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Meta-Analysis of Evidence from the Practice Environment Scale of the Nursing Work Index

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Abstract
The Practice Environment Scale of the Nursing Work Index (PES-NWI) is a National Quality Forum nursing care performance standard with sizable global evidence about nurse practice environments. This research synthesis includes qualitative integration (meta-synthesis) and quantitative integration (meta-analysis). A multinomial meta-analysis was used to model multiple classes of like outcomes for which separate coefficients were estimated. One hundred nineteen articles utilizing the PES-NWI, published from 2002 through 2014, were reviewed and 22 were included in the meta-analysis. Most articles linked practice environments to nurse job outcomes, to nurse-reported assessments of quality, safety, and frequency of adverse events and patient outcomes from administrative data, to organizational outcomes, or to a combination of these outcomes. The preliminary meta-analysis showed strong associations between nursing practice environment and patient safety outcomes. There is also a strong association between practice environment and nurse job outcomes, including dissatisfaction, burnout, and intent to leave.

Keywords
Organizational and Workforce Issues, Methods – Qualitative, Quantitative, and Community-based participatory research

Disciplines
Business

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ABSTRACT

The Practice Environment Scale of the Nursing Work Index (PES-NWI) is a National Quality Forum nursing care performance standard with sizable global evidence about nurse practice environments. This research synthesis includes qualitative integration (meta-synthesis) and quantitative integration (meta-analysis). A multinomial meta-analysis was used to model multiple classes of like outcomes for which separate coefficients were estimated. One hundred nineteen articles utilizing the PES-NWI, published from 2002 through 2014, were reviewed and 22 were included in the meta-analysis. Most articles linked practice environments to nurse job outcomes, to nurse-reported assessments of quality, safety, and frequency of adverse events and patient outcomes from administrative data, to organizational outcomes, or to a combination of these outcomes. The preliminary meta-analysis showed strong associations between nursing practice environment and patient safety outcomes. There is also a strong association between practice environment and nurse job outcomes, including dissatisfaction, burnout, and intent to leave.

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INTRODUCTION AND BACKGROUND

Registered nurses make up the largest group of health care professionals in the medical system according to the American Nurses Association (2014). Over the next 10 years, employment is expected to grow by 20%; this expected growth would make nursing the third largest profession in the country (Bureau of Labor Statistics 2014). Despite this growth, there is still an expected deficit of nearly 1,000,000 nurses over the next decade (Juraschek et al. 2012). A clear understanding of the impact of nursing work environment is necessary in order to attract new nurses to the profession and sustain the current workforce. Practice environment has been shown to influence a wide range of health care outcomes such as quality of care, nurse outcomes and organizational outcomes (Warshawsky and Havens 2011). Given this extensive influence, understanding the environment in which nurses work has become of the utmost importance to improving patient, nurse and organization outcomes.

The Practice Environment Scale of the Nursing Work Index (PES-NWI) was developed by Lake (2002) as a concise and data driven tool for measuring nursing work environments. It was derived from the established Nursing Work Index (NWI)- a tool used to understand the hospital characteristics which improved nurse recruitment and retention (Kramer and Hafner 1989). The NWI was designed to include all factors determined to influence nursing job satisfaction and quality of care which were defined by an extensive literature review as well as interviews with magnet hospital nurses and nursing directors (McClure 1983). The 31 items of the PES-NWI, which were determined to be relevant to nursing practice environment, were derived from a subset of original NWI items. An exploratory factor analysis was used to group into the 31 items into five subscales: 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 (Lake 2002). Each item is scored using a 4-point Likert scale with 1 being strongly disagree to 5 strongly agree.

The PES-NWI is the most widely used tool for assessing practice environment and is endorsed by several U.S. healthcare quality organizations including the National Quality Forum and the Joint Commission (The Joint Commission 2009, National Quality Forum 2014, Warshawsky and Havens 2011). The extensive use of this scale has provided the nursing community with a vast body of literature concerning work environment both as a dependent and independent variable. The amount of literature is too great and spans too many subtopics to be of use for any clinician, administrator or manager resulting in a lack of understanding of the effects of practice environment.

In 2011 Warshawsky and Havens published a comprehensive research review of the PES-NWI from its inception through the first quarter of 2010 (Warshawsky and Havens 2011). Thirty-seven articles were found relevant to the uses, changes and adaptations of the scale across different work settings. The scale had been translated into three languages: Chinese (Chiang and Lin 2009), French (McCusker et al. 2004), and Icelandic (Gunnarsdóttir et al. 2009) and modified for 10 different practice settings. Changes to the PES-NWI across studies were most commonly revisions to increase the relevance of the measure to the setting being used. Other changes included the modification of the scale because primary data did not include all scale items.

