

A Meta-Analysis of the Associations Between the Nurse Work Environment in Hospitals and 4 Sets of Outcomes

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Background: The nurse work environment is theorized to influence the quality of nursing care, nurse job outcomes, and patient outcomes.

Objective: The aim of this meta-analysis was to evaluate quantitatively the association of the work environment with job and health outcomes.

Research Design: Relevant studies published through September 2018 were identified. Inclusion criteria were use of a nationally endorsed work environment measure and reporting of odds ratios (ORs) and 95% confidence intervals from regression models of 4 outcome classes: nurse job outcomes, safety and quality ratings, patient outcomes, and patient satisfaction. Pooled ORs and confidence intervals were estimated for each outcome using fixed or random effects models.

Subjects: Of 309 articles reviewed, 40 met inclusion criteria. After excluding 23 due to sample overlap or too few observations to meta-analyze, a set of 17 articles, comprising 21 independent samples, was analyzed. Cumulatively, these articles reported data from 2677 hospitals, 141 nursing units, 165,024 nurses, and 1,368,420 patients, in 22 countries.

Measures: Practice Environment Scale of the Nursing Work Index, a National Quality Forum nursing care performance standard.

Results: Consistent, significant associations between the work environment and all outcome classes were identified. Better work

environments were associated with lower odds of negative nurse outcomes (average OR of 0.71), poor safety or quality ratings (average OR of 0.65), and negative patient outcomes (average OR of 0.93), but higher odds of patient satisfaction (OR of 1.16).

Conclusions: The nurse work environment warrants attention to promote health care quality, safety, and patient and clinician well-being.

Key Words: health outcomes, hospitals, meta-analysis, nurse job outcomes, nurse work environment

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The registered nurse, the principal caregiver in hospitals, is responsible for administering treatments, monitoring patient status, and coordinating efforts across the care team. The nurse plays a critical role in patient safety and is often the last line of defense against medical errors and unsafe practices. The Institute of Medicine (IOM) report *Crossing the Quality Chasm*¹ prompted attention to system-level causes of safety and error. The nurse work environment is the system foundation for nursing practice and the nurse's surveillance capacity.² The nurse work environment is defined as the organizational traits that facilitate professional nursing practice.³ These traits include the nurse's managerial and interprofessional relationships, the nurse's role in institutional decisions and quality improvement, and nurse staffing and patient care resources. The subsequent 2004 IOM report *Keeping Patients Safe* promulgated considerable research effort exploring the relationship between the nurse work environment and a variety of quality and safety outcomes. To accelerate safety efforts, a synthesis of evidence is warranted.

Among various multidimensional instruments developed to measure nurse work environments, the Practice Environment Scale of the Nursing Work Index (PES-NWI) had several desirable attributes.⁴ An evaluation of seven instruments was conducted by a scholar in the field applying the criteria of theoretical relevance, ease of use, and body of evidence.⁴ The strengths of the PES-NWI were its 4 theory-based domains, single response format, and body of evidence comprising 9 studies.⁴ The author concluded that the PES-NWI was the most useful instrument to best satisfy the evaluation criteria.⁴ The PES-NWI was developed as a concise tool for measuring the nurse work environment³ from the established Nursing Work Index (NWI).⁵ The NWI was designed to include all factors determined to influence nurse job

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satisfaction and quality of care.⁶ A final set of 31 items was classified into 5 subscales using exploratory factor analysis: Nurse Participation in Hospital Affairs; Nursing Foundations for Quality Care; Nurse Manager Ability, Leadership and Support of Nurses; Staffing and Resource Adequacy; and Collegial Nurse-Physician Relations.³

The use of the PES-NWI was promulgated nationally by quality, health professional, and accreditation bodies. It has been endorsed continuously since 2004 as a nursing care performance measure by the National Quality Forum.^{7,8} The National Database of Nursing Quality Indicators (NDNQI), developed by the American Nurses Association, and now owned by Press Ganey Inc., added the PES-NWI to its annual nurse survey in 2006.⁹ The Joint Commission developed measure specifications for consistent data collection.¹⁰ Consequently, the PES-NWI is the most widely used tool for assessing the practice environment.^{11–13}

The work environment's influence on patient and nurse outcomes has been researched widely. A 2011 publication reviewed the research using the PES-NWI from its inception through the first quarter of 2010.¹¹ In total, 37 articles reported consistent relationships in correlational studies or instrument revisions and adaptations across different work settings. The scale's versatility was shown through its translation into 3 languages: Chinese, French, and Icelandic; the scale had also been adapted for 10 different practice settings.¹¹ The research recommendations included to reduce the instrument length, to score the instrument consistently, and to progress toward longitudinal and intervention studies. Another paper considered studies published between 2010 and 2016 with a comparable focus on the work environment and various outcomes.¹² The study reviewed 46 studies from 28 countries. Twenty-eight studies found a significant association between the PES-NWI and patient outcomes, patient satisfaction, nurse job outcomes, nurse-reported quality, or organizational outcomes. Similar to the earlier systematic review, this study concluded it is imperative to test interventions to improve work environments. Such intervention research would support causal inferences regarding the well-documented associations between the work environment and patient and nurse outcomes, and thereby motivate work environment improvements. Most recently, a systematic review of literature over the period 1999–2016 identified 15 studies with a significant association between the work environment and various adverse events.¹³

