the COVID-19 pandemic, studies from different parts of the globe began reporting on alarming levels of fatigue in healthcare. Both healthcare staff on the frontline and those who were providing care for hospitalized patients for non-COVID-19-related reasons experienced high levels of fatigue (Hou et al., 2020; Sagherian et al., 2020; Zhan et al., 2020). As such, during the pandemic, fatigue management during extended shifts remains a challenge, and this is likely to continue as the pandemic subsides.

One frequently recommended within-work recovery strategy is the use of short rest breaks by staff. It remains unclear to what extent these rest breaks help with fatigue recovery for nursing staff working on hospital units during the COVID-19 pandemic. They may be too small of a 'dose' to lower the high acute fatigue for nursing staff delivering patient care under difficult working conditions (Sonntag, 2018). This study aimed to address this gap and, in turn, provide evidence for rest break recommendations to reduce nurses' fatigue.

2 | BACKGROUND

Acute fatigue is a daily expected occurrence that develops and accumulates during working hours in response to physical and cognitive activity efforts. This type of fatigue is short-lived, ideally dissipating with frequent rests and sufficient sleep outside of work hours (Beurskens et al., 2000; Kant et al., 2003). The COVID-19 pandemic contributed substantially to the rapid increase of acute fatigue among hospital nurses (Hou et al., 2020; Sagherian et al., 2020; Zhan et al., 2020). Specifically, Sagherian et al. (2020) found that nursing staff caring for patients with COVID-19 had significantly higher acute fatigue and lower intershift recovery compared with co-workers caring for non-COVID-19-related hospitalized patients.

When recovery from acute fatigue is regularly not achieved, nurses may experience a shift towards chronic fatigue, which in turn is related to psychological problems, long-term sickness absences and poor health (Bültmann et al., 2002; Sagherian et al., 2019; Winwood et al., 2006). Workers including nurses may experience acute fatigue alone, or both acute and chronic fatigue at the same

time. Chronic fatigue is a prolonged type of tiredness experienced even in the absence of any work activity. Chronically fatigued workers require longer periods of recovery time, particularly when restful activities and sleep alone have become less effective. Chronically fatigued workers face challenges in maintaining day-to-day physical, mental and occupational functioning (Beurskens et al., 2000; Janssen et al., 2003; Kant et al., 2003). Often, the concept of chronic fatigue is poorly differentiated from worker burnout. While these two conditions overlap about exhaustion or extreme tiredness, burnout is conceptualized as a negative mental state caused by work where workers carry dysfunctional attitudes and indifferent behaviours in the workplace. It is possible for workers to have burnout without chronic fatigue and vice versa or experience both conditions at the same time (Huibers et al., 2003; Leone et al., 2007; Maslach & Leiter, 2016).

One common way to reduce some of the accumulated acute fatigue during work is by taking rest breaks during the shift. Rest breaks are defined as short periods of work cessation (Trogakos & Hideg, 2009) used to restore the energy spent on work activities. Rest breaks, which target within-work shift recovery, reduce subjective reports of acute fatigue and accident risk and maintain performance ability in other categories of workers, such as truck or bus drivers, industry workers and office employees (Kim et al., 2017; Sianoja et al., 2016; Tucker, 2003). Among nursing staff, most rest break studies have focused on patient safety and the risk of making errors (Min et al., 2020; Rogers et al., 2004), feeling demoralized after a shift (Senek et al., 2020), turnover behaviours (Wendsche et al., 2017) and sleep quality (Wilson et al., 2018), with almost none examining acute fatigue (Blasche et al., 2017). One early study reported a decrease in error risk by 10% with every 10-min increase in break duration. However, the study did not find any significant relationship between nurses' rest breaks and the risk of making errors during three shift durations: ≤ 8.5 , 8.5–12.5 and ≥ 12.5 h (Rogers et al., 2004). Another recent study found that understaffing on nursing units significantly predicted increased turnover among nurses with irregular rest breaks (Wendsche et al., 2017).

