JAMA Network Open

Original Investigation | Occupational Health

Nurse Burnout and Patient Safety, Satisfaction, and Quality of Care
A Systematic Review and Meta-Analysis

Lambert Zixin Li, MPhil; Peilin Yang, BS; Sara J. Singer, PhD, MBA; Jeffrey Pfeffer, PhD; Maya B. Mathur, PhD; Tait Shanafelt, MD

Abstract

IMPORTANCE Occupational burnout syndrome is characterized by emotional exhaustion, depersonalization, and a diminished sense of personal accomplishment and is prevalent among nurses. Although previous meta-analyses have explored the correlates of nurse burnout, none have estimated their association with health care quality and safety and patient morbidity and mortality.

OBJECTIVE To evaluate the magnitude and moderators of the association between nurse burnout and patient safety, patient satisfaction, and quality of care.

DATA SOURCE The Web of Science, Scopus, MEDLINE, Embase, PsycINFO, CINAHL, and ProQuest databases were searched from January 1, 1994, to February 29, 2024.

STUDY SELECTION Two reviewers independently identified studies that reported a quantifiable association between nurse burnout and any of the outcomes of patient safety, patient satisfaction, or quality of health care.

DATA EXTRACTION AND SYNTHESIS The PRISMA 2020 guideline was followed. Two reviewers independently extracted the standardized mean difference (SMD) (Cohen *d*) estimates for a random-effects meta-analysis. Subgroup analyses and meta-regressions were conducted using prespecified variables.

MAIN OUTCOMES AND MEASURES Any measure of patient safety, patient satisfaction, or quality of health care previously associated with nurse burnout.

RESULTS A total of 85 studies (81 cross-sectional and 4 longitudinal) involving 288 581 nurses from 32 countries (mean [SD] age, 33.9 (2.1) years; 82.7% female; mean [SD] burnout prevalence rate with study-specific ascertainments, 30.7% [9.7%]) were included. Nurse burnout was associated with a lower safety climate or culture (SMD, −0.68; 95% CI, −0.83 to −0.54), lower safety grade (SMD, −0.53; 95% CI, −0.72 to −0.34), and more frequent nosocomial infections (SMD, −0.20; 95% CI, −0.36 to −0.04), patient falls (SMD, −0.12; 95% CI, −0.22 to −0.03), medication errors (SMD, −0.30; 95% CI, −0.48 to −0.11), adverse events or patient safety incidents (SMD, −0.42; 95% CI, −0.76 to −0.07), and missed care or care left undone (SMD, −0.58; 95% CI, −0.91 to −0.26) but not with the frequency of pressure ulcers. Nurse burnout was also associated with lower patient satisfaction ratings (SMD, −0.51; 95% CI, −0.86 to −0.17) but not with the frequencies of patient complaints or patient abuse. Finally, nurse burnout was associated with lower nurse-assessed quality of care (SMD, −0.44; 95% CI, −0.57 to −0.30) but not with standardized mortality rate. The associations were consistent across nurses' age, sex, work experience, and geography and persistent over time. For patient safety outcomes, the association was smaller for the low personal accomplishment subcomponent of burnout than for emotional exhaustion or depersonalization, as well as for nurses with a college education.

(continued)

Key Points

Question What are the magnitude and moderators of the association between nurse burnout and health care quality and safety?

Findings In this systematic review and meta-analysis of 85 studies including 288 581 nurses, nurse burnout was associated with a lower patient safety climate and patient safety grade; more nosocomial infections, patient falls, medication errors, and adverse events; lower patient satisfaction ratings; and lower nurse-assessed quality of care. The associations were consistent across nurse age, sex, work experience, and geography.

Meaning These findings suggest that systems-level interventions for nurse burnout may improve patient outcomes.

+ Supplemental content

Author affiliations and article information are listed at the end of this article.

Abstract (continued)

CONCLUSIONS In this systematic review and meta-analysis, nurse burnout was found to be associated with lower health care quality and safety and lower patient satisfaction. This association was consistent across nurse and study characteristics.

JAMA Network Open. 2024;7(11):e2443059. doi:10.1001/jamanetworkopen.2024.43059

Introduction

Burnout syndrome has been characterized by emotional exhaustion, depersonalization, and a diminished sense of personal accomplishment and is typically observed to be the result of chronic workplace stress.[1] Numerous meta-analyses have estimated the prevalence of nurse burnout, which ranged from 11% to 56%[2,3] and was even higher during the COVID-19 pandemic given hospital overcrowding and understaffing.[4,5] Meta-analyses have also explored the correlates of nurse burnout, including younger age,[6] male sex,[7] single or divorced marital status,[7] not having children,[7] low staffing levels,[8] and workplace violence[9] as risk factors and resilience,[10] job control,[11] social support,[11] and nurse empowerment[12] as protective factors. A few meta-analyses have examined the association of burnout with nurses' well-being and career, including burnout and sleep problems,[13] depression,[14] and turnover intention.[15] However, to our knowledge, no meta-analysis has estimated the association between nurse burnout and health care quality and safety and patient morbidity and mortality. This absence is interesting as there have been several meta-analyses investigating the association between physician burnout and patient safety, satisfaction, and quality of care.[16,17]

Nurses are on the front line of patient care in hospitals and other settings, often present when physicians are not, and charged with making important clinical decisions.[18] Because of the critical role of nurses in delivering and, in some cases, overseeing patient care, nurse burnout may be associated with many dimensions of patient outcomes.

One systematic review involving 20 studies[18] concluded that there was an association between nurse burnout and health care quality and safety, but it did not include a quantitative synthesis of the evidence to estimate the magnitude of the association. Moreover, due to the nature of the analysis, we do not know whether the association was moderated by subcomponents of burnout or by nurse demographics, clinical specialty, geographic area, or when the survey was conducted. Answering these questions may help to clarify the nature and severity of the adverse effects of nurse burnout and may help to inform nurse burnout interventions.[19]

This study evaluates through a systematic review and meta-analysis the magnitude and moderators of the association between nurse burnout and patient safety, patient satisfaction, and quality of care. Patient safety is defined as the absence of preventable harm to a patient,[20] patient satisfaction as patients' positive evaluations of distinct dimensions of the health care,[21] and quality of care as the degree to which health services for individuals and populations increase the likelihood of desired health outcomes.[22]

Methods

Inclusion and Exclusion Criteria

This systematic review and meta-analysis followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) reporting guideline.[23] The population, exposure, comparator, outcomes, and study design framework was used to specify eligibility criteria.[24] The protocol was pre-registered at PROSPERO (CRD42024512637 and CRD42024512684). The Stanford Institutional Review Board exempted the study from review and informed consent as there were no identifiable human participants.

The population was nurses. The inclusion criteria were (1) any type of nurse (eg, registered nurse, nurse practitioner, or nurse supervisor); (2) any specialty; (3) any geographic region; and (4) any age, sex, work experience, or educational level. Exclusion criteria were populations consisting of (1) midwives, (2) nursing assistants, (3) nursing students, and (4) mixed samples of nurses and physicians.

The exposure was burnout. The inclusion criteria were (1) any validated measure of burnout; (2) any validated measure of burnout subcomponents, including emotional exhaustion, depersonalization, and low sense of personal accomplishment; (3) any validated measure of widely recognized synonyms of burnout subcomponents, such as cynicism and low professional efficacy; or (4) any study-specific measure that directly referred to burnout. Exclusion criteria were exposures related to but distinct from burnout, including (1) occupational stress, (2) fatigue, and (3) depressive symptoms. The comparator was (1) a low level of burnout if a continuous measure of burnout was used or (2) nonburnout if a dichotomous characterization of burnout was reported (eg, prevalence).

For outcomes, the inclusion criteria were (1) any measure of patient safety, including safety climate or safety culture, safety grade, patient safety incidents (any medical error or adverse event similar to those selected in the Agency for Healthcare Research and Quality indicators[25]); (2) any measure of patient satisfaction, including patient satisfaction survey rating, patient complaint, and patient abuse; and (3) any measure of quality of care, including nurse-assessed overall quality of care and commonly used objective quality indicators, such as length of hospital stay and 30-day standardized mortality rate. Exclusion criteria were structural antecedents of burnout (eg, nursing foundations for quality of care[26]).

For study design, a study had to report a quantifiable association between nurse burnout and any of the 3 outcomes to be included; both cross-sectional and longitudinal studies were eligible. Grey literature included dissertations. Qualitative studies and conference proceedings were excluded. Publications in languages other than English were excluded.

Search Strategy

Two reviewers (L.Z.L. and P.Y.) applied any search term from each of the nurse, burnout, and quality of health care categories using specific search strings listed in eMethods 1 in Supplement 1, which were developed in consultation with a research librarian. In February 2024, the reviewers independently searched major databases from January 1, 1994, to February 29, 2024, including MEDLINE (via PubMed), Web of Science, Scopus, Embase, CINAHL (via EBSCOhost), PsycINFO (via EBSCOhost), and ProQuest. Using prespecified eligibility criteria, they independently included studies, identified additional studies from the reference lists, and extracted data. All discrepancies were resolved through discussion. The data were recorded in an online spreadsheet, and citations were managed with EndNote (Clarivate).

Statistical Analysis

Due to expected heterogeneity, we conducted a random-effects meta-analysis to quantitatively synthesize the association between nurse burnout and quality of care. Statistics were converted to standardized mean differences (SMDs) (Cohen *d*) using conventional methods (eMethods 2 in Supplement 1).

Subgroup meta-analysis and meta-regression were performed using prespecified variables to examine heterogeneity. We used forest plots to compare outcome subtypes, burnout measures and subcomponents, clinical specialties, and regions. We used random-effects meta-regression to examine the stratification by age, sex, work experience, and educational level. Self-reported race and ethnicity were collected but not analyzed because of low comparability across countries and low power among US studies. We also grouped regions into World Bank–defined geographic areas for graphical display.[27]

All analyses were performed using R, version 4.3.2 (R Foundation). The significance level was defined as a 2-tailed $P < .05$ by *t* test.

Bias Assessment and Sensitivity Analysis

Two reviewers (L.Z.L. and P.Y.) independently used the Risk Of Bias in Nonrandomized Studies of Exposures (ROBINS-E) to assess 7 risks of bias.[28] We used the serial exclusion method to assess small-study effect bias. As sensitivity analyses, we used forest plots and meta-regressions to examine alternative variable coding, sample selection, and confounding adjustment.