The literature reviews provide consistent qualitative evidence of significant associations between the work environment and patient, nurse, and organizational outcomes. However, a gap exists in the quantitative synthesis of the data. A meta-analysis more clearly articulates the association between nurse work environments and outcomes and thereby provides convincing evidence for nurse managers, administrators, and policy makers. Furthermore, a meta-analysis pushes the field beyond correlational studies and provides original research that summarizes a topic, even one well described in the literature. It complements and builds on individual studies and systematic reviews. The search period for this meta-analysis extends to September 2018, which adds to the paper's originality.

METHODS

The preferred reporting items for systematic review and meta-analyses (PRISMA) were used to conduct this meta-analysis.¹⁴

Literature Search and Selection

The investigators searched the electronic databases PubMed and the Cumulative Index to Nursing and Allied Health Literature (CINAHL) for the period July 2002 through September 2018 to identify studies that reported empirical research using the PES-NWI. The search strategy used terms and their combinations “PES-NWI, nurse practice environment scale, and practice environment scale of the nursing work index.” In addition, in CINAHL, the term “nurs* work environment” was used as a search strategy to identify research studies using nurse work environment scales. Finally, the SCOPUS database was used to identify all references to Lake's original article describing the development of the PES-NWI and 2007 article evaluating multiple practice environment instruments.³ The searches were limited to peer-reviewed articles.

After eliminating duplicates, the remaining studies were screened for use of data from the PES-NWI. Instrument variants, including new items or subscales, were excluded due to noncomparability. The resulting studies were eligible for review. Among eligible studies, the key criterion was use of the PES-NWI data as an independent variable to predict health or job outcomes in hospitals. These studies underwent full-text screening. For comparability, the independent variable had to be specified from the PES-NWI composite, rather than 1 or more subscales. The other key criterion was the article had to report odds ratios (ORs) or beta coefficients or adjusted ORs/beta coefficients with SEs or confidence intervals (CIs) from a regression model. To qualify for inclusion, a minimum of 3 observations for any variable was needed to conduct a meta-analysis. The dependent variable had to be specified at the patient or nurse level. Most studies modeled the PES-NWI at the hospital level. Some modeled it at the nursing-unit level. We included studies at either organizational level. The Johns Hopkins Nursing Evidence-based Practice Rating Scale was used to evaluate the strength and quality of the evidence.¹⁵ One of us (J.S.) and a research assistant independently reviewed the papers that met inclusion criteria to assess the quality of studies. Any disagreements were determined by discussion with another author. Among the studies that qualified for inclusion, the final selection retained all nonoverlapping (in independent or dependent variables) samples for a given variable, with a minimum of 3 observations (samples) needed to estimate a model for each variable. Because there were 2 or fewer articles reporting beta coefficients from linear regression of the same continuous dependent variable, there were no models estimated on beta coefficients. Hereafter, the extraction and analyses procedures describe only ORs.

Data Extraction

Adjusted ORs if reported, unadjusted otherwise, were extracted with CIs for 4 classes of outcomes: nurse job outcomes, patient health record–based outcomes, patient satisfaction, and