Relationships between PES-NWI and organizational outcomes such as patient safety and nurse-physician communication were reported in six studies. Only four studies reported associations between structural outcomes including facility location, teaching status, profit status

and staffing levels with the PES-NWI. Five of the 16 studies which reported PES-NWI and patient outcome associations reported positive associations between work environment and nurse rated quality of care. Additionally, two more studies reported associations between poor quality of care and unfavorable work environments. Two more studies reported negative associations between PES-NWI scores and infection rates, patient falls and medication errors.

Warshawsky and Havens made several recommendations for the future of practice environment research. First, they recommend additional research to determine the relevance of certain items across different practice settings and contexts. They recommend that PES-NWI research is conducted using a standardized scoring method to ensure consistency and facilitate comparisons across studies. Further research about practice environment theory is also suggested. Finally they suggest research into the mediating factors that influence practice environment and outcome relationships.

The information provided in Warshawsky and Havens gave insight into the research trends involving the PES-NWI which are built upon in this article. A condensed summary of the research since Warshawsky and Havens will provide recommendations for best practices for nursing work environment in an employable format for nurses, administrators and managers. The research provides a condensed, concise presentation of the contemporary uses and applications of the scale and its variations for the purpose of application in nursing practice environments.

METHODS

This comprehensive qualitative research synthesis covers research concerning the uses, adaptations and alterations of the Practice Environment Scale of the Nursing Work Index. The database searches were limited to peer reviewed journals from 2002 through December 2015. Studies included were screened for the terms Practice Environment Scale of the Nursing Work

Index or a form of the measure name and data from the scale was used as either a dependent or independent variable. New scales derived from measures other than the PES-NWI were excluded as were instrument variants since they are not strictly comparable to the original scale. Studies which did not present robust research about the PES-NWI were also excluded. A database search of PubMed and the Cumulative Index to Nursing and Allied Health Literature (CINAHL) was conducted using the terms "PES-NWI, practice environment scale and practice environment scale of the nursing work index." Additionally in CINAHL, the term "nurs* work environment" was used as well as an instrumentation search of PES-NWI. Finally, a search of SCOPUS database of the original Lake (2002) publication was conducted to find all references to the article.

Research was analyzed by research focus based on independent and dependent variables associated with practice environment. This study focuses primarily on patient outcomes, nurse outcomes, organizational variables and measure modification studies. Some variables could be used both as dependent and independent variables which could affect or be affected by practice environment. To better understand the relationship between reported variables and practice environment, a graphic organizer was used. Articles were given a quality score based on the Johns Hopkins Nursing Evidence-based Practice Rating Scale (Newhouse R 2005). All studies were found to have either high or good quality. Quality ratings were validated by a sample comparison with two research assistants and found to be consistent with the primary investigator's assessment.

RESULTS

After removing duplicate references, 536 references were retrieved (Figure 1). After reviewing the abstracts and titles, 187 articles remained which reported empirical research using

the PES-NWI. After removing studies with qualitative or psychometric evidence and those where the PES-NWI was not the independent variable, 125 studies were left. A final group of 22 studies was used to conduct this meta-analysis. While only 22 studies were included in the meta-analysis, other studies from the group of 125 which reported other quantitative measures such as regression beta coefficients or qualitative evidence were used to support the meta-analysis findings.

The studies included in the meta-analysis all reported odds ratios and confidence intervals for outcomes in at least one of five categories: nurse job outcomes, patient record outcomes, patient satisfaction, nurse reported adverse events and nurse reported quality and safety measures. Nurse reported job outcomes include burnout, job dissatisfaction, and intention to leave. Patient record outcomes include 30 day inpatient mortality rates, failure to rescue, infants discharged without breastmilk, infants contracting a nosocomial infection and 30 readmission. Nurse reported adverse events were medication errors, pressure ulcers, patient fall, urinary tract infection, bloodstream infection, pneumonia, needle disconnection and hypotension. Final nurse reported quality and safety measures were safety grades, unit quality, patient care management and hospital recommendations. All outcome variable were dichotomized in order to produce and odds ratio. For outcomes measured on a scale, a score over a certain number qualified as a this outcome is present and below that score was considered not present in order to have dichotomized variables. Studies reporting the same outcomes used the same standards for determining presence of an outcome.

The PES-NWI was measured as an independent variable in two ways. First, it is measured continuously using a mean and standard deviation. The other method used is to group the scale into categories such as better, poor and mixed based on the results of data gathered

from the sample. In this meta-analysis, studies using either method were included given that a change in practice environment as it was appropriate in the setting (whether one SD or one category change) where it was measured.

The odds ratios and confidence intervals were converted to their log form and inverse weighted according to their confidence intervals which indicate the size of the standard error for each study. The results of the individual studies were aggregated according to their weights to create an overall variable odds ratio and confidence interval for the larger variables (Y_1-Y_5). All meta-analysis models were run with random effect models according to their I^2 value with the exception of patient satisfaction which was analyzed with a fixed effects model because of its small number of observations.