Results

Descriptive Statistics

Nurse Characteristics

The included studies involved 288 581 nurses from at least 5322 hospitals in 32 countries (mean [SD] age, 33.9 [2.1] years; 82.7% female and 17.3% male). The mean (SD) percentage of US nurses who self-identified as White was 70.9% (6.0%) and 29.1% (6.0%) for other races and ethnicities. The mean (SD) percentage of nurses holding college degrees (bachelor's degrees or higher) was 42.0% (15.7%), and the mean (SD) length work experience was 10.4 (1.6) years. The mean (SD) prevalence rate of burnout was 30.7% (9.7%) based on study-specific cutoffs. The ascertainments of burnout are described in eTable 1 in Supplement 1, and the burnout measures are compared in subgroup analyses later in the Results.

Study Characteristics

We identified 6231 studies from the initial search. Using prespecified criteria, 85 studies (81 cross-sectional and 4 longitudinal) were included for meta-analysis (eTables 1-5 in Supplement 1).[29-113] The studies were published between 1994 and 2024 and had a median sample size of 458 individuals (IQR, 234-1352 individuals). A flow diagram of study inclusion and exclusion is provided in eFigure 1 in Supplement 1.

Main Analyses

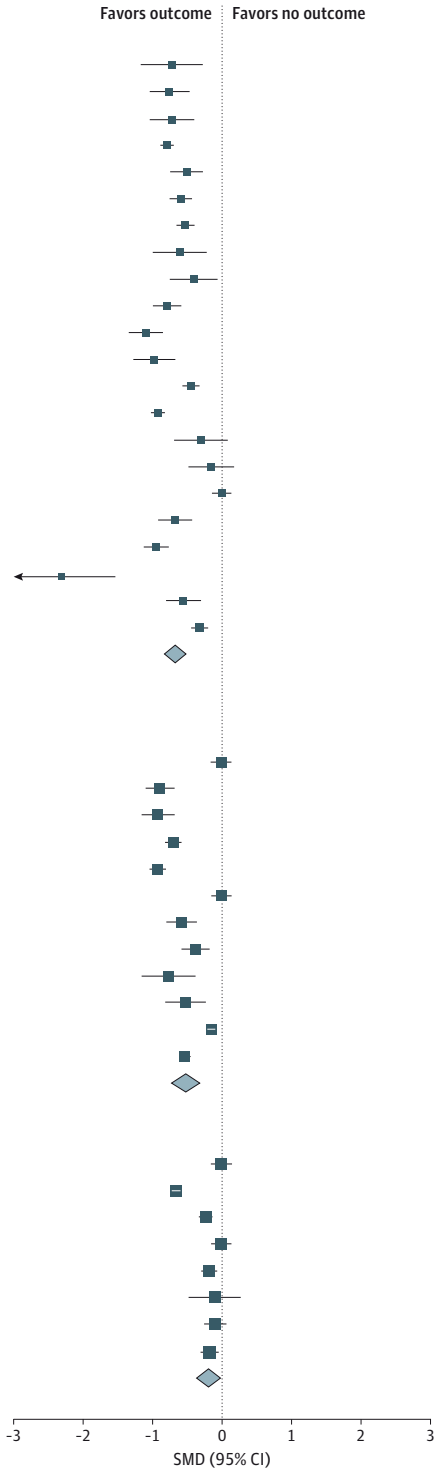
From the random-effects meta-analysis, we found negative associations between nurse burnout and various patient safety outcomes (**Figure 1** and **Figure 2**). Specifically, nurse burnout was associated with a lower safety climate or safety culture (SMD, −0.68; 95% CI −0.83 to −0.54; I^2 = 97.3%), lower safety grade (SMD, −0.53; 95% CI, −0.72 to −0.34; I^2 = 97.1%), more frequent nosocomial infections (SMD, −0.20; 95% CI, −0.36 to −0.04; I^2 = 97.0%), more frequent patient falls (SMD, −0.12; 95% CI, −0.22 to −0.03; I^2 = 62.2%), more frequent medication errors (SMD, −0.30; 95% CI, −0.48 to −0.11; I^2 = 87.6%), more incidences of medical errors (SMD, −0.19; 95% CI, −0.32 to −0.05; I^2 = 0.0%), more frequent adverse events or patient safety incidents (SMD, −0.42; 95% CI, −0.76 to −0.07; I^2 = 97.3%), and more incidences of missed care or nursing care left undone (SMD, −0.58; 95% CI, −0.91 to −0.26; I^2 = 92.2%). No association was found for frequency of pressure ulcers (SMD, −0.12; 95% CI, −0.24 to 0.01; I^2 = 70.7%) or for the 1 study[61] that investigated frequency of adverse infusion- and transfusion-related reactions (SMD, −0.01; 95% CI, −0.14 to 0.12).

The random-effects meta-analysis showed an association between nurse burnout and lower patient satisfaction survey ratings (SMD, −0.51; 95% CI, −0.86 to −0.17; I^2 = 98.1%) (**Figure 3**). However, the association was not significant for 2 studies[61,104] on the frequencies of patient complaints (SMD, −0.15; 95% CI, −0.43 to 0.12; I^2 = 89.4%) and patient abuse (SMD, −0.16; 95% CI, −0.42 to 0.11; I^2 = 88.8%).

The random-effects meta-analysis also showed negative associations between nurse burnout and quality of care outcomes (**Figure 4**). Specifically, nurse burnout was associated with lower nurse-assessed quality of care (SMD, −0.44; 95% CI, −0.57 to −0.30; I^2 = 97.2%), a higher rate of tube feeding in nursing home patients (SMD, −0.20; 95% CI, −0.27 to −0.12),[49] and a higher rate of urinary catheter use in nursing home patients (SMD, −0.22; 95% CI, −0.30 to −0.14).[49] No association was found for length of stay in 1 study[91] (SMD, −0.01; 95% CI, −0.04 to 0.02), failure to rescue rate in 1

study[91] (SMD, −0.03; 95% CI, −0.05 to 0.00), and 30-day standardized mortality rate in 2 studies[79,91] (SMD, −0.27; 95% CI, −0.75 to 0.20; I^2 = 99.2%).

Figure 1. Association of Nurse Burnout With Patient Safety Climate and Grade and Frequency of Nosocomial Infections

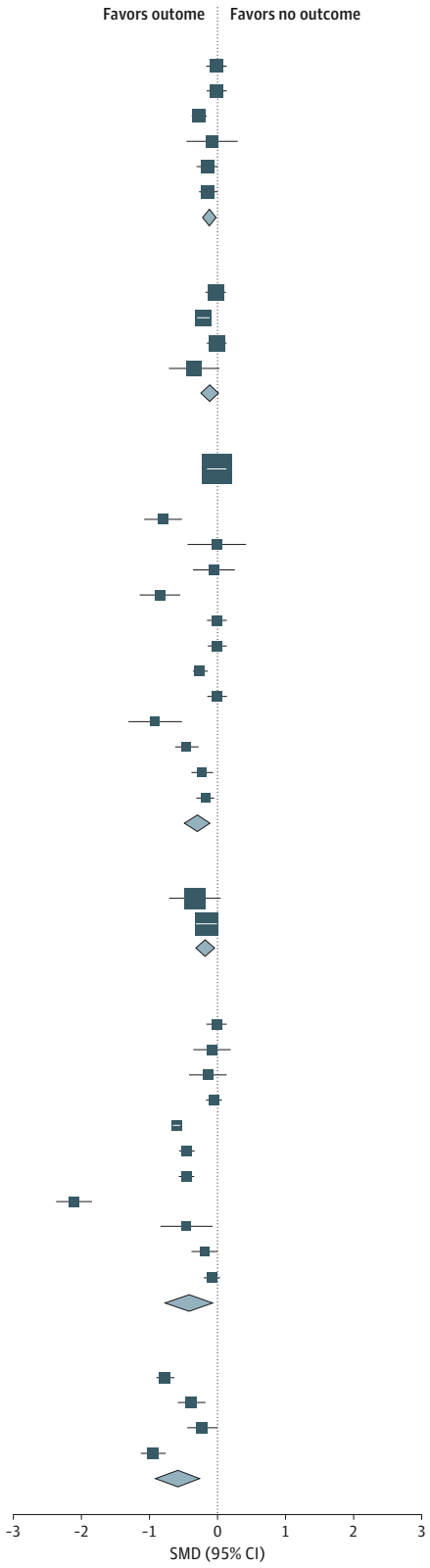


Source	SMD (95% CI)
Safety climate	
Aiken et al,[31] 2023	-1.20 (-1.24 to -1.17)
Al Ma'mari et al,[32] 2020	-0.73 (-1.17 to -0.29)
Alves and Guirardello,[33] 2016	-0.76 (-1.04 to -0.48)
Bilal and Yildirim Sari,[39] 2020	-0.72 (-1.03 to -0.41)
Cheng et al,[44] 2020	-0.80 (-0.89 to -0.71)
Colindres et al,[47] 2018	-0.52 (-0.74 to -0.29)
Fish et al,[50] 2022 (Australia)	-0.60 (-0.75 to -0.45)
Fish et al,[50] 2022 (China)	-0.53 (-0.65 to -0.41)
Guirardello,[54] 2017	-0.61 (-0.99 to -0.23)
Halbesleben et al,[56] 2008	-0.41 (-0.74 to -0.08)
Johnson et al,[59] 2019	-0.80 (-0.99 to -0.61)
Johnson et al,[60] 2017	-1.10 (-1.33 to -0.86)
Kim et al,[64] 2015	-0.98 (-1.27 to -0.69)
Kirwan et al,[65] 2013	-0.45 (-0.56 to -0.34)
Liu et al,[72] 2024	-0.93 (-1.02 to -0.84)
Majrabi,[75] 2022	-0.31 (-0.68 to 0.07)
Mansour et al,[76] 2021	-0.16 (-0.48 to 0.16)
Montgomery et al,[81] 2022	-0.01 (-0.14 to 0.12)
Ryu and Shim,[90] 2021	-0.68 (-0.91 to -0.44)
Squires et al,[94] 2010	-0.95 (-1.12 to -0.78)
Vifladt et al,[106] 2016	-2.32 (-3.08 to -1.56)
Vitale et al,[107] 2020	-0.56 (-0.80 to -0.32)
Vogus et al,[108] 2014	-0.33 (-0.43 to -0.22)
Random-effects model	-0.68 (-0.83 to -0.54)
Heterogeneity: I^2 = 97.3%; τ^2 = 0.11; P < .001	
Safety grade	
Bagnasco et al,[36] 2020	-0.02 (-0.16 to 0.12)
Johnson et al,[59] 2019	-0.90 (-1.09 to -0.71)
Johnson et al,[60] 2017	-0.93 (-1.16 to -0.70)
Liu et al,[71] 2019	-0.70 (-0.81 to -0.60)
Liu et al,[73] 2018	-0.93 (-1.04 to -0.82)
Prapanjaroensin,[85] 2019	-0.01 (-0.14 to 0.12)
Rainbow et al,[86] 2020	-0.59 (-0.79 to -0.38)
Ramanujam et al,[87] 2008	-0.38 (-0.58 to -0.19)
Soósová,[93] 2021	-0.77 (-1.15 to -0.39)
Van Wyk,[105] 2010	-0.53 (-0.81 to -0.26)
You et al,[110] 2013	-0.16 (-0.20 to -0.12)
Zander et al,[113] 2013	-0.54 (-0.61 to -0.47)
Random-effects model	-0.53 (-0.72 to -0.34)
Heterogeneity: I^2 = 97.1%; τ^2 = 0.11; P < .001	
Nosocomial infection, frequency	
Bagnasco et al,[36] 2020	-0.01 (-0.15 to 0.13)
Cimiotti et al,[45] 2012	-0.67 (-0.72 to -0.62)
Eltaybani et al,[49] 2021	-0.24 (-0.32 to -0.16)
Kakemam et al,[61] 2021	-0.01 (-0.15 to 0.12)
Nantsupawat et al,[82] 2016	-0.19 (-0.29 to -0.09)
Soósová,[93] 2021	-0.11 (-0.47 to 0.25)
Van Bogaert et al,[100] 2014	-0.10 (-0.25 to 0.05)
Van Bogaert et al,[104] 2014	-0.18 (-0.30 to -0.06)
Random-effects model	-0.20 (-0.36 to -0.04)
Heterogeneity: I^2 = 97.0%; τ^2 = 0.05; P < .001	