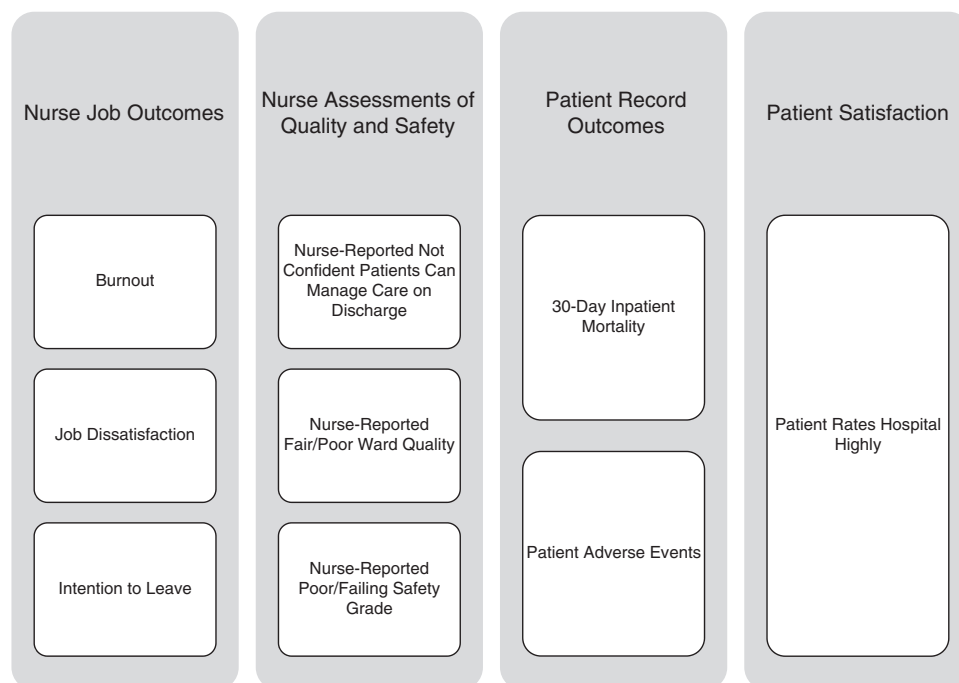


FIGURE 1. Outcome categories and included variables.

quality and safety assessments (Fig. 1). For 16 papers, the PES-NWI was a specified as a categorical variable classifying organizations into better, mixed or poor environments. One study¹⁶ specified the PES-NWI as a standardized continuous variable. The selected OR indicated the odds of the outcome occurring in a better, as compared with poor, environment. Other relevant information, including country of data collection, sample size, year the nurse survey data were generated, and variables included in multivariate models, was collected.

Statistical Analysis

We performed meta-analysis of the association between the PES-NWI and multiple outcomes, which all were binary variables. Fixed or random effect models were used to obtain the specific OR and 95% CI for each dependent variable. The number of studies included and the heterogeneity index *I*² were used to choose a fixed or random effect model. Potential publication bias was evaluated by funnel plots and Egger tests when there were > 10 studies of the same outcome.¹⁷ A *P*-value < 0.10 from Egger test would indicate evidence of bias. Analyses were performed using the “metafor” package in R.¹⁸

RESULTS

Study Selection

After removing duplicates, 884 studies were screened; 387 were excluded because they were not empirical papers (Fig. 2). Another 188 were excluded due to noncomparable measures, such as the Professional Practice Environment Scale or the Nursing Work Index-Revised, or being conference abstracts. Of the remaining 309, about half (150) were eligible for full-text screening. Forty met inclusion criteria. Most articles omitted at

this step analyzed subscales rather than the composite (n = 45 or 41%) or had a unique or noncomparably measured dependent variable (n = 39 or 35%). Seventeen articles comprised the final dataset, after excluding articles with samples derived from included parent studies and articles that collectively yielded fewer than 3 observations for a variable. Figure 2 details the bases for article exclusion. These 17 studies reported data from 2677 hospitals, 141 nursing units, 165,024 nurses, and 1,368,420 patients. From these 17 articles, 21 samples were used for the meta-analysis. These samples comprise data from the Pennsylvania Registered Nurse Survey, the Multi-State Nursing Care and Patient Safety survey (the 4-state survey), the International Health Outcomes study samples from China, South Korea, Thailand, Japan, New Zealand, United Kingdom, Canada, and Germany, the RN4Cast Survey-Europe, the Veterans Affairs Nursing Outcomes database, the National Health and Family Planning Commission of China-High Quality Nursing Care Project, the Chinese Nursing Human Resources survey, and 4 individual studies.

Study Characteristics

All 17 studies were cross-sectional in design. Study and sample characteristics are detailed in Table 1. Data from 22 countries were included. Two studies analyzed multicountry data.^{21,22} One had samples from the United States (2006), China (2009), Thailand (2007), Japan (2006), New Zealand (2004), South Korea (2008), Canada, England, Scotland, and Germany (1999).²¹ The other had a US sample and a sample from 12 European countries: Belgium, England, Finland, Germany, Greece, Ireland, the Netherlands, Norway, Poland, Spain, Sweden, and Switzerland.²² Five studies used US data exclusively.^{16,19,20,25,26} Two US studies used the 4-state nurse