Findings

Nurse Outcomes

In this study, we examined three primary nurse outcome variables which were job dissatisfaction, intent to leave and burnout. These variables were primarily measured in the aforementioned form, but occasionally we measured as intent to stay and job satisfaction in which case the sign on the outcome variable was changed. Changing the sign allowed for these results to be integrated with the other studies in the meta-analysis.

Researches studying burnout classify a nurse as burnt out based on the Maslach Burnout Inventory survey. Many studies found association between nurse work environments and burnout rates. Gabriel et al. (2013), Leiter and Laschinger (2006) established the PES-NWI as a reasonable way to measure factors that might influence nurse outcomes including burnout, job satisfaction and intention to leave. A significant large negative relationship between better work environments and lower burnout rates was found in many studies (Aiken, Buchan, et al. 2008,

Coetzee et al. 2013, Friese 2005, Kutney-Lee et al. 2013, Liu et al. 2012, McHugh and Ma 2014, McHugh et al. 2011, Poghosyan et al. 2010, Shang et al. 2013, You et al. 2013, Zhang et al. 2014). These findings were consistent across the United States and internationally. Hanrahan et al. (2010), Lang, Patrician, and Steele (2012), O'Mahony (2011) and Wang and Liu (2013) found significant relationships between two components of burnout, emotional exhaustion and depersonalization, and the nurse work environment composite score. Significant associations were not found with the third component personal accomplishment. Magnet hospitals which were found to have statistically better work environments, were also found to have statistically lower burnout rates when models were adjusted for individual nurse and hospital characteristics not including work environment (Kelly, McHugh, and Aiken 2012b). Klopper et al. (2012) and Li et al. (2013) found a weak correlation between subscales of the PES-NWI and burnout.

Intent to leave can be classified as intent to leave a current job or intent to leave the nursing profession altogether. A basic correlation between practice environment and intention to leave among Asian nurses in US hospitals (Cheng and Liou 2011). DeKeyser Ganz and Toren (2014) found a similar correlation Israeli hospital sample. Similar preliminary results were supported by Lin, Chiang, and Chen (2011). Decreased odds of intention to leave within one year were found to be associated with better vs mixed or poor work environments (Aiken, Clarke, et al. 2008, Coetzee et al. 2013, McHugh and Ma 2014, Zhang et al. 2014). Mixed effects on odds ratios were reported by Shang et al. (2013). Breau and Rhéaume (2014) found while work environment of ICU nurses impacted intent to leave other factors such as job satisfaction had a more significant impact. However, job satisfaction has been shown to be influenced by work environment so the variable interaction should be accounted for to produce a reliable result. Organizational commitment was found to mediate the relationship between practice environment

and intention to leave among a sample of Asian nurses in US hospitals (Liou and Grobe 2008). Friese and Himes-Ferris (2013) found improved odds of intent to stay in the ambulatory oncology setting with improvements in staffing and resource adequacy, medical assistant support[1], and nurse participation in hospital affairs.

The final major nurse outcome reported was job satisfaction. A positive association between better work environments and job satisfaction has been established by several studies (Choi, Flynn, and Aiken 2012, DeKeyser Ganz and Toren 2014, Ditomassi 2012, Klopper et al. 2012, Kutney-Lee et al. 2013, McGlynn et al. 2012, McHugh et al. 2011). Better nurse work environments were found to decrease odds of a nurse being dissatisfied with his or her job (Aiken, Clarke, et al. 2008, Coetzee et al. 2013, Kelly, McHugh, and Aiken 2012a, Friese 2005, Friese and Himes-Ferris 2013, Liu et al. 2012, You et al. 2013, Zhang et al. 2014, Shang et al. 2013, McHugh and Ma 2014). Breau and Rhéaume (2014) found workplace empowerment to be a significant predictor of work environment which together predict over two-thirds of job satisfaction among ICU nurses in their study. Manojlovich (2005) found the RN-MD communication component of work environment to be a significant predictor of job satisfaction when work environment was measured with the PES-NWI as well as Conditions for Work Effectiveness Questionnaire-II. Other similar findings regarding the predictive nature of work environment on job satisfaction were found by Wade et al. (2008).

Given the results from the literature review and quantitative meta-analysis, it is reasonable to conclude that nurse work environment as significant influence on outcomes for nurses. The similarity of results across diverse populations and settings corroborate the data in the meta-analysis and allow for generalization of the results. Improvements to work environment

[1] Subscale added by Friese for the ambulatory oncology setting and not included in original scale. (Friese 2012)

and policies which induce such improvements could substantially improve outcomes for nurses related to their professional lives.