The size of the boxes corresponds to the weight of the study in the meta-analysis. SMD indicates standardized mean difference.

Figure 2. Association of Nurse Burnout With Patient Safety Issues

Source	SMD (95% CI)
Patient fall, frequency	
Bagnasco et al,[36] 2020	-1.02 (-0.16 to 0.12)
Kakemam et al,[61] 2021	-0.01 (-0.15 to 0.12)
Nantsupawat et al,[82] 2016	-0.27 (-0.37 to -0.17)
Soósová et al,[93] 2021	-0.08 (-0.44 to 0.29)
Van Bogaert et al,[100] 2014	-0.15 (-0.30 to -0.00)
Van Bogaert et al,[104] 2014	-0.14 (-0.26 to -0.02)
Random-effects model	-0.12 (-0.22 to -0.03)
Heterogeneity: I^2 = 62.2%; τ^2 = 0.01; P = .02	
Pressure ulcer, frequency	
Bagnasco et al,[36] 2020	-0.03 (-0.17 to 0.11)
Eltaybani et al,[49] 2021	-0.21 (-0.29 to -0.13)
Kakemam et al,[61] 2021	-0.01 (-0.15 to 0.12)
Soósová et al,[93] 2021	-0.34 (-0.71 to 0.03)
Random-effects model	-0.12 (-0.24 to 0.01)
Heterogeneity: I^2 = 70.7%; τ^2 = 0.01; P = .02	
Infusion or transfusion reaction, frequency	
Kakemam et al,[61] 2021	-0.01 (-0.14 to 0.12)
Medication error, frequency	
Bao et al,[37] 2013	-0.80 (-1.06 to -0.53)
Betsiou et al,[38] 2022	-0.01 (-0.43 to 0.41)
Holden et al,[57] 2011	-0.05 (-0.35 to 0.24)
Im et al,[58] 2023	-0.84 (-1.13 to -0.55)
Kakemam et al,[61] 2021	-0.01 (-0.14 to 0.12)
Montgomery et al,[80] 2021	-0.01 (-0.13 to 0.12)
Nantsupawat et al,[82] 2016	-0.26 (-0.35 to -0.16)
Prapanjaroensin et al,[85] 2019	-0.01 (-0.14 to 0.13)
Soósová et al,[93] 2021	-0.91 (-1.30 to -0.53)
Squires and Tourangeau,[94] 2010	-0.45 (-0.61 to -0.29)
Van Bogaert et al,[100] 2014	-0.22 (-0.37 to -0.08)
Van Bogaert et al,[104] 2014	-0.18 (-0.30 to -0.06)
Random-effects model	-0.30 (-0.48 to -0.11)
Heterogeneity: I^2 = 87.6%; τ^2 = 0.09; P < .001	
Medical error, incidence	
Kwon et al,[66] 2021	-0.33 (-0.70 to 0.03)
Melnyk et al,[77] 2021	-0.16 (-0.31 to -0.01)
Random-effects model	-0.19 (-0.32 to -0.05)
Heterogeneity: I^2 = 0.0%; τ^2 = 0.00; P = .39	
Adverse event, frequency	
Bagnasco et al,[36] 2020	-0.01 (-0.15 to 0.13)
Khatatbeh et al,[62] 2023	-0.08 (-0.34 to 0.18)
Khatatbeh et al,[63] 2024	-0.14 (-0.40 to 0.12)
Kirwan et al,[65] 2013	-0.05 (-0.16 to 0.05)
Spence Laschinger and Leiter,[68] 2006	-0.60 (-0.64 to -0.56)
Liu et al,[71] 2019	-0.45 (-0.56 to -0.35)
Liu et al,[73] 2018	-0.46 (-0.56 to -0.35)
Rainbow et al,[86] 2020	-2.10 (-2.35 to -1.85)
Soósová,[93] 2021	-0.45 (-0.82 to -0.08)
Teng et al,[95] 2010	-0.19 (-0.37 to -0.00)
Vogus et al,[108] 2014	-0.08 (-0.19 to 0.03)
Random-effects model	-0.42 (-0.76 to -0.07)
Heterogeneity: I^2 = 97.3%; τ^2 = 0.33; P < .001	
Missed care, incidence	
Clark and Lake,[46] 2020	-0.76 (-0.88 to -0.64)
Liu et al,[70] 2019	-0.38 (-0.57 to -0.19)
Nantsupawat et al,[83] 2023	-0.23 (-0.43 to -0.02)
White et al,[109] 2019	-0.94 (-1.11 to -0.77)
Random-effects model	-0.58 (-0.91 to -0.26)
Heterogeneity: I^2 = 92.2%; τ^2 = 0.10; P < .001	



The size of the boxes corresponds to the weight of the study in the meta-analysis. SMD indicates standardized mean difference.

Subgroup Analyses

We conducted subgroup analyses of the planned variables for the patient safety quality-of-care outcomes. These analyses were stratified by measurement scale of burnout; subcomponents of burnout; nurse age, sex, work experience, and education; clinical specialty; geographic region; and survey time.

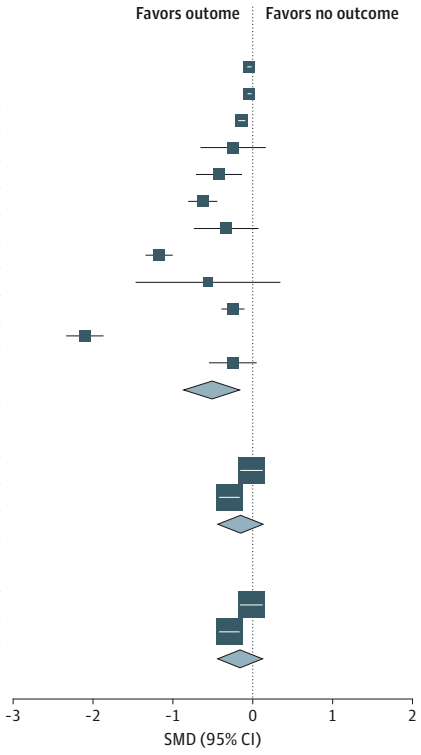
Stratification by Measurement Scale of Burnout

An association between nurse burnout and patient safety and quality of care was found for most burnout measurement scales (eFigures 2 and 3 in Supplement 1), including the Maslach Burnout Inventory (safety: SMD, −0.51 [95% CI, −0.61 to −0.41]; quality: SMD, −0.33 [95% CI, −0.45 to −0.21]), Oldenburg Burnout Inventory (safety: SMD, −0.85; 95% CI, −1.04 to −0.66), Shirom-Melamed Burnout Measure (safety: SMD, −0.80; 95% CI, −1.06 to −0.53), and Bergen Burnout Inventory (safety: SMD, −2.32; 95% CI, −3.08 to −1.56). The Professional Quality of Life Questionnaire did not find an association of nurse burnout with patient safety (SMD, −0.81; 95% CI, −1.63 to 0.02), possibly due to low power, but found a significant association with quality of care (SMD, −0.92; 95% CI, −1.19 to −0.66). The Copenhagen Burnout Inventory found a significant association of nurse burnout with patient safety (SMD, −0.15; 95% CI, −0.27 to −0.02) but did not find an association with quality of care (SMD, −0.84; 95% CI, −1.72 to 0.05).

Stratification by Subcomponent of Burnout

Forest plots (eFigures 4 and 5 in Supplement 1) showed that among the studies that used the Maslach Burnout Inventory as the measurement tool, the low personal accomplishment subcomponent of burnout had a smaller association with patient safety (SMD, −0.28; 95% CI, −0.38 to −0.19) than the emotional exhaustion subcomponent (SMD, −0.52; 95% CI, −0.63 to −0.41; $z = -3.15$; $P = .002$) and the depersonalization subcomponent (SMD, −0.45; 95% CI, −0.57 to −0.33; $z = -2.10$; $P = .04$).