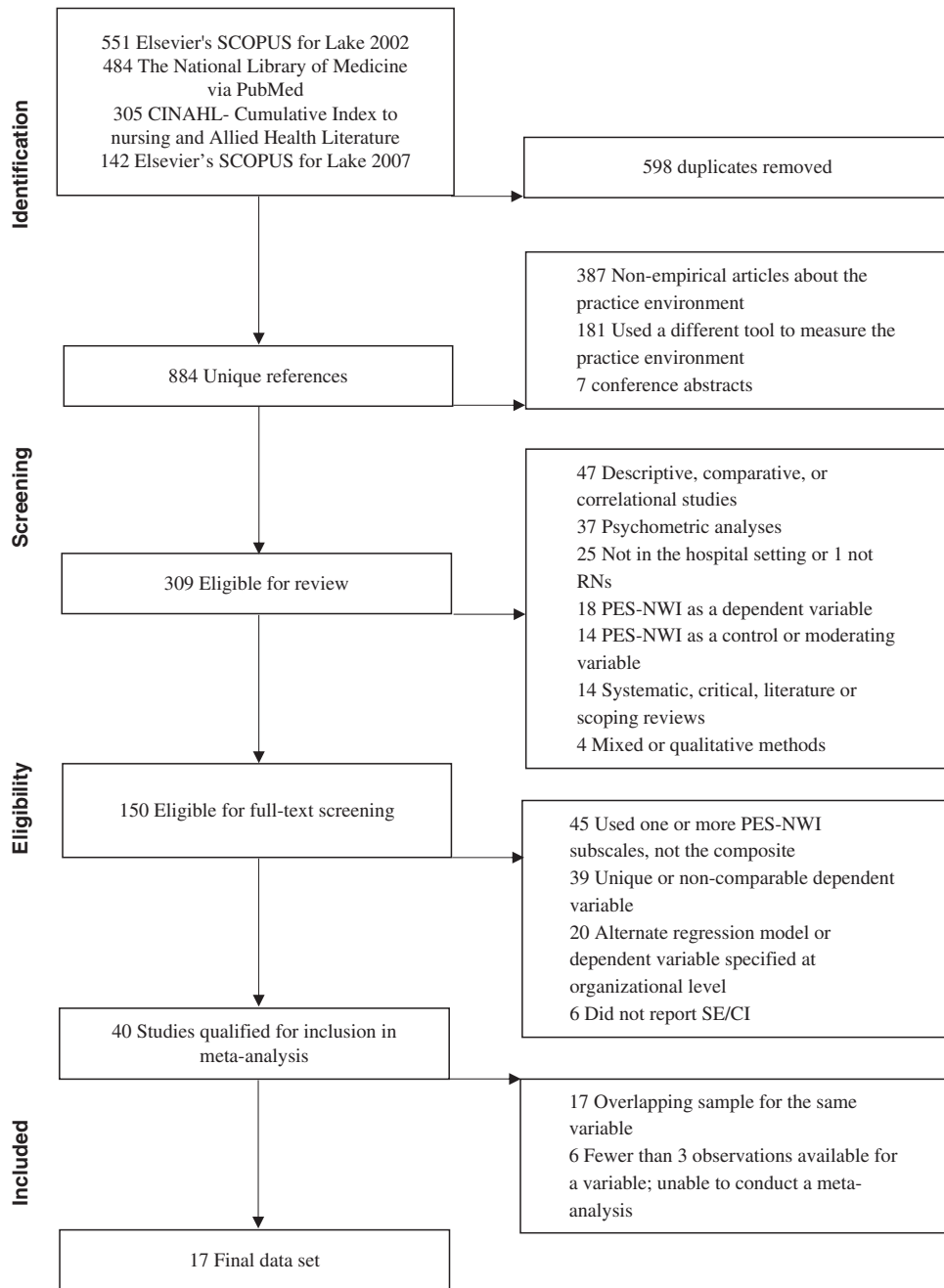


FIGURE 2. The preferred reporting items for systematic review and meta-analyses (PRISMA) flowchart of the sample selection process. After the exclusion of ineligible articles, we included 20 articles published between July 2002 and September 2018 in this meta-analysis. PES-NWI indicates Practice Environment Scale of the Nursing Work Index.

survey data from 2006.^{20,26} The other 3 US studies reported data from surveys conducted in 1999,¹⁹ 2008,¹⁶ and 2010–2011.²⁵ The remaining 10 studies were from South Korea (2008),²³ South Africa,²⁴ China,^{27,28,32–34} Thailand (2007),^{29,30} and Turkey.³¹

The practice environment was analyzed at the hospital level in all but 4 samples, where the nursing unit was the analysis level.^{16,26,27,30} The average hospital sample size was

141 (range, 14–762). Of the 4 nursing unit studies, 2 of the units were medium size (about 100 units); 1 was moderately larger (171 units), and 1 was smaller (43 units).