Our study's theoretical framework was based on Meijman and Mulder's (1998) effort-recovery model with emphasis on within-work shift recovery. Nursing staff encounter different work demands and time pressures during their shifts. In return, they spend energy and invest personal resources to accomplish assigned nursing tasks and provide quality patient care. According to our theoretical model, these exerted efforts during working hours lead to acute fatigue that in return needs to be lowered and possibly decreased to levels prior to the exposure from work demands. Within-work shift recovery (i.e. partial fatigue recovery) can be achieved by taking rest breaks. Consequently, our theoretical model suggests that taking regular rest breaks at work will lower the acute fatigue experienced by nursing staff. For nursing staff, rest breaks typically include meal and coffee breaks to rest physically and mentally from patient care responsibilities. At times, the restorative effect of the rest break may depend on the frequency and duration of the break and the worker's recovery need. For example, a single meal or coffee break

taken after extra effort or prolonged time spent on executing complex nursing tasks may be insufficiently restorative. Also, rest breaks based on our theoretical model may be less effective in substantially lowering workers' acute fatigue because of certain work-related factors where psychological detachment from work, which is important in enhancing recovery, is not achieved (Sonnetag, 2018). During the pandemic, the high workload and limited safety resources (e.g. personal protective equipment and COVID-19 screening) may have compelled nursing staff who were caring for patients with COVID-19 to stay at the bedside or in their nursing units due to fear and worry of carrying the virus to others. Nursing staff's inability to be physically away from the critical care of patients with COVID-19 and/or psychologically detach from work may have resulted in sub-optimal within-work shift recovery. Consequently, our theoretical model suggests that rest breaks will not be sufficient in substantially lowering acute fatigue among nursing staff caring for patients with COVID-19. During the earlier months of the COVID-19 pandemic, the study of Sagherian et al., (2020) reported nursing staff's likelihood of taking 30-min rest breaks as follows: 30% rarely or never, 26% sometimes and 43% often or always.

We test two hypotheses. First, we hypothesized that nursing staff who regularly took rest breaks reported lower levels of acute fatigue. Second, we hypothesized that the benefit of rest breaks for nursing staff caring for patients with COVID-19, although present, was smaller than for nursing staff not caring for patients with COVID-19.

3 | THE STUDY

3.1 | Aim

The aim of this cross-sectional study was to explore whether 30-min rest breaks were as effective at lowering acute fatigue among 12-h shift hospital nursing staff who cared for patients with COVID-19 as among those who did not.

3.2 | Design

Our study was cross-sectional in design and used secondary data from the Sleep And Fatigue during COVID-19 in health CARE (SAFE-CARE) study. The study was designed to assess levels of insomnia, occupational fatigue and recovery, and psychological problems among a convenience sample of nursing staff across hospitals in the United States during the early months of the COVID-19 pandemic (details are published elsewhere; Sagherian et al., 2020).

3.3 | Participants

The SAFE-CARE study included 587 hospital registered nurses and certified nursing assistants who were recruited online from social

media outlets over a 1-month period beginning 27 May 2020. The inclusion criteria for our secondary data analysis were nursing staff who provided direct patient care on inpatient nursing units and were working 12-h shifts, which is the current norm in the United States. Our study excluded 249 participants from the original sample who worked less than 12-h shift durations ($n = 71$), were missing observations on shift type ($n = 170$), were on paid or unpaid leave ($n = 3$) or who cared for patients in outpatient settings ($n = 5$). The final sample consisted of 312 registered nurses and 26 nursing assistants ($N = 338$). There were no statistically significant differences between bedside care nurses and nursing assistants on acute fatigue ($p = .308$), and therefore, the latter group was included in the final analytic sample.

3.4 | Data collection

The SAFE-CARE study collected data online via Qualtrics survey software. The main questionnaire included measures on insomnia, fatigue type, recovery, psychological distress, post-traumatic stress, burnout, health status, work and demographic characteristics. Our study focused on the measures described below in detail.

3.5 | Measures

Outcome. Acute fatigue was operationalized by the Occupational Fatigue and Exhaustion Recovery (OFER-15) subscale (Winwood et al., 2005, 2006). It consisted of five items (e.g. 'my work drains my energy completely every day') with responses ranging from 0 (strongly disagree) to 6 (strongly agree). After two positively worded items were reverse coded, the items were summed and multiplied by 0.33. Higher scores indicated higher levels of acute fatigue (score range: 0–100).

Patient care with COVID-19. This dichotomous (yes/no) variable was measured with the following question: During your shift rotations, did you care for known COVID-positive patients?

Rest breaks. Rest breaks was measured by the frequency of 30-min relieved breaks. This duration is typically taken by US hospital nurses reported in previous nursing studies and is in line with US federal law regulations (Rogers et al., 2004; Sagherian et al., 2017; Stimpfel & Aiken, 2013; Wilson et al., 2018). The question asked: 'During a work shift, how likely were you to take a 30-min relieved break (i.e. meal breaks and coffee breaks)?' The response options were always, often, sometimes, rarely and never. Rest breaks were dichotomized as follows: 0 indicated no breaks based on rarely and never and 1 indicated breaks based on sometimes, often and always.