Figure 3. Association of Nurse Burnout With Patient Satisfaction



Source	SMD (95% CI)
Patient satisfaction survey rating	
Aiken et al,[30] 2012 (Europe)	-0.04 (-0.06 to -0.02)
Aiken et al,[30] 2012 (US)	-0.04 (-0.05 to -0.02)
Brooks Carthon et al,[41] 2021	-0.14 (-0.17 to -0.10)
Chao et al,[42] 2016	-0.24 (-0.64 to 0.16)
Cheng et al,[43] 2016	-0.42 (-0.70 to -0.24)
Dimitrios et al,[48] 2023	-0.62 (-0.80 to -0.45)
Gravlin,[53] 1994	-0.33 (-0.73 to 0.06)
Leiter et al,[69] 1998	-1.17 (-1.33 to -1.00)
Ríos-Risquez and García-Izquierdo,[88] 2016	-0.56 (-1.45 to 0.34)
Vahey et al,[96] 2004	-0.25 (-0.39 to -0.11)
Zaghini et al,[111] 2020	-2.10 (-2.32 to -1.87)
Zaki et al,[112] 2016	-0.25 (-0.54 to 0.04)
Random-effects model	-0.51 (-0.86 to -0.17)
Heterogeneity: $I^2 = 98.1\%$; $\tau^2 = 0.35$; $P < .001$	
Patient complaint, frequency	
Kakemam et al,[61] 2021	-0.01 (-0.15 to 0.12)
Van Bogaert et al,[104] 2014	-0.29 (-0.41 to -0.17)
Random-effects model	-0.15 (-0.43 to 0.12)
Heterogeneity: $I^2 = 89.4\%$; $\tau^2 = 0.03$; $P = .002$	
Patient abuse, frequency	
Kakemam et al,[61] 2021	-0.02 (-0.15 to 0.12)
Van Bogaert et al,[104] 2014	-0.29 (-0.41 to -0.17)
Random-effects model	-0.16 (-0.42 to 0.11)
Heterogeneity: $I^2 = 88.8\%$; $\tau^2 = 0.03$; $P = .003$	

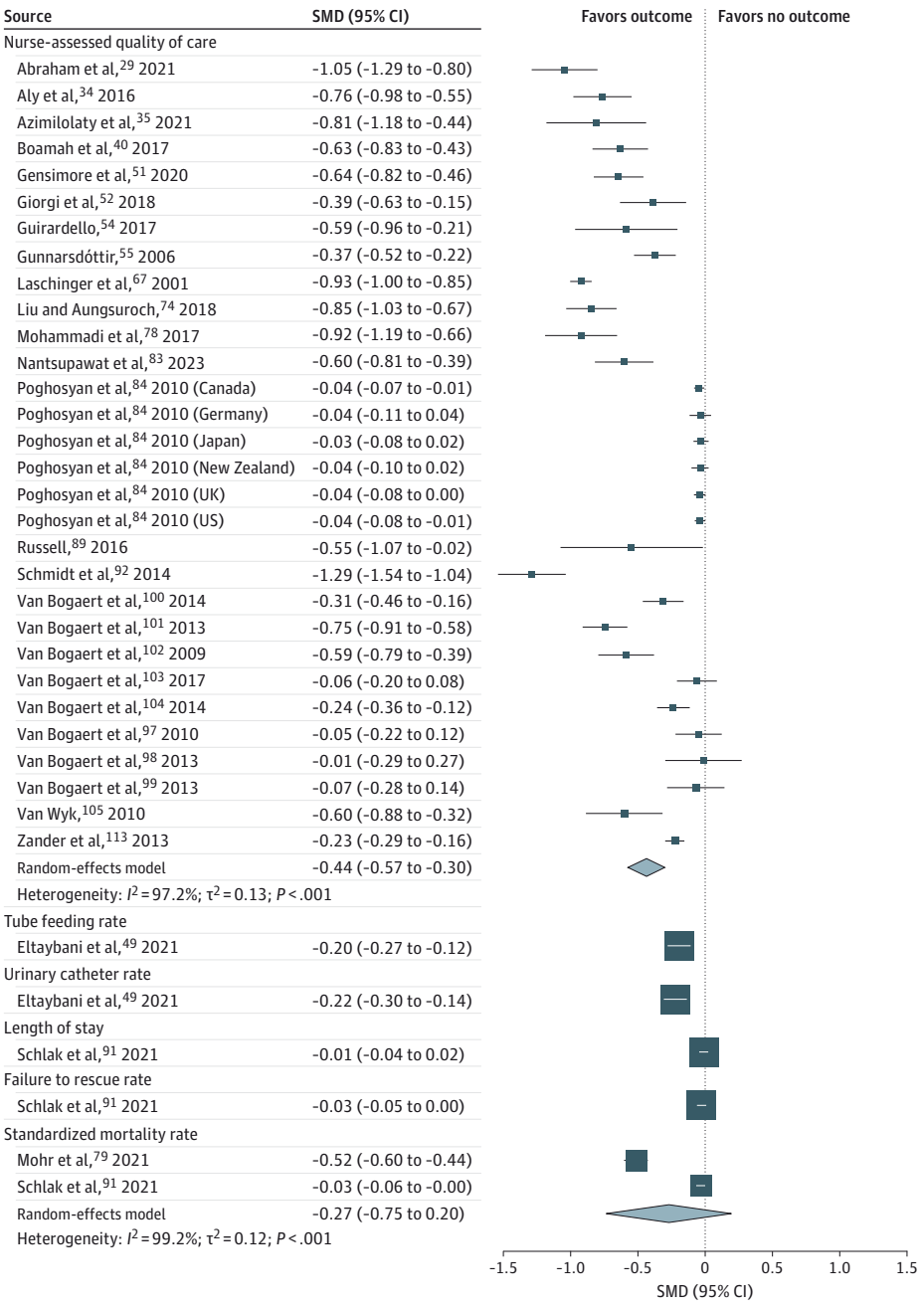
The size of the boxes corresponds to the weight of the study in the meta-analysis. SMD indicates standardized mean difference.

However, the forest plots did not show any difference in the association between nurse burnout and quality of care across the burnout subcomponents.

Stratification by Nurse Age, Sex, Work Experience, and Education

Meta-regression results indicated that the association between nurse burnout and patient safety and quality of care was consistent across various demographic characteristics. Specifically, the association was not moderated by nurses' age (safety: meta-regression coefficient, −0.01 [95% CI, −0.03 to 0.02; P = .63]; quality: meta-regression coefficient, 0.01 [95% CI, −0.04 to 0.02; P = .48]),

Figure 4. Association of Nurse Burnout With Quality of Health Care



The size of the boxes corresponds to the weight of the study in the meta-analysis. SMD indicates standardized mean difference.

sex (safety: meta-regression coefficient, −0.43 [95% CI, −1.39 to 0.54; *P* = .39]; quality: meta-regression coefficient, 0.34 [95% CI, −1.63 to 2.30; *P* = .74]), or work experience (safety: meta-regression coefficient, −0.02 [95% CI, −0.05 to 0.01; *P* = .20]; quality: meta-regression coefficient, 0.01 [95% CI, −0.02 to 0.05; *P* = .46]).

The association between nurse burnout and quality of care was not moderated by nurses' educational level (meta-regression coefficient, −0.01; 95% CI, −0.49 to 0.47; *P* = .97) (eFigure 6 in Supplement 1). However, the association between nurse burnout and lower patient safety was smaller for the nurses with a higher percentage of college degrees (meta-regression coefficient, 0.52; 95% CI, 0.15-0.89; *P* = .006) (**Figure 5**). Stratification by graduate degrees (master's degree or higher) is presented in eMethods 3 in Supplement 1, with the caveat of lower power.

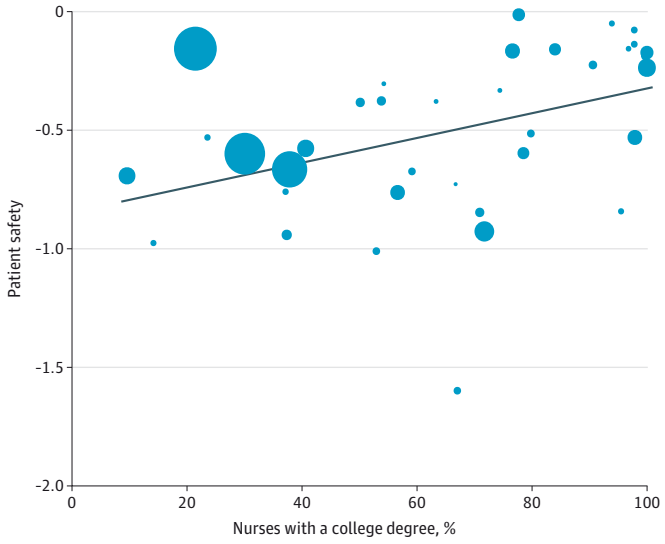
Stratification by Clinical Specialty

The meta-regression showed negative associations between nurse burnout and patient safety and quality of care in most nursing specialties. Associations between nurse burnout and patient safety and quality of care by clinical specialty (eFigures 7 and 8 in Supplement 1) were as follows: nurses without a reported specialty (safety: SMD, −0.50 [95% CI, −0.62 to −0.38]; quality: SMD, −0.34 [95% CI, −0.49 to −0.19]), primary care (quality: SMD, −1.05; 95% CI, −1.29 to −0.80), acute care (safety: SMD, −0.55 [95% CI, −0.83 to −0.26]; quality: SMD, −0.34 [95% CI, −0.74 to 0.06]), emergency department or urgent care (safety: SMD, −0.16; 95% CI, −0.48 to 0.16), intensive care unit or critical care (safety: SMD, −0.62 [95% CI, −1.10 to −0.14]; quality: SMD, −0.66 [95% CI, −0.82 to −0.51]), pediatrics (safety: SMD, −0.29; 95% CI, −0.56 to −0.01), geriatrics (safety: SMD, −0.43 [95% CI, −0.93 to 0.06]; quality: SMD, −0.60 [95% CI, −1.26 to 0.07]), psychiatry (quality: SMD, −0.05; 95% CI, −0.22 to 0.12), maternity (safety: SMD, −0.76; 95% CI, −0.88 to −0.64), and oncology (safety: SMD, −0.93 [95% CI, −1.02 to −0.84]; quality: SMD, −0.55 [95% CI, −1.07 to −0.02]). For patient safety, the negative association was significant for all but geriatric and emergency nurses, possibly due to low power. For quality of care, the negative association was significant for all specialties except geriatrics, psychiatry, and acute care.

Stratification by Geography and Survey Time

The meta-regression showed negative associations between nurse burnout and health care quality and safety in most countries. A significant association between nurse burnout and patient safety was found in Australia, Belgium, Brazil, Canada, China, Ecuador, Germany, Iran, Ireland, Japan, Korea,

Figure 5. Nurse Burnout and Patient Safety Stratified by Education



The circle area is proportional to the reciprocal of the variance.

Norway, Oman, the Slovak Republic, South Africa, Spain, Thailand, Turkey, the United Kingdom, and the US but not in Greece, Italy, Jordan, and Saudi Arabia (eFigure 9 in Supplement 1). A significant association between nurse burnout and quality of care was observed in Belgium, Brazil, Canada, China, Egypt, Iceland, Iran, Italy, South Africa, Thailand, and the US but not in Germany, Japan, New Zealand, and the United Kingdom (eFigure 10 in Supplement 1). eFigure 36 in Supplement 1 presents a graph of the mean association by geographic area.

The association between nurse burnout and patient safety was not moderated by when the survey was conducted (meta-regression coefficient, −0.00; 95% CI, −0.02 to 0.02; $P = .98$ (eFigure 11 in Supplement 1) over a 33-year survey completion period from 1991 to 2023. However, the association between nurse burnout and quality of care was more negative over time (meta-regression coefficient, −0.03; 95% CI, −0.05 to −0.009; $P = .006$) (eFigure 12 in Supplement 1), even after excluding the studies published after 2019 to account for the COVID-19 pandemic (eFigures 13 and 14 in Supplement 1).