Patient Outcomes

Patient outcomes can be broken down into those which personally effect patients' lives and those which as reported as hospital metrics such as adverse event rates Two studies examined the relationship between work environment and hospitalization rates. Jarrín et al. (2014) found an association between quality of home health work environments and patient hospitalization rate. Heart failure and pneumonia patient readmission rates were also associated with quality of acute care work environment (McHugh and Chenjuan 2013). Hallowell et al. (2014) found a relationship between work environment quality and breast feeding support rates for new mothers.

Several studies investigated relationships between patient satisfaction and quality of work environment. McHugh et al. (2011) and You et al. (2013) found significant relationships between lower rates of dissatisfied nurses and improved patient satisfaction. Patients in high black concentration hospitals reported lower satisfaction mediated by work environment reported lower satisfaction mediated by work environment (Brooks-Carthon et al. 2011). Boev (2012) found that unit comparisons in adult critical care showed a relationship between patient satisfaction and perception of nurse manager leadership.

Another highly reported patient outcome was nurse reported quality of patient care; 16 studies reported findings which relate nurse reported quality of care and practice environment characteristics. McHugh and Stimpfel (2012) found that a 10% increase of nurses reporting excellent quality of care was associated with lower odds of patient mortality and failure to rescue and greater patient satisfaction. The proportion of nurses reporting excellent quality was higher

and statistically different in good vs mixed environments and mixed vs poor. (Lake et al. 2014)and Brooks-Carthon et al. (2011) found that nurse staffing and practice environments contribute to the disparities in the quality of care in hospitals with high black patient concentrations. Lake measured quality outcomes in terms of health care associated infections and patients discharged without breast milk. Flynn (2010) measured quality as nonadherence to federally mandated quality standards and found that in nursing homes, better practice environment was associated with better outcomes which were defined as fewer quality deficiency citations. Nurse reported adverse events were also used to assess care quality in relation to practice environment. Even when care environment was accounted for, the relationship between quality of care and unmet care needs persisted. The effect of unmet care needs was significantly weakened by accounting for care environment.

All other studies which examined quality of care used nurse reported quality of care. Coetzee et al. (2013) found that practice environment had a significant positive association with quality of care in South African settings. Specifically, nurses in favorable practice environments were half as likely to report poor quality of care. High burnout levels were significantly associated with higher levels of poor/fair nurse reported quality of care independent of practice environment across six countries (Poghosyan et al. 2010). In the oncology setting, improving practice environments holds significant potential for improving quality of care (Shang et al. 2013). Quality of care was significantly associated with magnet recognition with practice environment being the mediating variable (Stimpfel, Rosen, and McHugh 2014). Many studies found significant positive relationships between practice environment or specific subscales and nurse reported quality of care (Aiken et al. 2007, Anzai, Douglas, and Bonner 2014, Breau and Rhéaume 2014). Tvedt et al. (2012) found an inconsistent relationship between ward leadership

and quality of care, but significant relationships between collegial nurse physician relationships and staffing with high quality of care.

Nurse reported falls were not generally found to have robust relationships with practice environment but often mediated the relationship between falls and other characteristics (Ausserhofer et al. 2013, Breckenridge-Sproat, Johantgen, and Patrician 2012, Aiken et al. 2007). Other studies did produce robust evidence of a significant relationship between the two (Hanrahan, Kumar, and Aiken 2010, Lucero, Lake, and Aiken 2010, Prezerakos, Galanis, and Moisoglou 2013). Literature about the relationship between nurse reported health care associated infections and practice environment is also split. Some papers report significant associations between practice environment quality and infection rates (Kelly et al. 2013, Lucero, Lake, and Aiken 2010). Others found little or no direct effect on health care associated infection rates but did report a possible indirect effect (Aiken et al. 2007, Ausserhofer et al. 2013). Literature investigating medication errors in relation, some nurse reported other not, to PES-NWI found that although there is no distinct relationship between the two, practice environment again mediates the relationship between medication errors and other variables (Breckenridge-Sproat, Johantgen, and Patrician 2012, Chiang et al. 2010, Flynn et al. 2012, Lucero, Lake, and Aiken 2010).

Patient mortality rates are significantly influenced by work environment characteristics (Cho et al. 2014, McHugh et al. 2013). Aiken et al. (2011) found that decreasing patient workloads had the increasing impact as work environment quality improved. Patient safety was unanimously found to be significantly influenced by practice environment (Coetzee et al. 2013, Kirwan, Matthews, and Scott 2013, You et al. 2013). All of the studies used nurse reported patient safety with the exception of Flynn et al. (2010) who reported quality deficiency citation

rates. Specifically, adequate staffing and resources and unit leadership were found to influence patient safety (Hanrahan, Kumar, and Aiken 2010, Tvedt et al. 2012, Smeds Alenius et al. 2014).

According to the primary meta-analysis report, patient outcomes are significantly affected by changes in practice environment for both nurse reported adverse events or data collected from patient records (Figure 2). The three variables that pertain to patient outcomes, nurse reported adverse events, patient records outcomes, and patient satisfaction, showed the smallest changes given an improvement in practice environment, but all were significant.