3.5.1 | Covariates

Health-related variables. Chronic fatigue was operationalized by the OFER-15 subscale (Winwood et al., 2005, 2006). It consisted of five items (e.g. 'I often dread waking up to another day of my work') with

responses ranging from 0 (strongly disagree) to 6 (strongly agree). The items were summed and multiplied by 0.33. According to the scoring manual, acute and chronic fatigue subscale scores can be interpreted as low (0–25), low–moderate (26–50), moderate–high (51–75) and high (76–100). Participants with chronic fatigue scores in the upper fourth quartile were identified and categorized as probably chronic fatigue cases. Psychological distress was operationalized by the Patient Health Questionnaire-4 (PHQ-4). The PHQ-4 is a well-known short scale that screens for depressive (two items: 'feeling down, depressed or hopeless' and 'little interest or pleasure in doing things') and anxiety (two items: 'feeling nervous, anxious or on edge' and 'unable to stop or control worrying') symptoms. Item responses range from 0 (not at all) to 3 (nearly every day). The summative item scores can be interpreted as: normal (0–2), mild (3–5), moderate (6–8) and severe (9–12) psychological distress (Kroenke et al., 2009; Löwe et al., 2010). Sleep variables included average sleep duration during workdays and insomnia. Sleep hours during workdays were categorized as follows: ≥ 7 and < 7 h (short inadequate sleep). Insomnia was measured by the Insomnia severity Index (ISI). The ISI has seven items that measures initial and middle insomnia, early morning awakenings, sleep satisfaction and daytime functioning and sleep problems leading to distress or noticeable by others (e.g. 'how satisfied/dissatisfied are you with your current sleep pattern?' and 'how worried/distressed are you about your current sleep problem?'). The summative item scores can range from 0 to 28. Scores ≥ 15 indicate clinical insomnia (Morin et al., 2011). Morbidity (yes vs. no) was based on the participants' report of diagnosed health problems. Subjective health was measured with a single item asking respondents their self-rated health. Response options were poor, fair, good, very good and excellent.

Work-related variables. We included the following measures of work practices and the work environment: years of job experience (≤ 2 , 3–8, 9–14 and ≥ 15 years), employment status (full time vs. part time), having a second job (yes vs. no), unit of practice and average hours of work per week in the past month (≤ 40 and > 40 h). In addition, we assessed personal accomplishment from work with the Maslach Burnout Inventory-Human Services Survey subscale (Maslach & Jackson, 1981; Schaufeli et al., 1996). The subscale consisted of eight items (e.g. 'positively influencing other people's lives through my work') with responses ranging from 0 (never) to 6 (every day). The items were summed, and higher scores indicated more of personal accomplishment.

Socio-demographic variables. We measured the following socio-demographic variables: age divided into categories (≤ 29 , 30–39, 40–41 and ≥ 50 years and refused to answer/missing), gender (male and female), race (White, Black, Asian and others), marital status (not married and married/with partner), dependents-children (yes and no), dependents-older adults (yes and no) and census region (Northeast, Midwest, South and West).

3.6 | Validity, reliability and rigour

The psychometric properties of the OFER-15 have been demonstrated in hospital nurses, and the items showed no indication for

gender bias (Winwood et al., 2006). In our sample, the Cronbach's alphas were 0.82 and 0.87, respectively, for acute fatigue and chronic fatigue, indicating good internal consistency. The PHQ-4 has good psychometric properties in the general and clinical populations (Kroenke et al., 2009; Löwe et al., 2010). The Cronbach's alpha in our sample was 0.87, indicating good internal consistency. The ISI is widely used in clinical practice and in research and has well established psychometric properties (Morin et al., 2011). The Cronbach's alpha in our sample was 0.84, indicating good internal consistency. The Maslach Burnout Inventory-Human Services Survey has good psychometric properties in hospital nurses (Poghosyan et al., 2009). For the personal accomplishment subscale, the Cronbach's alpha in our sample was 0.81, indicating good internal consistency.

3.7 | Ethical considerations

The following secondary data analysis has ethics committee approval from the university.