Sensitivity Analysis

Risk of bias in nonrandomized studies of exposure scores for each included study are provided in eTable 6 in Supplement 1 and a bubble plot in eFigure 15 in Supplement 1. The Begg rank test ($z = −1.16$; $P = .25$) (eFigures 16-19 in Supplement 1) did not indicate small-study effects, and a meta-analysis of nonaffirmative results suggested that the results were highly robust to hypothetical worst-case publication bias and p-hacking (eFigure 20 in Supplement 1).[114] Serial exclusion of the studies found that each study contributed to a mean (SD) 0.00% (0.97%) of the Cohen *d* estimate (eTable 7 in Supplement 1). We show strength of evidence under effect heterogeneity[115] in eFigures 21 and 22 in Supplement 1. We used robust variance estimation to account for multiple outcomes from the same study (eTable 8 in Supplement 1). Sensitivity analyses (eFigures 23 and 24 in Supplement 1) showed that burnout levels or prevalence rates did not moderate the association, suggesting that the results were not driven by divergent ascertainments of burnout.[116] We found similar results using alternative variable coding (odds ratio conversion) (eFigures 25-30 in Supplement 1), sample selection (mixed professions) (eFigures 31-33 in Supplement 1), and confounding adjustment (eFigures 34 and 35 in Supplement 1).

Discussion

This meta-analysis shows a negative association between nurse burnout and patient safety, patient satisfaction, and quality of care. The association between nurse burnout and these outcomes was consistent independent of nurses' age, sex, work experience, and geography. The associations and effect size between nurse burnout and quality of care were also consistent with previous meta-analyses of burnout and quality of care in physicians and pooled studies of health care professionals.[16,17]

The emotional exhaustion and depersonalization dimensions of burnout, more so than personal accomplishment, were observed to be the most closely associated with patient safety. This finding is consistent with previous research suggesting that the personal accomplishment dimension may be a somewhat distinct construct.[117]

The association of nurse burnout with patient safety was persistent over time, and the association with quality of care was increasingly negative over 3 decades, even after accounting for the COVID-19 pandemic. This finding is concerning considering decades of national and organizational efforts for quality improvement.

The moderation of having a bachelor's degree on patient safety and having a graduate degree on quality of care were consistent with a previous finding that higher levels of nurse education were associated with lower patient mortality.[117] Accordingly, investments in nursing education and training may be considered as a component of burnout mitigation efforts.

To date, most antiburnout efforts have focused on individual interventions, such as mindfulness or personal resilience training designed to help people more effectively cope with stress, instead of interventions to reduce stress and burnout in the workplace.[118] Many effective interventions are at the work unit level, where health care workers experience teamwork, feelings of community, professional development, and recognition. Numerous health care organizations have begun to take action, including appointing senior leaders to develop an organizational strategy to address the root cause issues in the clinical practice environment, such as low staffing levels and long work hours or overtime.[119] Hospital accrediting bodies have also begun evaluating such organizational efforts, which may encourage more widespread adoption.[120]

The US Surgeon General has prioritized the mitigation of burnout for the nation's health care delivery system.[121] The National Academy of Medicine has launched a holistic action collaborative involving stakeholder groups, including health care payers, technology companies, government agencies, professional societies, and health care organizations to promote well-being for health care workers.[122] Congress has passed legislation allocating more than $100 million of funding to promote mental health, foster resilience, and reduce stigma among health care professionals.[123] Allocation of even more substantive funding, commensurate with the magnitude and adverse effects of health worker burnout, seems necessary to support research and implementation of evidence-based approaches to reduce clinician burnout.

Limitations

This study is subject to several limitations. One key limitation of the meta-analysis is the heterogeneity across the included studies, which is common among studies of psychosocial factors. Another limitation is that most included studies used cross-sectional research designs, which prevented us from determining the causal direction of the association between nurse burnout and the outcomes. We also combined 2 separate preregistrations because we determined that patient safety is an inseparable dimension of quality of care.[124] Finally, despite many countries included, the comparisons by geography did not represent all countries in an area and should be interpreted with that qualification.

Conclusions

In this systematic review and meta-analysis of 85 studies, nurse burnout was associated with lower health care quality and safety and lower patient satisfaction. These associations were consistent across nurses' age, sex, work experience, and geography and have been persistent over time.

ARTICLE INFORMATION

Accepted for Publication: September 12, 2024.

Published: November 5, 2024. doi:10.1001/jamanetworkopen.2024.43059

Corresponding Author: Peilin Yang, BS, Department of Economics, Barcelona School of Economics, Carrer de Ramon Trias Fargas, 25-27, Sant Martí, 08005 Barcelona, Spain (peilin.yang@upf.edu).

Author Affiliations: Graduate School of Business, Stanford University, Stanford, California (Li, Yang, Pfeffer); Department of Economics, Barcelona School of Economics, Barcelona, Spain (Yang); School of Medicine, Stanford University, Stanford, California (Singer, Mathur, Shanafelt); T. H. Chan School of Public Health, Harvard University, Boston, Massachusetts (Singer).

Author Contributions: Messrs Li and Yang had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Messrs Li and Yang contributed equally as co–first authors.

Concept and design: Li, Yang, Pfeffer.

Acquisition, analysis, or interpretation of data: Li, Yang, Singer, Mathur, Shanafelt.

Drafting of the manuscript: Li.

Critical review of the manuscript for important intellectual content: Yang, Singer, Pfeffer, Mathur, Shanafelt.

Statistical analysis: Yang, Mathur.

Administrative, technical, or material support: Yang.

Supervision: Pfeffer, Mathur.

Conflict of Interest Disclosures: Dr Shanafelt reported receiving patents for well-being index and leadership behavior index instruments, with royalties shared with the Mayo Clinic (the copyright holder), and speaker honoraria from Baylor Scott & White Health; UT Southwestern Medical Center; California Pacific Medical Center; Albany Medical Center; Doctors' Health SA; Southwestern Health Resources; University of California, San Diego; All American Entertainment (on behalf of the Association of Faculties of Medicine of Canada); Samaritan Health Services; American Society of Clinical Oncology; Centra; American Medical Group Association; Inland Empire Health Plan; Cleveland Clinic; NYU Grossman School of Medicine (Emergency Medicine); Beamtree Health Roundtable; Well-Being Collaborative of Arizona Health Professionals; Corewell Health; Mercy Clinic East Community; Federation of Medical Specialists of Quebec; Sutter Health; Overlake Hospital; Gould Medical Group; Optum Massachusetts (Reliant Medical Group and Atrius Health); DAP Health; Children's National Hospital; Georgia Heart Institute; Honor Health of Arizona; Meharry Medical College; and the University of Kentucky College of Medicine and UK HealthCare, St Jude Children's Research Hospital outside the submitted work. No other disclosures were reported.

Funding/Support: This study was supported by the Business, Government, and Society Research Fund from the Stanford Graduate School of Business (Mr Li).

Role of the Funder/Sponsor: The funder had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Data Sharing Statement: See Supplement 2.

Additional Contributions: The authors acknowledge suggestions from Phyllis Kayten, PhD, Stanford University Libraries, on the development of search keywords and strategies and suggestions from Sarah A. Soule, PhD, Stanford University. Dr Kayten and Prof Soule did not receive compensation for their contributions.

REFERENCES

1. Maslach C, Schaufeli WB, Leiter MP. Job burnout. *Annu Rev Psychol*. 2001;52(1):397-422. doi:10.1146/annurev.psych.52.1.397

2. Woo T, Ho R, Tang A, Tam W. Global prevalence of burnout symptoms among nurses: a systematic review and meta-analysis. *J Psychiatr Res*. 2020;123:9-20. doi:10.1016/j.jpsychires.2019.12.015

3. Zhang YY, Han WL, Qin W, et al. Extent of compassion satisfaction, compassion fatigue and burnout in nursing: a meta-analysis. *J Nurs Manag*. 2018;26(7):810-819. doi:10.1111/jonm.12589

4. Ge MW, Hu FH, Jia YJ, Tang W, Zhang WQ, Chen HL. Global prevalence of nursing burnout syndrome and temporal trends for the last 10 years: a meta-analysis of 94 studies covering over 30 countries. *J Clin Nurs*. 2023;32(17-18):5836-5854. doi:10.1111/jocn.16708

5. Shah MK, Gandrakota N, Cimiotti JP, Ghose N, Moore M, Ali MK. Prevalence of and factors associated with nurse burnout in the US. *JAMA Netw Open*. 2021;4(2):e2036469. doi:10.1001/jamanetworkopen.2020.36469

6. Gómez-Urquiza JL, Vargas C, De la Fuente EI, Fernández-Castillo R, Cañadas-De la Fuente GA. Age as a risk factor for burnout syndrome in nursing professionals: a meta-analytic study. *Res Nurs Health*. 2017;40(2):99-110. doi:10.1002/nur.21774

7. Cañadas-De la Fuente GA, Ortega E, Ramirez-Baena L, De la Fuente-Solana EI, Vargas C, Gómez-Urquiza JL. Gender, marital status, and children as risk factors for burnout in nurses: a meta-analytic study. *Int J Environ Res Public Health*. 2018;15(10):2102. doi:10.3390/ijerph15102102

8. Shin S, Park JH, Bae SH. Nurse staffing and nurse outcomes: a systematic review and meta-analysis. *Nurs Outlook*. 2018;66(3):273-282. doi:10.1016/j.outlook.2017.12.002

9. Wang J, Zeng Q, Wang Y, et al. Workplace violence and the risk of post-traumatic stress disorder and burnout among nurses: a systematic review and meta-analysis. *J Nurs Manag*. 2022;30(7):2854-2868. doi:10.1111/jonm.13809

10. Castillo-González A, Velando-Soriano A, De La Fuente-Solana EI, et al. Relation and effect of resilience on burnout in nurses: a literature review and meta-analysis. *Int Nurs Rev*. 2024;71(1):160-167. doi:10.1111/inr.12838

11. Aronsson G, Theorell T, Grape T, et al. A systematic review including meta-analysis of work environment and burnout symptoms. *BMC Public Health*. 2017;17(1):264. doi:10.1186/s12889-017-4153-7

12. Şenol Çelik S, Sariköse S, Çelik Y. Structural and psychological empowerment and burnout among nurses: a systematic review and meta-analysis. *Int Nurs Rev*. 2024;71(1):189-201. doi:10.1111/inr.12878

13. Membrive-Jiménez MJ, Gómez-Urquiza JL, Suleiman-Martos N, et al. Relation between burnout and sleep problems in nurses: a systematic review with meta-analysis. *Healthcare (Basel)*. 2022;10(5):954. doi:10.3390/healthcare10050954