Organizational Variables

Six studies examined the relationship between education and work environment half of which also reported association with patient outcomes. Cho et al. (2014), Aiken et al. (2011), and You et al. (2013) found significant relationships between nurse education levels and adverse events and patient satisfaction. The other three studies reported that organizations with higher levels of BSN educated nurses have better practice environments (Kelly, McHugh, and Aiken 2012b, McHugh and Lake 2010, Dimattio, Roe-Prior, and Carpenter 2010).

Nursing rounds were investigated in two separate intervention studies. Both of which reported no significant impact on practice environment from the introduction of nursing rounds (Aitken et al. 2011, Gardner et al. 2010). Lake et al. (2014) and Brooks-Carthon et al. (2011) both reported poorer outcomes for patients in high black concentration hospitals which was explained in part by poorer practice environments as compared to lower concentration hospitals. Everhart et al. (2013) reported a positive association between better work environments and a hospital's financial performance. Two articles reported evidence of an indirect relationship between structural empowerment and practice environment, and specifically that better work environments by way of increased structural empowerment lead to better work engagement

(Wang and Liu 2013, Yang et al. 2013). In an interventional study, Calarco (2011) found that increased education about workplace empowerment did not impact practice environment.

Six studies investigated the relationship between magnet characteristics and practice environment. Three studies reported better practice environments in Magnet designated hospitals and better patient outcomes. Three studies reported better practice environments in Magnet designated hospitals and better patient outcomes (Kelly, McHugh, and Aiken 2012b, McHugh et al. 2013, Stimpfel, Rosen, and McHugh 2014). O'Mahony (2011) reported that Irish emergency department nurses had a burnout rate three times as high as the reported Magnet hospital rate and recommended using the magnet model to improve burnout rate. Two other studies also recommended implementing a magnet model by way of the PES-NWI to assess preparedness for Magnet recognition and level of readiness in order to improve nurse and patient outcomes (Walker, Fitzgerald, and Duff 2014, Desmedt et al. 2012). Nurse reported quality and safety measures showed the greatest improvement given a change in practice environment (Figure 2). This variable showed a relatively small confidence interval compared to the other aggregate variables while also indicating the largest affect. The combination of these two factors indicates a reliable association between improvement in practice environment and quality and safety factors.

CONCLUSIONS

Overall, the meta-analysis data supports the meta-synthesis findings for the outcome variables. While individual study findings cannot be generalized to larger health care work environments, the evidence in this paper shows continuity of findings. The findings for each outcome are consistent enough that when aggregated, they create more robust evidence of the importance of practice environment for patient, environmental and nurse outcomes. This

evidence suggests that practice environment is a significant predictor of outcomes across practice settings and therefore important across those settings. Future policy recommendations for the improvement of safety and care quality could focus on improvements in practice environment. Not only could improvements in practice environment possibly improve organization's safety outcomes, they could improve personal outcomes for nurses. High turnover imposes huge costs for health care systems, by improving practice environment and minimizing burnout, job dissatisfaction and turnover; organizations could potentially see cost savings. Those cost savings could of course be dependent on the cost of implementing practice environment improvements.

Future research should move towards longitudinal studies to inspect how policies intended to improve practice environment effect outcomes. These studies would provide even more robust data approaching causation. Tests policies could be implemented across similar systems and eventually dissimilar ones as well.

LIMITATIONS

The sample size for each aggregate variable was relatively small and some of the study samples overlapped. The same survey data was used in multiple studies because data was collected from nurses in nationwide nurse surveys. Given the difficulty of collecting such a large amount of data, only a few samples exist presently.

Another limitation of this study is the difference in how the practice environment was measured. An odds ratio measures the difference in likelihood of an event occurring given an event versus the likelihood of the event occurring without the event. The event for this study was an improvement in practice environment based on differences in scores on the PES-NWI. The change in practice environment was mostly, but not always, measured in the same way. Some papers (Clarke 2007, Lake et al. 2015, Ma and Park 2015, You et al. 2013) measured the practice

environment differently using a change in standard deviation from the mean as the metric. For the purpose of this study, these studies were included because the difference in measurement techniques should not largely alter the data.

Given that the data from this study is primarily secondary data for this study, publication bias could be present. Studies whose results do not confirm already present data or have inconclusive results are less likely to be published than those which support current trends.