3.8 | Data analysis

Descriptive statistics such as means, standard deviations, ranges, frequencies and percentages were computed depending on the level of measurement of the variables. The continuous variables were assessed for normality and skewness based on histograms and outliers identified using boxplots. Skewness values ranged from -1.23 for acute fatigue to 0.20 for personal accomplishment (acceptable range ± 1.5). Linear regression assumptions were examined for multivariate outliers, homoscedasticity of residuals, linearity and multicollinearity. Multivariate outliers were examined for unusual and influential cases and were found to be non-influential observations. There were no violations of homoscedasticity of residuals and no indications of multicollinearity based on Variance Inflation Factor and Tolerance values. Non-linearity was examined analytically by adding quadratic terms. One significant curvilinear relationship was found and added in the model building process. The percentage of missingness ranged from 0.29 to 6.71. The person-mean substitution method was used to impute the missing item responses of the scales only when the number of items missing was $\leq 20\%$ (i.e. 1 item missing).

Hierarchical multiple linear regression was used to explore the association between rest breaks, patient care with COVID-19 and acute fatigue. Covariates were retained in the statistically adjusted models if $p < .20$ or if they were of theoretical relevance. The selection of covariates was made using the full analytic sample. The first model included the main predictors of interest: rest breaks and patient care with COVID-19. The linear regression model was then adjusted for health measures (model 2: subjective health status, psychological distress, sleep hours during workdays and chronic fatigue cases) followed by work-related variables (model 3: average worked hours per week, shift type, unit of practice and personal accomplishment at work) and finally for age and gender (model 4). After

determining the covariates in the final hierarchical multiple linear regression model, we stratified analyses based on whether nursing staff in the sample cared for patients with COVID-19. Stratified analyses were chosen because they allowed the association between each covariate and acute fatigue to differ across groups, thereby allowing a more accurate assessment of the association between rest breaks and acute fatigue in each group of nursing staff. We note that to test the sensitivity of our findings to model specifications, we also included an interaction term of rest breaks and patient care with COVID-19 in an adjusted linear model estimated using the full sample. This model yielded similar results of significant interaction effects ($p = .004$).

4 | RESULTS

Female bedside care registered nurses represented the majority of the sample ($n = 312$, 92.3%). Participants' mean age was 36.8 years (SD 10.85, range 19–67), and 31.4% ($n = 106$) reported they were married or living with a partner. The detailed socio-demographic characteristics of the sample are presented in Table 1.

The study participants on average reported to be in good health and in moderate psychological distress. Nearly two-thirds ($n = 212$, 63.7%) of the participants had one or more diagnosed health problems. As shown in Table 2, 30.8% ($n = 104$) of the sample had high levels of chronic fatigue, and 45.1% ($n = 151$) had ISI scores of ≥ 15 that indicated clinical insomnia. Related to work, more than three quarters of the sample were full-time employees ($n = 293$, 86.7%), and one-third had worked more than 40 h per week ($n = 103$, 31.4%) during the pandemic (Table 2). Participants on average experienced high levels of acute fatigue ($M = 77.46$, SD 17.20, range 3.33–100) yet also had high scores on personal accomplishment ($M = 32.95$, SD 8.04, range 0–48). The staff who cared for patients with COVID-19 experienced slightly more acute fatigue ($M = 78.84$, SD 16.03) than the overall sample ($M = 77.46$, SD 17.20). During work shifts, 71.1% ($n = 236$) of the participants had provided care for hospitalized patients with COVID-19, and 29.6% ($n = 98$) reported to rarely or never taking rest breaks. There were no statistically significant differences between staff who cared for and did not care for patients with COVID-19 based on rest breaks ($p = .088$).

As shown in Table 3, the unadjusted model that included the main predictors (rest breaks and patient care with COVID-19) explained 4.8% of the variance in acute fatigue, $F(2, 328) = 8.31$, $p < .001$. Nursing staff who took rest breaks experienced significantly lower acute fatigue when compared with co-workers who did not take rest breaks. Nursing staff who cared for patients with COVID-19 experienced significantly higher acute fatigue when compared with nursing staff who did not care for patients with COVID-19. The second model did not retain these significant relationships after adjusting for four health measures that included chronic fatigue cases, psychological distress, subjective health status and sleep hours during workdays. The total variance explained by model 2 was 29.3%, $F(7, 320) = 20.39$, $p < .001$. The third model was further adjusted for four

TABLE 1 Socio-demographic characteristics of the study sample ($N = 338$)