Nurse job outcomes were the dependent variable in 18 samples.^{19,21,22,24,27,29–31,33,34} Nurse-assessed quality or safety was the dependent variable in 16 samples.^{19,21,22,24,26,27,29,32} Patient health record outcomes measured from administrative or registry data were the dependent variable in 4

TABLE 1. Summary of Individual Study Characteristics

References (Sample #)	Abbreviation in Figure 3	Country	Organizational Level (N)	Nurses or Patients (N)	Outcome Measures
Aiken et al ¹⁹	AIK2008	USA	Hospital (N = 168)	Nurses (N = 10,184)	Burnout Job dissatisfaction Intention to leave 30-d inpatient mortality Failure-to-rescue Not confident patients can manage care on discharge
Aiken et al ²⁰	AIK2011	USA	Hospital (N = 665)	Patients (N = 1,262,120)	Fair/poor ward quality 30-d inpatient mortality Failure-to-rescue
Aiken et al ²¹					Burnout Job dissatisfaction Not confident patients can manage care on discharge Fair/poor ward quality
0	AIK2011a	USA	Hospital (N = 762)	Nurses (N = 39,148)	
1	AIK2011a1	China	Hospital (N = 121)	Nurses (N = 6571)	
2	AIK2011a2	South Korea	Hospital (N = 59)	Nurses (N = 4904)	
3	AIK2011a3	Thailand	Hospital (N = 39)	Nurses (N = 8222)	
4	AIK2011a4	Japan	Hospital (N = 19)	Nurses (N = 5956)	
5	AIK2011a5	New Zealand	Hospital (N = 26)	Nurses (N = 3944)	
6	AIK2011a6	United Kingdom	Hospital (N = 60)	Nurses (N = 9851)	
7	AIK2011a7	Canada	Hospital (N = 293)	Nurses (N = 16,844)	
8	AIK2011a8	Germany	Hospital (N = 27)	Nurses (N = 2676)	
Aiken et al ²²					Burnout Job dissatisfaction Intention to leave Patient rates hospital highly Not confident patients can manage care on discharge Fair/poor ward quality Poor/failing safety grade
1	AIK2012	Belgium, England, Finland, Germany, Greece, Ireland, Netherlands, Norway, Poland, Spain, Sweden, and Switzerland	Hospital (N = 488)	Patients (N = 11,318) Nurses (N = 33,659)	
2	AIK2012a	USA*	Hospital (N = 617)	Nurses (N = 27,509)	
Cho et al ²³	CHO2015	South Korea	Hospital (N = 14)	Patients (N = 76,036)	30-d inpatient mortality
Coetzee et al ²⁴	COE2013	South Africa	Hospital (N = 62)	Nurses (N = 1187)	Burnout Job dissatisfaction Intention to leave Not confident patients can manage care on discharge Fair/poor ward quality Poor/failing safety grade
Kutney-Lee et al ²⁵	KUT2015	USA	Hospital (N = 116)	Patients (N = 4908)	Patient rates hospital highly
Lake et al ¹⁶	LAK2015	USA	Nursing unit (N = 98)	Patients (N = 8252)	Nosocomial infection
Lake et al ²⁶	LAK2016	USA	Nursing unit (N = 171)	Nurses (N = 1247)	Poor/failing safety grade
Liu et al ²⁷	LIU2012	China	Nursing unit (N = 89)	Nurses (N = 1104)	Burnout Job dissatisfaction Intention to leave
Liu et al ²⁸	LIU2016	China	Hospital (N = 134)	Nurses (N = 1890)	Fair/poor ward quality
Nantsupawat et al ²⁹	NAN2011	Thailand	Hospital (N = 39)	Nurses (N = 5247)	Burnout Job dissatisfaction Poor/failing safety grade
Nantsupawat et al ³⁰	NAN2017	Thailand	Nursing unit (N = 43)	Nurses (N = 1351)	Burnout Job dissatisfaction Intention to leave
Topcu et al ³¹	TOP2016	Turkey	Hospital (N = 49)	Nurses (N = 2592)	Burnout Intention to leave

(Continued)

TABLE 1. Summary of Individual Study Characteristics (*continued*)

References (Sample #)	Abbreviation in Figure 3	Country	Organizational Level (N)	Nurses or Patients (N)	Outcome Measures
You et al ³²	YOU2013	China	Hospital (N = 181)	Patients (N = 5786) Nurses (N = 9688)	Patient rates hospital highly Fair/poor ward quality
Zhang et al ³³	ZHA2014	China	Hospital (N = 181)	Nurses (N = 9698)	Burnout Job dissatisfaction
Zhou et al ³⁴	ZHO2015	China	Hospital (N = 20)	Nurses (N = 1100)	Intention to leave Intention to leave

*US sample used for intention to leave outcome only due to overlap of sample with Aiken et al.¹⁹

samples.^{16,19,20,23} Patient satisfaction was the dependent variable in 3 samples.^{22,32,35} The number of samples does not total 21 because some studies evaluated multiple dependent variables.