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FIGURES AND TABLES

Figure 1 Literature review flow of information

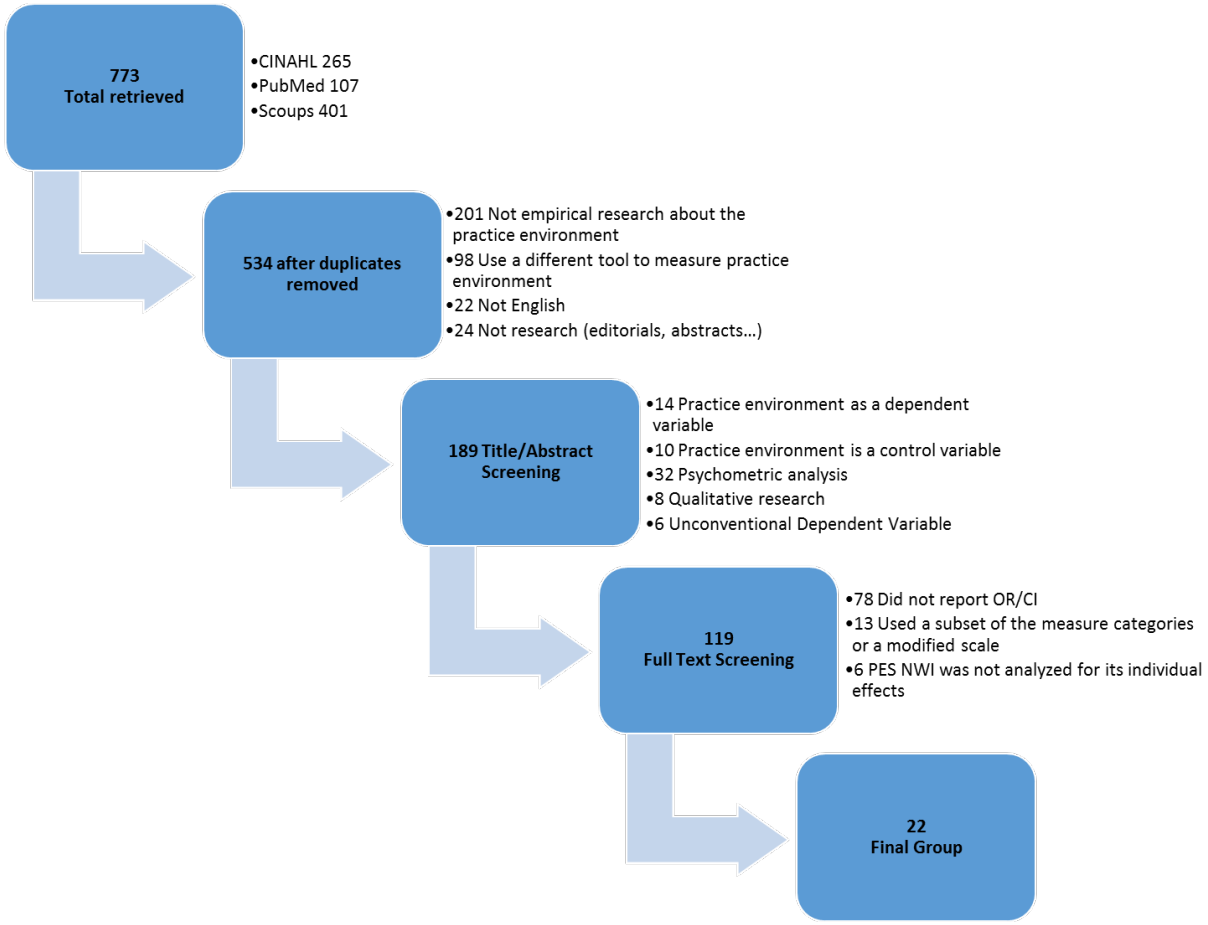

Figure 2 Meta Analysis Forest Plots for Individual Studies and Aggregate Outcomes