Characteristics	<i>n</i> (%)
Age in years	
≤29	94 (27.81)
30–39	111 (32.84)
40–49	61 (18.05)
≥50	49 (14.50)
Refused to answer	23 (6.80)
Gender	
Male	21 (6.21)
Female	317 (93.79)
Race ^a	
White	294 (87.50)
Black	10 (2.98)
Asian	14 (4.17)
Others (Hispanics, Natives, more than one race)	18 (5.35)
Marital status	
Not married (single, widowed, divorced, separated)	232 (68.64)
Married or living with partner	106 (31.36)
Dependents-children ^a	
Yes	148 (43.92)
No	189 (56.08)
Dependents-older adults ^a	
Yes	56 (16.62)
No	281 (83.38)
Census regions ^a	
Northeast	31 (9.20)
Midwest	121 (35.91)
South	153 (45.40)
West	32 (9.50)

^aRepresents missing observations.

work-related variables that included shift type, average worked hours during a week, unit of practice and personal accomplishment, and overall explained 33.0% of the variance in acute fatigue, $F(14, 311) = 12.41$, $p < .001$. In this model, the relationship between rest breaks and acute fatigue became statistically significant ($p = .045$).

The final model was further adjusted for age and gender and explained 34.6% of the variance in acute fatigue, $F(19, 306) = 10.04$, $p < .001$. Nursing staff who took rest breaks significantly experienced lower acute fatigue by almost four points when compared with their co-workers who skipped rest breaks ($p = .023$). There was no statistically significant relationship between care for patients with COVID-19 and acute fatigue ($p = .108$).

Table 4 presents the stratified results to answer the question of whether rest breaks are associated with acute fatigue differently among staff with and without COVID-19 patient care. In the group that did not care for patients with COVID-19, participants who took

TABLE 2 Fatigue, health and work-related characteristics of the study sample (N = 338)

Characteristic	n (%)
Subjective health ^a , M (SD) n = 337	3.30 (0.85)
Psychological distress ^a , M (SD) n = 337	5.97 (3.25)
Morbidity ^a	
Yes	212 (63.66)
No	121 (36.34)
Chronic fatigue	
Yes	104 (30.77)
No	234 (69.23)
Sleep during workdays ^a	
<7 h	273 (83.23)
≥7 h	55 (16.77)
Insomnia ^a	
Yes, ≥15	151 (45.07)
No	184 (54.93)
Work status	
Full-time	293 (86.69)
Part-time/per diem	45 (13.31)
Job experience in years ^a	
≥2	55 (16.47)
3–8	143 (42.81)
9–14	51 (15.27)
≥15	85 (25.45)
Second job ^a	
Yes	64 (19.34)
No	267 (80.66)
Shift type	
Day	176 (52.07)
Night	136 (40.24)
Rotating	26 (7.69)
Worked hours per week ^a	
≤40	225 (68.60)
>40	103 (31.40)
Unit of practice ^a	
Emergency	40 (12.01)
Intensive care	116 (34.83)
Medical-surgical	124 (37.24)
Others	53 (15.92)
30-min breaks ^a	
Yes (sometimes, often, always)	233 (70.39)
No (never, rarely)	98 (29.61)

Note: M, mean; SD, standard deviation.

^aRepresents missing observations.

rest breaks experienced substantially lower acute fatigue ($\beta = -9.70$, $p = .010$) than those who did not take rest breaks. This adjusted stratified model explained 51.8% of the variance in acute fatigue,

$F(18, 76) = 6.61$, $p < .001$. Five covariates (chronic fatigue, psychological distress, subjective health status, rotating shifts and older age) were also significantly associated with acute fatigue. In the group that cared for patients with COVID-19, the relationship between rest breaks and acute fatigue was in the expected direction but not statistically significant ($p = .507$). Three covariates (psychological distress, night shifts and being female) were also significantly associated with acute fatigue. This adjusted stratified model explained 28.1% of the variance in acute fatigue, $F(18, 212) = 5.98$, $p < .001$.

5 | DISCUSSION

The findings from this cross-sectional study showed the simultaneous importance and inadequacy of 30-min rest breaks in mitigating acute fatigue among 12-h shift nursing staff during the COVID-19 pandemic. When rest breaks were sometimes, often or regularly taken, nursing staff who cared for hospitalized patients for non-COVID-19-related reasons had significantly less acute fatigue. Contrary to our expectation, there was no association between rest breaks and acute fatigue among nursing staff who cared for patients with COVID-19.