14. Özkan AH. The effect of burnout and its dimensions on turnover intention among nurses: a meta-analytic review. *J Nurs Manag*. 2022;30(3):660-669. doi:10.1111/jonm.13525

15. Chen C, Meier ST. Burnout and depression in nurses: a systematic review and meta-analysis. *Int J Nurs Stud*. 2021;124:104099. doi:10.1016/j.ijnurstu.2021.104099

16. Hodkinson A, Zhou A, Johnson J, et al. Associations of physician burnout with career engagement and quality of patient care: systematic review and meta-analysis. *BMJ*. 2022;378:e070442. doi:10.1136/bmj-2022-070442

17. Tawfik DS, Scheid A, Profit J, et al. Evidence relating health care provider burnout and quality of care: a systematic review and meta-analysis. *Ann Intern Med*. 2019;171(8):555-567. doi:10.7326/M19-1152

18. Jun J, Ojemeni MM, Kalamani R, Tong J, Crecelius ML. Relationship between nurse burnout, patient and organizational outcomes: systematic review. *Int J Nurs Stud*. 2021;119:103933. doi:10.1016/j.ijnurstu.2021.103933

19. Lee M, Cha C. Interventions to reduce burnout among clinical nurses: systematic review and meta-analysis. *Sci Rep*. 2023;13(1):10971. doi:10.1038/s41598-023-38169-8

20. Patient safety. World Health Organization. 2024. Accessed February 24, 2024. https://www.who.int/news-room/fact-sheets/detail/patient-safety

21. Linder-Pelz SU. Toward a theory of patient satisfaction. *Soc Sci Med*. 1982;16(5):577-582. doi:10.1016/0277-9536(82)90311-2

22. Quality of care. World Health Organization. 2024. Accessed February 24, 2024. https://www.who.int/health-topics/quality-of-care#tab=tab_1

23. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021;372:n71. doi:10.1136/bmj.n71

24. Morgan RL, Whaley P, Thayer KA, Schünemann HJ. Identifying the PECO: a framework for formulating good questions to explore the association of environmental and other exposures with health outcomes. *Environ Int*. 2018;121(pt 1):1027-1031. doi:10.1016/j.envint.2018.07.015

25. PSI 90 fact sheet. Agency for Healthcare Research and Quality. August 31, 2016. Accessed March 24, 2024. https://qualityindicators.ahrq.gov/news/psi90_factsheet_faq.pdf

26. Lake ET. Development of the practice environment scale of the Nursing Work Index. *Res Nurs Health*. 2002; 25(3):176-188. doi:10.1002/nur.10032

27. World Bank country and lending groups. The World Bank Group. March 26, 2024. Accessed February 24, 2024. https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

28. Morgan RL, Thayer KA, Santesso N, et al; GRADE Working Group. A risk of bias instrument for non-randomized studies of exposures: a users' guide to its application in the context of GRADE. *Environ Int*. 2019;122:168-184. doi: 10.1016/j.envint.2018.11.004

29. Abraham CM, Zheng K, Norful AA, Ghaffari A, Liu J, Poghosyan L. Primary care nurse practitioner burnout and perceptions of quality of care. *Nurs Forum*. 2021;56(3):550-559. doi:10.1111/nuf.12579

30. Aiken LH, Sermeus W, Van den Heede K, et al. Patient safety, satisfaction, and quality of hospital care: cross sectional surveys of nurses and patients in 12 countries in Europe and the United States. *BMJ*. 2012;344:e1717. doi: 10.1136/bmj.e1717

31. Aiken LH, Lasater KB, Sloane DM, et al; US Clinician Wellbeing Study Consortium. Physician and nurse well-being and preferred interventions to address burnout in hospital practice: factors associated with turnover, outcomes, and patient safety. *JAMA Health Forum*. 2023;4(7):e231809. doi:10.1001/jamahealthforum.2023.1809

32. Al Ma'mari Q, Sharour LA, Al Omari O. Fatigue, burnout, work environment, workload and perceived patient safety culture among critical care nurses. *Br J Nurs*. 2020;29(1):28-34. doi:10.12968/bjon.2020.29.1.28

33. Alves DFS, Guirardello EB. Safety climate, emotional exhaustion and job satisfaction among Brazilian paediatric professional nurses. *Int Nurs Rev*. 2016;63(3):328-335. doi:10.1111/inr.12276

34. Aly NAEFM, Ghanem M, El-Shanawany S. Organizational cynicism and its consequences on nurses and quality of care in critical care and toxicology units. *J Educ Pract*. 2016;7(8):85-96.

35. Azimilolaty H, Rezaei S, Khorram M, Mousavinasab SN, Heidari T. Correlation between the quality of nursing care and burnout of nurses in the teaching hospitals affiliated to Mazandaran University of Medical Sciences, Iran. *Iran J Nurs*. 2021;33(128):54-66. doi:10.52547/ijn.33.128.54

36. Bagnasco A, Dasso N, Rossi S, et al. A cross-sectional multisite exploration of Italian paediatric nurses' reported burnout and its relationship to perceptions of clinical safety and adverse events using the RN4CAST@IT-Ped. *J Adv Nurs*. 2020;76(8):2072-2081. doi:10.1111/jan.14401

37. Bao Y, Vedina R, Moodie S, Dolan S. The relationship between value incongruence and individual and organizational well-being outcomes: an exploratory study among Catalan nurses. *J Adv Nurs*. 2013;69(3):631-641. doi:10.1111/j.1365-2648.2012.06045.x

38. Betsiou S, Pitsiou G, Panagiotidou E, Sarridou D, Kioumis I, Boutou AK. Nursing errors in intensive care unit and their association with burnout, anxiety, insomnia and working environment: a cross-sectional study. *Hippokratia*. 2022;26(3):110-117.

39. Bilal H, Yildirim Sari H. Relación entre agotamiento emocional y la actitud hacia la seguridad del paciente en enfermeras pediátricas en un hospital de Turquía. *Enferm Clin (Engl Ed)*. 2020;30(1):37-41. doi:10.1016/j.enfcli.2019.08.001

40. Boamah SA, Read EA, Spence Laschinger HK. Factors influencing new graduate nurse burnout development, job satisfaction and patient care quality: a time-lagged study. *J Adv Nurs*. 2017;73(5):1182-1195. doi:10.1111/jan.13215

41. Brooks Carthon JM, Hatfield L, Brom H, et al. System-level improvements in work environments lead to lower nurse burnout and higher patient satisfaction. *J Nurs Care Qual*. 2021;36(1):7-13. doi:10.1097/NCQ.0000000000000475

42. Chao M, Shih CT, Hsu SF. Nurse occupational burnout and patient-rated quality of care: the boundary conditions of emotional intelligence and demographic profiles. *Jpn J Nurs Sci*. 2016;13(1):156-165. doi:10.1111/jjns.12100

43. Cheng C, Bartram T, Karimi L, Leggat S. Transformational leadership and social identity as predictors of team climate, perceived quality of care, burnout and turnover intention among nurses. *Person Rev*. 2016;45(6):1200-1216. doi:10.1108/PR-05-2015-0118

44. Cheng H, Yang H, Ding Y, Wang B. Nurses' mental health and patient safety: an extension of the Job Demands-Resources model. *J Nurs Manag*. 2020;28(3):653-663. doi:10.1111/jonm.12971

45. Cimiotti JP, Aiken LH, Sloane DM, Wu ES. Nurse staffing, burnout, and health care-associated infection. *Am J Infect Control*. 2012;40(6):486-490. doi:10.1016/j.ajic.2012.02.029

46. Clark RRS, Lake E. Burnout, job dissatisfaction and missed care among maternity nurses. *J Nurs Manag*. 2020;28(8):2001-2006. doi:10.1111/jonm.13037

47. Colindres CV, Bryce E, Coral-Rosero P, Ramos-Soto RM, Bonilla F, Yassi A. Effect of effort-reward imbalance and burnout on infection control among Ecuadorian nurses. *Int Nurs Rev*. 2018;65(2):190-199. doi:10.1111/inr.12409

48. Dimitrios M, Maria P, Kloutsiniotis P. The influence of leadership on structural empowerment and work-life balance on nurses' burnout and patients' assessed quality of care during the COVID-19 pandemic. *Med Res Arch*. 2023;11(7.1). doi:10.18103/mra.v11i7.1.4102

49. Eltaybani S, Yamamoto-Mitani N, Ninomiya A, Igarashi A. The association between nurses' burnout and objective care quality indicators: a cross-sectional survey in long-term care wards. *BMC Nurs*. 2021;20(1):34. doi:10.1186/s12912-021-00552-z

50. Fish JA, Sharplin G, Wang L, An Y, Fan X, Eckert M. Cross-cultural differences in nurse burnout and the relationship with patient safety: an East-West comparative study. *J Adv Nurs*. 2022;78(4):1001-1011. doi:10.1111/jan.15024

51. Gensimore MM, Maduro RS, Morgan MK, McGee GW, Zimbro KS. The effect of nurse practice environment on retention and quality of care via burnout, work characteristics, and resilience: a moderated mediation model. *J Nurs Adm*. 2020;50(10):546-553. doi:10.1097/NNA.0000000000000932

52. Giorgi F, Mattei A, Notarnicola I, Petrucci C, Lancia L. Can sleep quality and burnout affect the job performance of shift-work nurses? a hospital cross-sectional study. *J Adv Nurs*. 2018;74(3):698-708. doi:10.1111/jan.13484

53. Gravlin GL. *The Relationships Among Nurse Work Satisfaction, Burnout, and Patient Satisfaction With Nursing Care*. Teachers College, Columbia University; 1994.

54. Guirardello EB. Impact of critical care environment on burnout, perceived quality of care and safety attitude of the nursing team. *Rev Lat Am Enfermagem*. 2017;25(0):e2884. doi:10.1590/1518-8345.1472.2884

55. Gunnarsdóttir S. *Quality of Working Life and Quality of Care in Icelandic Hospital Nursing*. University of London, London School of Hygiene and Tropical Medicine; 2006.