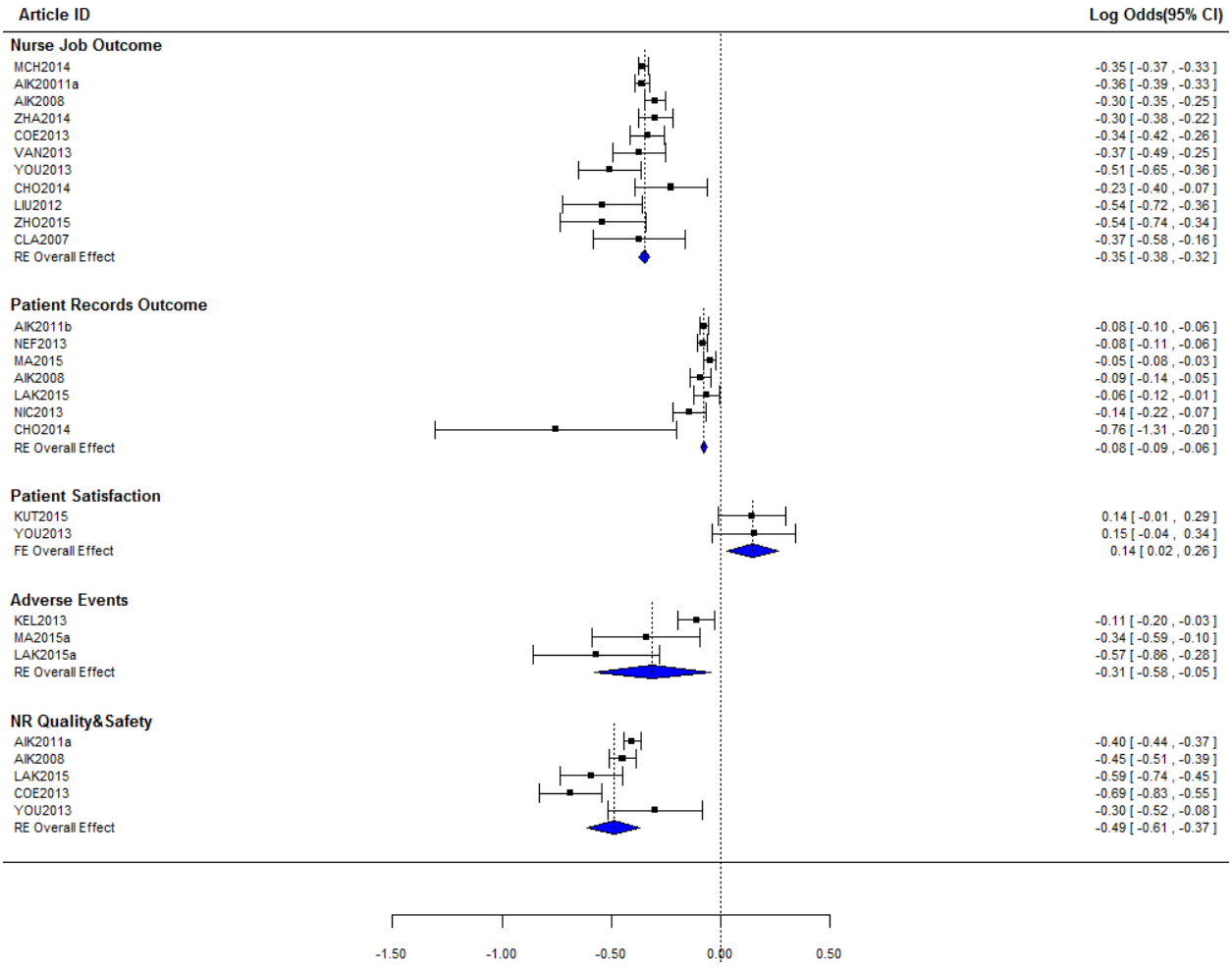

Table 1 Individual Study Outcome Variable Data

(See description after table)