Normally, work-related acute fatigue can be decreased to safer levels by short rest breaks in the workplace (Sianoja et al., 2016; Tucker, 2003) and resolved by leisure activities and sleep outside work hours (Sonnentag, 2018). The non-significance in the relationship between rest breaks and acute fatigue among nursing staff engaged for 12 h or more in COVID-19 patient care that is highly stressful may be partially explained by the recovery process of psychological detachment from work (Sonnentag, 2018; Sonnentag & Fritz, 2015). It is possible that during brief rest breaks, nursing staff were unable to disengage themselves mentally and/or emotionally from the critical care of patients with COVID-19. In other words, although the rest breaks were designed to be recuperative short periods with no work activity, in actuality they may not have been. Although our study did not have data on the location of rest breaks, it is possible that physical detachment from work in the form of leaving the nursing unit was unlikely during these breaks. Nursing staff may have been compelled to stay in close patient proximity due to high patient acuity and close monitoring, limited resources in personal protective equipment at the time, which may have created fear and worry of carrying the virus to other colleagues or hospital units among others (Fawaz & Samaha, 2020; Liu et al., 2020; Sun et al., 2020).

Similar to previous reports (Sagherian et al., 2017; Stimpfel & Aiken, 2013; Wilson et al., 2018), nearly three-quarters of our sample sometimes, often or regularly took 30-min rest breaks during 12-h shifts. Despite this prevalence, our results contrary to the study's research hypothesis showed that rest breaks did not operate similarly among nursing staff with and without COVID-19 patient care. The findings raise concerns about the sufficiency (i.e. duration and frequency) of rest breaks in mitigating acute fatigue. It is possible that the COVID-19 patient care group may have required more

TABLE 3 Hierarchical multiple linear regression results for predicting acute fatigue from rest breaks and nursing staff's delivery of COVID-19 patient care

Parameter	Model 1	Model 2	Model 3	Model 4
	β [95% CI], <i>p</i>	β [95% CI], <i>p</i>	β [95% CI], <i>p</i>	β [95% CI], <i>p</i>
Rest breaks 1, yes; 0, no	-6.76 [-10.72, -2.81], .001	-3.14 [-6.63, 0.34], .077	-3.50 [-6.93, 0.07], .045	-3.96 [-7.37, -0.56], .023
COVID-19 pt. care 1, yes; 0, no	4.00 [0.02, 7.98], .049	3.20 [-0.23, 6.64], .068	2.94 [-0.62, 6.51], .105	2.90 [-0.65, 6.45], .108
Covariates				
Chronic fatigue 1, yes; 0, no		7.55 [3.75, 11.35], <.001	6.62 [2.79, 10.45], .001	6.72 [2.90, 10.52], .001
Subjective health		-2.02 [-3.90, -0.14], .036	-2.30 [-4.20, -0.39], .018	-2.37 [-4.27, -0.47], .015
Psych. Distress		3.98 [2.15, 5.82], <.001	3.95 [2.15, 5.76], <.001	3.76 [1.97, 5.44], <.001
Psych. distress ²		-0.19 [-0.33, -0.05], .007	-0.19 [-0.33, -0.06], .006	-0.19 [-0.33, -0.05], .006
Sleep (h) 1, ≥ 7 ; 0, <7		-5.70 [-10.00, -1.41], .009	-5.16 [-9.48, -0.85], .019	-5.01 [-9.33, -0.68], .023
Personal accomplishment			-0.20 [-0.41, 0.01], .057	-0.18 [-0.39, 0.03], .092
Work (h/week) 1, ≥ 40 ; 0, <40.			2.39 [-1.11, 5.88], .180	2.65 [-0.83, 6.13], .135
Shift type 1, night; 0, day			-5.33 [-8.59, -2.07], .001	-5.49 [-8.75, -2.23], .001
2, rotating; 0, day			-8.26 [-14.30, -2.21], .008	-8.80 [-14.92, -2.69], .005
Unit 1, MS; 0, ED			1.36 [-3.96, 6.69], .615	1.21 [-4.11, 6.52], .655
2, ICU; 0, ED			4.94 [-0.35, 10.23], .067	4.87 [-0.38, 10.12], .069
3, OB-GYN; 0, ED			2.10 [-3.88, 8.08], .490	2.66 [-3.36, 8.67], .385
Age (years) 1, 30–39; 0, ≤ 29				-2.51 [-6.50, 1.48], .217
2, 40–49; 0, ≤ 29				-1.30 [-5.96, 3.37], .585
3, ≥ 50 ; 0, ≤ 29				-6.51 [-11.56, -1.46], .012
4, missing; 0, ≤ 29				-8.20 [-15.18, -1.21], .022
Gender 1, female; 0, male				6.06 [-0.48, 12.61], .069
F-value	8.31	20.39	12.41	10.04
Adjusted R ²	0.048	0.293	0.330	.346