Nurse Job Outcomes

Among the 20 samples that evaluated relationships between the nurse work environment and nurse job outcomes, samples from 9 countries, namely, the United States, China, South Korea, Thailand, Japan, New Zealand, United Kingdom, Canada, and Germany, were included from 1 study.²¹ Of the 11 remaining samples, 1 study used RN4Cast data from 12 European countries stated above²² and 1 used data from an earlier US single-state survey.¹⁹ Four other samples used data from China^{21,32–34} and 3 others from Thailand.^{21,29,30} The last 2 samples used data from Turkey and South Africa.^{24,31} Researchers measured job dissatisfaction by creating a dichotomous variable from Likert-type responses to the question, “How satisfied are you with your primary job?” Nurse burnout was measured by dichotomizing burnout as a high degree of burnout or not using the Maslach Burnout Inventory, a standardized, widely used tool.^{19,21,22,24,27,29,30,33,34} The level of burnout that was considered high was emotional exhaustion ≥ 27 , based on norms established for health care workers.³⁶ Intent to leave was measured by nurses’ response to the question of whether they

planned to leave their current position within the next year.^{19,22,24,27,30,31,33,34}

Nurse Assessments of Quality and Safety

Fifteen samples examined relationships between the nurse work environment and nurse-assessed quality and safety.^{19,21,22,24,26,28,29,32} Three dependent variables comprised this category: nurse-reported not confident patient can manage care on discharge, nurse-reported fair or poor ward quality, and nurse-reported poor/failing safety grade. These questions had Likert-style responses that were converted to binary variables. All samples reported nurse-assessed nursing unit quality.^{19,21,22,24,26,28,29,32} Twelve samples assessed nurse confidence that patients can manage their care on discharge.^{19,21,22,24,32} Three studies analyzed poor safety ratings.^{22,24,26}

Patient Health Record–based Outcomes

Four studies reported associations between the nurse work environment and adverse patient outcomes measured from patient health record data.^{16,19,20,23} Three studies reported nurse work environment at the hospital level. Lake et al¹⁶ measured the work environment at the unit level because the setting was neonatal intensive care units. Two dependent variables comprised this category, patient adverse events and 30-day inpatient mortality. Lake et al¹⁶ reported nosocomial infection among very low birthweight infants. The 2 other studies of patient adverse events reported failure-to-rescue.^{19,20} Thirty-day inpatient mortality was measured in

TABLE 2. Pooled Odds Ratios for Each Individual Variable

Outcome	# Obs.	Model	OR	P	Lower CI	Upper CI	I ²
Nurse job outcomes							
Burnout	17	RE	0.74	< 0.01	0.64	0.85	93.1
Job dissatisfaction	16	RE	0.68	< 0.01	0.62	0.73	88.4
Intention to leave	8	RE	0.72	< 0.01	0.65	0.80	73.7
Patient health record–based outcomes							
30 d mortality	3	FE	0.92	< 0.01	0.90	0.95	60.4
Patient adverse events	3	FE	0.92	< 0.01	0.89	0.95	0.0
Patient satisfaction							
Patient rates hospital highly	3	FE	1.16	< 0.01	1.08	1.25	21.6
Nurse assessments of quality and safety							
Not confident patients can manage care on discharge	12	RE	0.78	< 0.01	0.74	0.82	64.6
Fair/poor ward quality	15	RE	0.67	< 0.01	0.60	0.75	86.1
Poor/failing safety grade	3	FE	0.49	< 0.01	0.44	0.55	0.0

CI indicates confidence interval; FE, fixed effects; Obs., observations; OR, odds ratio; RE, random effects.

3 samples,^{19,20,23} one used data from a US single-state survey,¹⁹ one used the Multi-State Nursing Care and Patient Safety survey,²⁰ and the other used data from South Korean hospitals.²³

Patient Satisfaction

Three studies reported the relationship between the nurse work environment and patient satisfaction.^{22,25,32} All 3 studies measured satisfaction with a dichotomous variable: patient rates hospital highly (9 or 10 on a 0–10 scale). The

work environment samples ranged from 116 to 488 hospitals. The patient samples ranged from 4908 to 11,318.

Meta-Analysis Results

Table 2 reports meta-analysis results for 9 outcomes classified into 4 categories: nurse job outcomes, nurse assessments of quality and safety, patient health record–based outcomes, and patient satisfaction.