56. Halbesleben JRB, Wakefield BJ, Wakefield DS, Cooper LB. Nurse burnout and patient safety outcomes: nurse safety perception versus reporting behavior. *West J Nurs Res*. 2008;30(5):560-577. doi:10.1177/0193945907311322

57. Holden RJ, Scanlon MC, Patel NR, et al. A human factors framework and study of the effect of nursing workload on patient safety and employee quality of working life. *BMJ Qual Saf*. 2011;20(1):15-24. doi:10.1136/bmjqs.2008.028381

58. Im C, Song S, Kim K. The associations of psychological burnout and time factors on medication errors in rotating shift nurses in Korea: a cross sectional descriptive study. *Nurs Open*. 2023;10(8):5550-5559. doi:10.1002/nop2.1794

59. Johnson J, Cameron L, Mitchinson L, et al. An investigation into the relationships between bullying, discrimination, burnout and patient safety in nurses and midwives: is burnout a mediator? *J Res Nurs*. 2019;24(8):604-619. doi:10.1177/1744987119880329

60. Johnson J, Louch G, Dunning A, et al. Burnout mediates the association between depression and patient safety perceptions: a cross-sectional study in hospital nurses. *J Adv Nurs*. 2017;73(7):1667-1680. doi:10.1111/jan.13251

61. Kakemam E, Chegini Z, Rouhi A, Ahmadi F, Majidi S. Burnout and its relationship to self-reported quality of patient care and adverse events during COVID-19: a cross-sectional online survey among nurses. *J Nurs Manag*. 2021;29(7):1974-1982. doi:10.1111/jonm.13359

62. Khatatbeh H, Al-Dwaikat T, Alfatafta H, Ali AM, Pakai A. Burnout, quality of life and perceived patient adverse events among paediatric nurses during the COVID-19 pandemic. *J Clin Nurs*. 2023;32(13-14):3874-3886. doi:10.1111/jocn.16540

63. Khatatbeh H, Al-Dwaikat T, Rababah J, Oláh A, Pakai A. Paediatric nurses' burnout, quality of life and perceived patient adverse events during the COVID-19 pandemic: testing an integrated model using structural equation modelling. *J Clin Nurs*. 2024;33(1):255-264. doi:10.1111/jocn.16114

64. Kim MJ, Kim YJ, Sim HS. The relationship between fatigue, burnout and patient safety management activities in clinical nurses. *Indian J Sci Technol*. 2015;8(35). doi:10.17485/ijst/2015/v8i35/87136

65. Kirwan M, Matthews A, Scott PA. The impact of the work environment of nurses on patient safety outcomes: a multi-level modelling approach. *Int J Nurs Stud*. 2013;50(2):253-263. doi:10.1016/j.ijnurstu.2012.08.020

66. Kwon CY, Lee B, Kwon OJ, Kim MS, Sim KL, Choi YH. Emotional labor, burnout, medical error, and turnover intention among South Korean nursing staff in a university hospital setting. *Int J Environ Res Public Health*. 2021;18(19):10111. doi:10.3390/ijerph181910111

67. Laschinger HKS, Shamian J, Thomson D. Impact of magnet hospital characteristics on nurses' perceptions of trust, burnout, quality of care, and work satisfaction. *Nurs Econ*. 2001;19(5):209-219.

68. Spence Laschinger HK, Leiter MP. The impact of nursing work environments on patient safety outcomes: the mediating role of burnout/engagement. *J Nurs Adm*. 2006;36(5):259-267. doi:10.1097/00005110-200605000-00019

69. Leiter MP, Harvie P, Frizzell C. The correspondence of patient satisfaction and nurse burnout. *Soc Sci Med*. 1998;47(10):1611-1617. doi:10.1016/S0277-9536(98)00207-X

70. Liu J, Zheng J, Liu K, You L. Relationship between work environments, nurse outcomes, and quality of care in ICUs: mediating role of nursing care left undone. *J Nurs Care Qual*. 2019;34(3):250-255. doi:10.1097/NCQ.0000000000000374

71. Liu J, Zheng J, Liu K, et al. Workplace violence against nurses, job satisfaction, burnout, and patient safety in Chinese hospitals. *Nurs Outlook*. 2019;67(5):558-566. doi:10.1016/j.outlook.2019.04.006

72. Liu M, Liu L, Lv Z, Ma F, Mao Y, Liu Y. Effects of burnout and work engagement in the relationship between self-efficacy and safety behaviours—a chained mediation modelling analysis. *J Adv Nurs*. 2024;80(4):1473-1483. doi:10.1111/jan.15925

73. Liu X, Zheng J, Liu K, et al. Hospital nursing organizational factors, nursing care left undone, and nurse burnout as predictors of patient safety: a structural equation modeling analysis. *Int J Nurs Stud*. 2018;86:82-89. doi:10.1016/j.ijnurstu.2018.05.005

74. Liu Y, Aungsuroch Y. Factors influencing nurse-assessed quality nursing care: a cross-sectional study in hospitals. *J Adv Nurs*. 2018;74(4):935-945. doi:10.1111/jan.13507

75. Majrabi M. Nurses burnout, resilience and its association with safety culture: a cross sectional study. *Open J Nurs*. 2022;12(1):70-102. doi:10.4236/ojn.2022.121006

76. Mansour H, Abu Sharour L. Results of survey on perception of patient safety culture among emergency nurses in Jordan: influence of burnout, job satisfaction, turnover intention, and workload. *J Healthc Qual Res*. 2021;36(6):370-377. doi:10.1016/j.jhqr.2021.05.001

77. Melnyk BM, Tan A, Hsieh AP, et al. Critical care nurses' physical and mental health, worksite wellness support, and medical errors. *Am J Crit Care*. 2021;30(3):176-184. doi:10.4037/ajcc2021301

78. Mohammadi M, Peyrovi H, Mahmoodi M. The relationship between professional quality of life and caring ability in critical care nurses. *Dimens Crit Care Nurs*. 2017;36(5):273-277. doi:10.1097/DCC.0000000000000263

79. Mohr DC, Swamy L, Wong ES, Mealer M, Moss M, Rinne ST. Critical care nurse burnout in Veterans Health Administration: relation to clinician and patient outcomes. *Am J Crit Care*. 2021;30(6):435-442. doi:10.4037/ajcc2021187

80. Montgomery AP, Azuero A, Baernholdt M, et al. Nurse burnout predicts self-reported medication administration errors in acute care hospitals. *J Healthc Qual*. 2021;43(1):13-23. doi:10.1097/JHQ.0000000000000274

81. Montgomery AP, Patrician PA, Azuero A. Nurse burnout syndrome and work environment impact patient safety grade. *J Nurs Care Qual*. 2022;37(1):87-93. doi:10.1097/NCQ.0000000000000574

82. Nantsupawat A, Nantsupawat R, Kunaviktikul W, Turale S, Poghosyan L. Nurse burnout, nurse-reported quality of care, and patient outcomes in Thai hospitals. *J Nurs Scholarsh*. 2016;48(1):83-90. doi:10.1111/jnu.12187

83. Nantsupawat A, Wichaikhum OA, Abhicharttibutra K, Sadarangani T, Poghosyan L. The relationship between nurse burnout, missed nursing care, and care quality following COVID-19 pandemic. *J Clin Nurs*. 2023;32(15-16):5076-5083. doi:10.1111/jocn.16761

84. Poghosyan L, Clarke SP, Finlayson M, Aiken LH. Nurse burnout and quality of care: cross-national investigation in six countries. *Res Nurs Health*. 2010;33(4):288-298. doi:10.1002/nur.20383

85. Prapanjaroensin A. *Investigating the Relationship Between Nurse Burnout and Self-Reported Medication Administration Errors in Alabama Hospitals*. The University of Alabama at Birmingham; 2019.

86. Rainbow JG, Drake DA, Steege LM. Nurse health, work environment, presenteeism and patient safety. *West J Nurs Res*. 2020;42(5):332-339. doi:10.1177/0193945919863409

87. Ramanujam R, Abrahamson K, Anderson JG. Influence of workplace demands on nurses' perception of patient safety. *Nurs Health Sci*. 2008;10(2):144-150. doi:10.1111/j.1442-2018.2008.00382.x

88. Ríos-Risquez MI, García-Izquierdo M. Patient satisfaction, stress and burnout in nursing personnel in emergency departments: a cross-sectional study. *Int J Nurs Stud*. 2016;59:60-67. doi:10.1016/j.ijnurstu.2016.02.008

89. Russell K. Perceptions of burnout, its prevention, and its effect on patient care as described by oncology nurses in the hospital setting. *Oncol Nurs Forum*. 2016;43(1):103-109. doi:10.1188/16.ONF.103-109

90. Ryu IS, Shim J. The influence of burnout on patient safety management activities of shift nurses: the mediating effect of compassion satisfaction. *Int J Environ Res Public Health*. 2021;18(22):12210. doi:10.3390/ijerph182212210

91. Schlak AE, Aiken LH, Chittams J, Poghosyan L, McHugh M. Leveraging the work environment to minimize the negative impact of nurse burnout on patient outcomes. *Int J Environ Res Public Health*. 2021;18(2):610. doi:10.3390/ijerph18020610

92. Schmidt SG, Dichter MN, Bartholomeyczik S, Hasselhorn HM. The satisfaction with the quality of dementia care and the health, burnout and work ability of nurses: a longitudinal analysis of 50 German nursing homes. *Geriatr Nurs*. 2014;35(1):42-46. doi:10.1016/j.gerinurse.2013.09.006

93. Soósová MS. Association between nurses' burnout, hospital patient safety climate and quality of nursing care. *Cent Eur J Nurs Midw*. 2021;12(1):245-256. doi:10.15452/cejnm.2020.11.0039

94. Squires M, Tourangeau A, Spence Laschinger HK, Doran D. The link between leadership and safety outcomes in hospitals. *J Nurs Manag*. 2010;18(8):914-925. doi:10.1111/j.1365-2834.2010.01181.x

95. Teng CI, Shyu YIL, Chiou WK, Fan HC, Lam SM. Interactive effects of nurse-experienced time pressure and burnout on patient safety: a cross-sectional survey. *Int J Nurs Stud*. 2010;47(11):1442-1450. doi:10.1016/j.ijnurstu.2010.04.005

96. Vahey DC, Aiken LH, Sloane DM, Clarke SP, Vargas D. Nurse burnout and patient satisfaction. *Med Care*. 2004;42(2)(suppl):II57-II66. doi:10.1097/01.mlr.0000109126.50398.5a

97. Van Bogaert P, Clarke S, Roelant E, Meulemans H, Van de Heyning P. Impacts of unit-level nurse practice environment and burnout on nurse-reported outcomes: a multilevel modelling approach. *J Clin Nurs*. 2010;19(11-12):1664-1674. doi:10.1111/j.1365-2702.2009.03128.x

98. Van Bogaert P, Clarke S, Willems R, Mondelaers M. Nurse practice environment, workload, burnout, job outcomes, and quality of care in psychiatric hospitals: a structural equation model approach. *J Adv Nurs*. 2013;69(7):1515-1524. doi:10.1111/jan.12010