Note: CI, 95% confidence intervals; Psych. distress² (psychological distress)², represents quadratic relationship; ED, emergency department; ICU, intensive care unit; MS, medical-surgical unit; OB-GYN, obstetrics and gynecology; model 1 includes the main effects of the independent variables; model 2 is adjusted for health covariates; model 3 is adjusted for model 2 and work-related covariates; model 4 is adjusted for model 3, age and gender.

frequent but shorter rest breaks or less frequent but longer rest breaks during work hours for within-work recovery from acute fatigue. Fatigue is a multidimensional construct with multiple aspects related to physical exertion and discomfort, low energy, difficulty in concentration, decreased motivation and sleepiness (Ahsberg, 2000; Sagherian & Geiger-Brown, 2016). As such, it is possible that the COVID-19 patient care group may have experienced higher levels of certain aspects of fatigue such as difficulty in concentration or discomfort that were not adequately captured in the overall acute fatigue measure, and thus the effect of rest breaks was not evident. Currently, there is lack of evidence related to the dimensions of fatigue experiences and where more exploratory data will assist in

tailoring fatigue management strategies for the COVID-19 patient care groups in the workplace.

When examining the list of covariates in stratified models, it was surprising to find that the night shifts had protective effect on acute fatigue unique in the COVID-19 subgroup (Table 4). In response to nights that inherently carry an element of fatigue and sleepiness derived from circadian misalignment and homeostatic pressure (Akerstedt, 2003), it is possible that some nursing staff took brief naps during rest breaks. Unfortunately, we do not have data on napping behaviours during the COVID-19 pandemic because our survey question asked the frequency of rest breaks that included meal and coffee breaks. However, over the past years, napping interventions

TABLE 4 The relationships between rest breaks and acute fatigue stratified by nursing staff's delivery of COVID-19 patient care in hierarchical multiple linear regression analyses

Parameter	Stratified models by COVID-19 patient care	
	No β [95% CI], <i>p</i>	Yes β [95% CI], <i>p</i>
Rest breaks 1, yes; 0, no	-9.70 [-16.99, -2.42], .010	-1.33 [-5.28, 2.62], .507
Covariates		
Chronic fatigue 1, yes; 0, no	13.86 [6.19, 21.54], .001	4.19 [-0.32, 8.70], .069
Subjective health	-3.92 [-7.59, -0.25], .036	-1.48 [-3.71, 0.76], .194
Psych. distress	4.13 [0.69, 7.58], .019	3.77 [1.61, 5.93], .001
Psych. distress ²	-0.24 [-0.51, 0.02], .073	-0.17 [-0.34, -0.01], .036
Sleep (h) 1, ≥ 7 ; 0, < 7	-8.47 [-18.17, 1.22], .086	-3.28 [-8.24, 1.67], .193
Personal accomplishment	-0.17 [-0.60, 0.25], .424	-0.16 [-0.40, 0.08], .185
Work (h/week) 1, ≥ 40 ; 0, < 40 .	2.92 [-5.77, 11.61], .505	2.67 [-1.17, 6.51], .172
Shift type 1, night; 0, day	-5.19 [-11.87, 1.49], .126	-6.30 [-10.17, -2.44], .002
2, rotating; 0, day	-13.21 [-23.73, -2.69], .015	-4.93 [-12.84, 2.98], .220
Unit 1, MS; 0, ED	-18.62 [-49.65, 12.42], .236	2.22 [-3.35, 7.79], .434
2, ICU; 0, ED	-10.93 [-42.10, 20.25], .487	4.05 [-1.39, 9.48], .144
3, OB-GYN; 0, ED	-14.36 [-46.39, 17.67], .375	2.88 [-3.61, 9.37], .382
Age (years) 1, 30-39; 0, ≤ 29	-0.36 [-8.18, 7.46], .927	-1.62 [-6.34, 3.10], .499
2, 40-49; 0, ≤ 29	-6.63 [-15.26, 1.99], .130	0.46 [-5.16, 6.07], .872
3, ≥ 50 ; 0, ≤ 29	-10.67 [-20.55, -0.79], .035	-4.24 [-10.18, 1.70], .161
4, missing; 0, ≤ 29	-10.75 [-22.93, 1.43], .083	-5.49 [-13.95, 2.96], .202
Gender 1, female; 0, male	-0.06 [-10.12, 9.99], .990	13.48 [4.75, 22.21], .003
F-value	6.61	5.98
Adjusted <i>R</i> ²	.518	.281