The average OR for patient health record–based outcomes was 0.93. The ORs were the same for the 2 patient

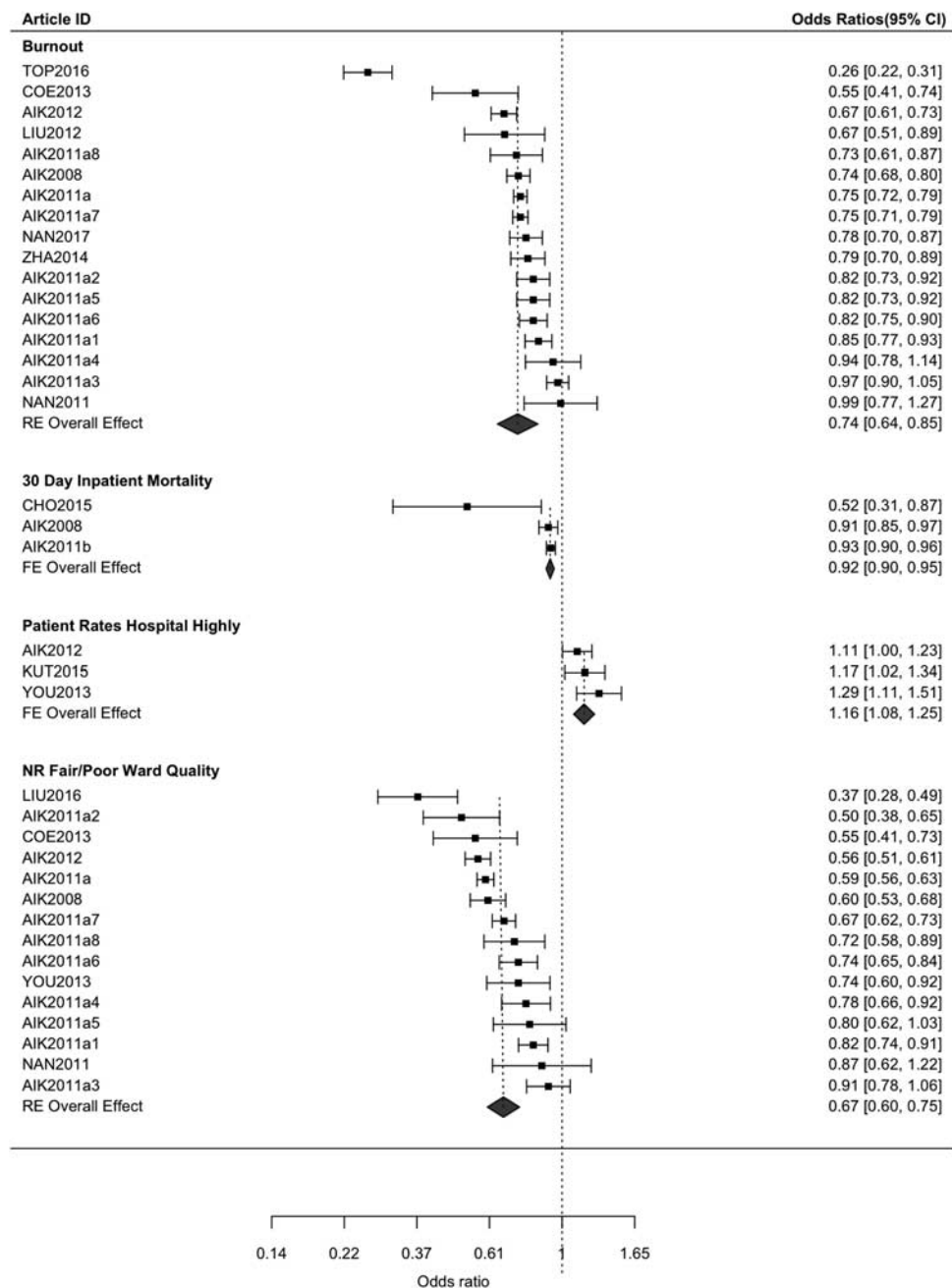


FIGURE 3. Forest plots for representative variable for each outcome group. CI indicates confidence interval; FE, fixed effect; RE, random effect.

health record–based outcomes: 0.93 and 0.92 for 30-day mortality and adverse events, respectively. The average OR for nurse assessments of quality and safety was 0.65. The ORs ranged from 0.49, for poor/failing safety grade, to 0.78, for not confident patients can manage care after discharge. The average OR for nurse job outcomes was 0.71. Across the three nurse job outcomes, the ORs were similar: 0.72, 0.68, and 0.72, for burnout, dissatisfaction, and intention to leave, respectively. The OR for patient satisfaction was 1.16.

For 3 of 9 outcomes, the I^2 were above 75%. We conducted sensitivity analyses to identify the possible causes of high heterogeneity in these outcomes. We analyzed whether the sample was from the United States or another country, whether the data were older or newer (dichotomized by the median year across samples), and average years of nurse experience for a sample. For burnout, we found that differences in the average years of nurse experience explained the high heterogeneity across studies. However, for the other 3 outcomes, job dissatisfaction, intention to leave, and fair/poor nursing unit quality, the extracted variables did not explain the heterogeneity. We believe one possible cause of high heterogeneity is the relatively subjective definition of these outcomes.