99. Van Bogaert P, Clarke S, Wouters K, Franck E, Willems R, Mondelaers M. Impacts of unit-level nurse practice environment, workload and burnout on nurse-reported outcomes in psychiatric hospitals: a multilevel modelling approach. *Int J Nurs Stud*. 2013;50(3):357-365. doi:10.1016/j.ijnurstu.2012.05.006

100. Van Bogaert P, Dilles T, Wouters K, Rompaey BV. Practice environment, work characteristics and levels of burnout as predictors of nurse reported job outcomes, quality of care and patient adverse events: a study across residential aged care services. *Open J Nurs*. 2014;04(5):343-355. doi:10.4236/ojn.2014.45040

101. Van Bogaert P, Kowalski C, Weeks SM, Van Heusden D, Clarke SP. The relationship between nurse practice environment, nurse work characteristics, burnout and job outcome and quality of nursing care: a cross-sectional survey. *Int J Nurs Stud*. 2013;50(12):1667-1677. doi:10.1016/j.ijnurstu.2013.05.010

102. Van Bogaert P, Meulemans H, Clarke S, Vermeyen K, Van de Heyning P. Hospital nurse practice environment, burnout, job outcomes and quality of care: test of a structural equation model. *J Adv Nurs*. 2009;65(10):2175-2185. doi:10.1111/j.1365-2648.2009.05082.x

103. Van Bogaert P, Peremans L, Van Heusden D, et al. Predictors of burnout, work engagement and nurse reported job outcomes and quality of care: a mixed method study. *BMC Nurs*. 2017;16(1):5. doi:10.1186/s12912-016-0200-4

104. Van Bogaert P, Timmermans O, Weeks SM, van Heusden D, Wouters K, Franck E. Nursing unit teams matter: impact of unit-level nurse practice environment, nurse work characteristics, and burnout on nurse reported job outcomes, and quality of care, and patient adverse events–a cross-sectional survey. *Int J Nurs Stud*. 2014;51(8):1123-1134. doi:10.1016/j.ijnurstu.2013.12.009

105. Van Wyk A. *The Relationship Between Burnout and the Safety and Quality of Patient Care in Private Critical Care Units in Gauteng Province*. North-West University; 2010.

106. Vifladt A, Simonsen BO, Lydersen S, Farup PG. The association between patient safety culture and burnout and sense of coherence: a cross-sectional study in restructured and not restructured intensive care units. *Intensive Crit Care Nurs*. 2016;36:26-34. doi:10.1016/j.iccn.2016.03.004

107. Vitale E, Cesano E, Germini F. Correlations of burnout and healthcare safety perceptions among Italian nurses. *Acta Biomed*. 2020;91(4):e2020117. doi:10.23750/abm.v91i4.9008

108. Vogus TJ, Cooil B, Sitterding M, Everett LQ. Safety organizing, emotional exhaustion, and turnover in hospital nursing units. *Med Care*. 2014;52(10):870-876. doi:10.1097/MLR.0000000000000169

109. White EM, Aiken LH, McHugh MD. Registered nurse burnout, job dissatisfaction, and missed care in nursing homes. *J Am Geriatr Soc*. 2019;67(10):2065-2071. doi:10.1111/jgs.16051

110. You LM, Aiken LH, Sloane DM, et al. Hospital nursing, care quality, and patient satisfaction: cross-sectional surveys of nurses and patients in hospitals in China and Europe. *Int J Nurs Stud*. 2013;50(2):154-161. doi:10.1016/j.ijnurstu.2012.05.003

111. Zaghini F, Fiorini J, Piredda M, Fida R, Sili A. The relationship between nurse managers' leadership style and patients' perception of the quality of the care provided by nurses: cross sectional survey. *Int J Nurs Stud*. 2020;101:103446. doi:10.1016/j.ijnurstu.2019.103446

112. Zaki SM, Elsayed LA, Ibrahim MM. Factors contributing to burnout among Saudi nurses and their effect on patients' satisfaction at Makkah Al-Mukaramah hospitals. *Life Sci J*. 2016;13(5):73-88.

113. Zander B, Dobler L, Busse R. The introduction of DRG funding and hospital nurses' changing perceptions of their practice environment, quality of care and satisfaction: comparison of cross-sectional surveys over a 10-year period. *Int J Nurs Stud*. 2013;50(2):219-229. doi:10.1016/j.ijnurstu.2012.07.008

114. Mathur MB. Assessing robustness to worst case publication bias using a simple subset meta-analysis. *BMJ*. 2024;384:e076851. doi:10.1136/bmj-2023-076851

115. Mathur MB, VanderWeele TJ. Robust metrics and sensitivity analyses for meta-analyses of heterogeneous effects. *Epidemiology*. 2020;31(3):356-358. doi:10.1097/EDE.0000000000001180

116. Rotenstein LS, Torre M, Ramos MA, et al. Prevalence of burnout among physicians: a systematic review. *JAMA*. 2018;320(11):1131-1150. doi:10.1001/jama.2018.12777

117. Aiken LH, Clarke SP, Cheung RB, Sloane DM, Silber JH. Educational levels of hospital nurses and surgical patient mortality. *JAMA*. 2003;290(12):1617-1623. doi:10.1001/jama.290.12.1617

118. Cohen C, Pignata S, Bezak E, Tie M, Childs J. Workplace interventions to improve well-being and reduce burnout for nurses, physicians and allied healthcare professionals: a systematic review. *BMJ Open*. 2023;13(6):e071203. doi:10.1136/bmjopen-2022-071203

119. Shanafelt T, Farley H, Wang H, Ripp J; CHARM CWO Network. Responsibilities and job characteristics of health care chief wellness officers in the United States. *Mayo Clin Proc*. 2020;95(11):2563-2566. doi:10.1016/j.mayocp.2020.09.004

120. Longo BA, Schmaltz SP, Williams SC, Shanafelt TD, Sinsky CA, Baker DW. Clinician well-being assessment and interventions in joint commission-accredited hospitals and federally qualified health centers. *Jt Comm J Qual Patient Saf*. 2023;49(10):511-520. doi:10.1016/j.jcjq.2023.04.007

121. Health worker burnout. Office of the US Surgeon General, US Dept of Health and Human Services. 2024. Accessed February 24, 2024. https://www.hhs.gov/surgeongeneral/priorities/health-worker-burnout/index.html

122. Action Collaborative on Clinician Well-Being and Resilience. National Academy of Sciences. 2017. Accessed March 26, 2024. https://nam.edu/initiatives/clinician-resilience-and-well-being/

123. President Biden signs Dr. Lorna Breen Heroes' Foundation signature bill into law. Dr. Lorna Breen Heroes' Foundation. 2022. Accessed February 24, 2024. https://drlornabreen.org/president-biden-signs-bill-into-law/#:~:text=1667%2C%20the%20Dr.,conditions%2C%20and%20substance%20use%20disorders

124. Institute of Medicine, ed. *Crossing the Quality Chasm: A New Health System for the 21st Century*. National Academy Press; 2001.

SUPPLEMENT 1.

eMethods 1. Search Strategy and Keywords
eMethods 2. Data Conversion Methods
eMethods 3. Subgroup Analysis: Master's Degree or Above
eTable 1. Ascertainment of Burnout
eTable 2. Study Characteristics
eTable 3. Ascertainment of Outcomes
eTable 4. Description of Educational Level
eTable 5. Description of Confounding Adjustment
eTable 6. Bias Assessment for Each Study
eTable 7. Serial Exclusion of Each Study
eTable 8. Robust Variance Estimation Test
eFigure 1. Flowchart of Study Exclusion and Inclusion
eFigure 2. Subgroup Analysis: Burnout Measure, Patient Safety
eFigure 3. Subgroup Analysis: Burnout Measure, Quality of Care
eFigure 4. Subgroup Analysis: Burnout Subcomponent, Patient Safety
eFigure 5. Subgroup Analysis: Burnout Subcomponent, Quality of Care
eFigure 6. Subgroup Analysis: Education, Quality of Care
eFigure 7. Subgroup Analysis: Clinical Specialty, Patient Safety
eFigure 8. Subgroup Analysis: Clinical Specialty, Quality of Care
eFigure 9. Subgroup Analysis: Region, Patient Safety
eFigure 10. Subgroup Analysis: Region, Quality of Care
eFigure 11. Subgroup Analysis: Survey Year, Patient Safety
eFigure 12. Subgroup Analysis: Survey Year, Quality of Care
eFigure 13. Sensitivity Analysis: Exclusion of Studies After the COVID-19 Pandemic, Patient Safety
eFigure 14. Sensitivity Analysis: Exclusion of Studies After the COVID-19 Pandemic, Quality of Care
eFigure 15. Bias Assessment: Risk of Bias, All Studies
eFigure 16. Bias Assessment: Funnel Plot, All Studies
eFigure 17. Bias Assessment: Funnel Plot, Patient Safety
eFigure 18. Bias Assessment: Funnel Plot, Patient Satisfaction
eFigure 19. Bias Assessment: Funnel Plot, Quality of Care
eFigure 20. Bias Assessment: Meta-Analysis of Nonaffirmative Studies (MAN)
eFigure 21. Bias Assessment: Strength of Evidence Under Heterogeneity, Patient Safety
eFigure 22. Bias Assessment: Strength of Evidence Under Heterogeneity, Quality of Care
eFigure 23. Sensitivity Analysis: Moderation by Mean Level of Burnout
eFigure 24. Sensitivity Analysis: Moderation by Prevalence Rate of Burnout
eFigure 25. Sensitivity Analysis: Exclusion of Studies With Odds Ratios, Patient Safety
eFigure 26. Sensitivity Analysis: Exclusion of Studies With Odds Ratios, Patient Satisfaction
eFigure 27. Sensitivity Analysis: Exclusion of Studies With Odds Ratios, Quality of Care
eFigure 28. Sensitivity Analysis: Studies With Odds Ratios Only, Patient Safety
eFigure 29. Sensitivity Analysis: Studies With Odds Ratios Only, Patient Satisfaction
eFigure 30. Sensitivity Analysis: Studies With Odds Ratios Only, Quality of Care
eFigure 31. Sensitivity Analysis: Exclusion of Nurses Practitioners, Patient Safety

eFigure 32. Sensitivity Analysis: Exclusion of Mixed Samples, Patient Safety
eFigure 33. Sensitivity Analysis: Exclusion of Mixed Samples, Quality of Care
eFigure 34. Sensitivity Analysis: Unadjusted Statistics, Patient Safety
eFigure 35. Sensitivity Analysis: Unadjusted Statistics, Quality of Care
eFigure 36. Nurse Burnout and Health Care Quality and Safety, Stratified by Geography

SUPPLEMENT 2.
Data Sharing Statement