Note: CI, 95% confidence intervals; Psych. distress² (psychological distress)², represents quadratic relationship; ED, emergency department; ICU, intensive care unit; MS, medical-surgical unit; OB-GYN, obstetrics and gynecology.

and napping implementation projects among night shift nurses have become increasingly popular on hospital units as means to combat sleepiness and fatigue (Geiger-Brown et al., 2016; Neville et al., 2017; Ruggiero & Redeker, 2014). It remains unclear if brief naps during night shifts or other work-related factors during the nights played a role in lowering nurses' acute fatigue levels during the COVID-19 pandemic; consequently, more exploratory research is needed in this area.

Lastly, it is worth mentioning the differences in acute fatigue variance explained by the stratified models (Table 4). These findings indicate how the traditional set of covariates, which adequately explain acute fatigue among non-COVID-19 nursing staff (adjusted *R*² 51.8%), are incomplete in explaining acute fatigue among nursing staff involved in COVID-19 patient care (adjusted *R*² 28.1%). Consequently, an understanding of what additional variables are

missing here would help nursing staff beyond the COVID-19 pandemic in other long-term intensive situations such as busy emergency departments, trauma units or even battlefields.

5.1 | Limitations

Our study has several limitations. One limitation is related to sample representativeness. There is limited information about the internet-based convenience sampling approach and about the pool of hospital nursing staff on social media platforms. To address concerns about external validity, we compared the proportional distributions of our analytic sample on key characteristics with a national data from the 2018 National Sample Survey of Registered Nurses (U.S. Department of Health & Human Services, 2018) that focused on

hospital nurses who provided patient care. Although the samples are not entirely equivalent (i.e. the national sample included nurses on less than 12-h shifts and no certified nursing assistants), we found similar percentages in family structures, dependent responsibilities and work features. However, our participants were younger and more likely to be female, White and from the Midwest and South. Although there may be sampling bias on other key characteristics, we have some degree of confidence in the generalizability of our findings to hospital nurses in certain regions of the United States.

Another limitation is that extremely fatigued hospital nurses or those who faced more challenges in patient care during the pandemic may have been more probably inclined than others to participate and share their experiences. The contrary is also possible, and nurses with high fatigue may have declined participation. It is also possible that the risk of reporting bias may exist with the subjective measure of rest breaks. Nursing staff who cared for patients with COVID-19 may be less likely to report taking rest breaks when witnessing the high workload of their co-workers and the worry of family members. Finally, we acknowledge limitations related to cross-sectional design that demonstrated correlational and not temporal relationships in our study. This precludes any inference of causality. Although this design was appropriate during the first months of the COVID-19 pandemic, future research would benefit from prospective cohort design using work diary and ecologic momentary systematic assessment approach to account for the number of patients with COVID-19; the timing, duration and place of rest breaks; and fatigue changes before and after rest breaks during working shifts. It is also important to include other possible explanatory variables such as caffeine consumption, unofficial rest breaks, staffing and patient acuity levels that might further explain acute fatigue.

5.2 | Conclusion and future research

Our study was the first to evaluate the role of rest breaks on the relationship between COVID-19 patient care and nursing staff acute fatigue. Acute fatigue was found to be high, and almost 30% of our sample skipped rest breaks during the pandemic. We found that although rest breaks may ease fatigue for nursing staff working in pre-COVID-19 conditions, they may not provide the same benefit to nursing staff who were treating patients with COVID-19 early in the pandemic. These findings showing that not all nursing groups experience within-work shift recovery similarly suggest the role of rest breaks on acute fatigue is more nuanced and complex than simply whether hospital nurses take rest breaks.

While rest breaks should be facilitated for all nursing staff, it is premature to make final conclusions here, and the potential benefit of making rest breaks more effective demands more research. The next logical steps are to further test these relationships among nursing staff in non-US samples where the COVID-19 pandemic has impacted the nursing workforce and to explore optimal rest break characteristics and the process of within-work shift fatigue recovery among nursing groups with different working conditions.

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CONFLICT OF INTEREST

No conflict of interest has been declared by the authors.

AUTHOR CONTRIBUTIONS

KS was responsible for the study's conceptual development and statistical analysis, drafting the manuscript and revising it for critically important intellectual content. CAM was responsible for the statistical analysis, drafting and revising the manuscript for important intellectual and methodological content. LS was responsible for revising the manuscript for critically important intellectual content, and all authors approved the final version for submission.

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