One outcome from each category was selected to be displayed in the forest plot (Fig. 3). Figure 3, which arrays samples by decreasing OR for ease of interpretation, shows overall consistency in ORs across samples, evident by CIs that overlap the overall effect for most studies. Two studies identified much larger effects of the work environment than the rest: the study of burnout from Turkey and mortality from South Korea.

As shown by the funnel plots in Appendix Figure 1 (Supplemental Digital Content 1, <http://links.lww.com/MLR/B755>) including the $P > 0.10$ from Egger test, there was no evidence of publication bias.

DISCUSSION

We were motivated to evaluate the evidence from the last 16 years regarding how the hospital work environment relates to patient health outcomes, safety and quality of care and nurse job outcomes. Our meta-analysis provides definitive evidence that the work environment is associated with a broad range of outcomes internationally. A meta-analysis provides a focused approach to answer this question by statistically integrating evidence from multiple studies. This meta-analysis fills this gap in the literature on the contribution of the work environment to a range of outcomes relevant to health care administrators and policymakers, as well as to patients, their families, and nurses.

Better work environments were associated with lower odds of negative outcomes ranging from job dissatisfaction to patient mortality. Patients were more likely to be satisfied in better work environments. The largest effects were observed for nurse job outcomes and nurse assessments of quality and safety. Nurses in better work environments had 28%–32% lower odds of job dissatisfaction, burnout, or intention to leave. Likewise, they had 23%–51% lower odds of rating nursing unit quality and safety as fair or poor. In better work environments, nurses had 22% lower odds of reporting they were not confident that patients could manage care after discharge. Patients

had 16% higher odds of being satisfied in better work environments. The odds that a patient experienced an adverse event or death were 8% lower in better work environments.

The varying magnitudes of the effect sizes across the outcome categories likely reflect the varying degrees of influence the work environment has on the respective outcomes and are consistent with what we would theorize from clinical practice. For example, it is acknowledged that the work environment has a principal impact on nurse job outcomes, whereas patient mortality is understood to be principally determined by underlying health conditions.

This meta-analysis builds on 3 systematic reviews. The effects identified in the meta-analysis mirror the relationships described in the reviews. The work environment is one of several organizational elements of nursing that are theorized to influence care processes and outcomes. Another frequently studied element is nurse staffing. A meta-analysis published a decade ago demonstrated consistent associations of staffing ratios to a range of patient outcomes.³⁷ Lower ratios of patients-per-nurse were associated with lower odds of adverse events such as patient mortality and hospital acquired infections, as well as shorter lengths of stay.

The foremost implication of our work is that managers should utilize the PES-NWI and the benchmarks provided by existing literature to identify areas of weakness in their work environments.²¹ With this measure collected routinely in several benchmarking databases, many hospitals are using the tool to identify areas of opportunity in their work environments.³⁸ For example, a hospital used their NDNQI RN survey data to identify highly rated nurse managers to promulgate their management practices throughout the hospital.³⁹ Magnet hospital accreditation is presently the only evidence-based approach to improve work environments.⁴⁰ A sizable set of literature ($n=18$ studies) omitted from the meta-analysis evaluated the work environment as a dependent variable, which offers an opportunity for a systematic review on factors that influence the work environment.

Professional organizations, such as the American Association of Critical-Care Nurses (AACN) have encouraged nurses to assess if their work environment is healthy. The AACN presented 6 standards: skilled communication, true collaboration, effective decision making, appropriate staffing, meaningful recognition, and authentic leadership.⁴¹ In general, nursing education should include content on the nurse work environment and its relation to health and job outcomes to prepare future nurses to recognize and promulgate healthy work environments. Current practicing nurses also deserve continuing education regarding the characteristics of healthy work environments.

This study has multiple strengths, including a search period encompassing and extending the 3 previous systematic reviews. The inclusion of a consistent independent variable strengthens the validity of the meta-analysis. The literature search used multiple databases with clear inclusion and exclusion criteria.

Our study relied on cross-sectional data, which do not support causal inference. Certain outcomes had fewer observations (ie, samples) than others did. Many relevant studies identified from the literature search (90/150; 60%) utilized

subscales rather than the composite, analyzed unique or non-comparable dependent variables, or did not report CIs, which reduced the scope of the study. The 45 studies that were omitted due to analysis of PES-NWI subscales signal growing interest in research regarding work environment domains, such as collegial nurse-physician relations. Twenty-five excluded studies focused on nonhospital settings, indicating the relevance of the tool beyond acute care. Meta-analyses may conduct multivariate modeling instead of marginal analyses for each outcome. However, multivariate modeling typically requires larger numbers of studies than were available.

This meta-analysis demonstrates the scope and consistency of 16 years of evidence linking the nurse work environment to health and job outcomes. The evidence supports the unique status of the work environment as a foundation for both patient and provider well-being. Accordingly, the work environment offers a powerful target and improvement efforts warrant the resources and attention of health care administrators.

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