		Y1							Y2					
		Job dissatisfaction	Burnout	Intention to Leave	Needlestick Injury	Emotional Exhaustion	Depersonal-ization	Study Aggregate	30 Day Inpatient Mortality	Failure to Rescue	Discharged without Breastmilk	Nonsocomial Infection	30 Day Readmission	Study Aggregate
AIK2008	Source	2	2	2			2	2	2					2
	PESNWI	1	1	1			1	1	1					1
	OR	-0.301105093	-0.301105093	-0.301105093			-0.301105093	-0.094310679	-0.094310679					-0.094310679
	SE	0.044333504	0.040629732	0.044333504			0.024819553	0.033014931	0.035579056					0.024200846
	W	508.7868608	605.7760188	508.7868608				917.4432826	789.9710374					
AIK20011a	Source	3	3				3							
	PESNWI	1	1				1							
	OR	-0.430782916	-0.287682072				-0.360503419							
	SE	0.02309333	0.023507237				0.016473839							
	W	1875.110542	1809.659275											
AIK20011b	Source							1	1					1
	PESNWI							1	1					1
	OR							-0.076881044	-0.077961541					-0.077420709
	SE							0.015385318	0.015401952					0.010884939
	W							4224.61409	4215.493745					
CHO2014	Source				0		0	0						0
	PESNWI				1		1	1						1
	OR				-0.230671818		-0.230671818	-0.755022584						-0.755022584
	SE				0.084277685		0.084277685	0.280750935						0.280750935
	W				140.7909726			12.68696016						
CLA2007	Source				2		2							
	PESNWI				0		0							
	OR				-0.371063681		-0.371063681							
	SE				0.107248901		0.107248901							
	W				86.93893099									
COE2013	Source	0	0	0			0							
	PESNWI	1	1	1			1							
	OR	-0.301105093	-0.597837001	-0.446287103			-0.335681883							
	SE	0.044333504	0.150979012	0.134749125			0.040564331							
	W	508.7868608	43.86992012	55.07418655										
KEL2013	Source													
	PESNWI													
	OR													
	SE													
	W													
KEL2014	Source								1					1
	PESNWI								1					1
	OR								0					0
	SE								0.035057335					0.035057335
	W								813.658554					
KUT2015	Source													
	PESNWI													
	OR													
	SE													
	W													
LAK2015	Source										0	0		0
	PESNWI										0	0		0
	OR										-0.083381609	-0.162518929		-0.127416175
	SE										0.089168736	0.079613433		0.059387158
	W										125.7693393	157.771044		
LAK2015a	Source													
	PESNWI													
	OR													
	SE													
	W													
LIU2012	Source	0	0	0			0							
	PESNWI	1	1	1			1							
	OR	-0.691149178	-0.396009949	-0.512493681			-0.540362214							
	SE	0.140186486	0.141026283	0.259248778			0.092830047							
	W	50.88475645	50.28053373	14.87875405										
MA2015	Source												24	24
	PESNWI												1	1
	OR												-0.051293294	-0.051293294
	SE												0.0132306	0.0132306
	W												75.58236002	
MA2015a	Source													
	PESNWI													
	OR													
	SE													
	W													
MCH2014	Source	1	1	1			1							
	PESNWI	1	1	1			1							
	OR	-0.415515444	-0.261364764	-0.415515444			-0.354124086							
	SE	0.018805855	0.01634569	0.018805855			0.010315354							
	W	2827.572956	3742.773048	2827.572956										
NEF2013	Source								1	1				1
	PESNWI													
	OR								-0.083381609	-0.083381609				-0.083381609
	SE								0.01631013	0.01631013				0.011533004
	W								3759.110827	3759.110827				
NIC2013	Source								1	1				1
	PESNWI								1	1				1
	OR								-0.162518929	-0.127833372				-0.143588964
	SE								0.056964209	0.05196902				0.038392385
	W								308.1739029	370.2635399				
PAT2010	Source	0												
	PESNWI	1												
	OR	-1.137833002												
	SE													
	W													
VAN2013	Source				5			5						
	PESNWI				1			1						
	OR				-0.371063681			-0.371063681						
	SE				0.061458741			0.061458741						
	W				264.7479991									
YOU2013	Source	0	0					0						
	PESNWI	0	0					0						
	OR	-0.579818495	-0.415515444					-0.506688168						
	SE	0.097716577	0.109106833					0.072791035						
	W	104.7281683	84.00325156											
ZHA2014	Source	25	25	25	25	25	25	25						
	PESNWI	1	1	1	1	1	1	1						
	OR	-0.342490309		-0.235722334		-0.235722334	-0.385662481	-0.299870026						
	SE	0.055785888		0.112996281		0.060035282	0.062365215	0.039815536						
	W	17.92568047		78.31982359		277.4513813	257.1077416							
ZHO2015	Source	0						0						
	PESNWI	1						1						
	OR	-0.540578582						-0.540578582						
	SE	0.100355935						0.100355935						
	W	9.964532789												

		Y3			Y4									
		Patient Rates Hospital Highly	Patient Satisfaction	**Study Aggregate**	NR Medication Error	NR Pressure Ulcer	NR Patient Falls	NR UTI	NR Bloodstream Infection	NR Pneumonia	NR Venous Needle Disconnection	NR Central Line Infection	NR Hypotension	**Study Aggregate**
AIK2008	Source													
	PESNWI													
	OR													
	SE													
	W													
AIK20011a	Source													
	PESNWI													
	OR													
	SE													
	W													
AIK20011b	Source													
	PESNWI													
	OR													
	SE													
	W													
CHO2014	Source													
	PESNWI													
	OR													
	SE													
	W													
CLA2007	Source													
	PESNWI													
	OR													
	SE													
	W													
COE2013	Source													
	PESNWI													
	OR													
	SE													
	W													
KEL2013	Source							1	1	1				1
	PESNWI							1	1	1				1
	OR							-0.15082289	-0.127833372	-0.051293294				-0.112554343
	SE							0.072763689	0.075998912	0.078770262				0.043719625
	W							188.8733047	173.1351511	161.1667409				
KEL2014	Source													
	PESNWI													
	OR													
	SE													
	W													
KUT2015	Source	23		23										
	PESNWI	1		1										
	OR	0.139761942		0.139761942										
	SE	0.07821808		0.07821808										
	W	163.4502894												
LAK2015	Source													
	PESNWI													
	OR													
	SE													
	W													
LAK2015a	Source											1	1	1
	PESNWI											1	1	1
	OR											-1.139434283		-1.139434283
	SE											0.292517813		0.292517813
	W											11.68679333		
LIU2012	Source													
	PESNWI													
	OR													
	SE													
	W													
MA2015	Source													
	PESNWI													
	OR													
	SE													
	W													
MA2015a	Source					8								8
	PESNWI					0								0
	OR					-0.342490309								-0.342490309
	SE					0.12588158								0.12588158
	W					7.943973991								
MCH2014	Source													
	PESNWI													
	OR													
	SE													
	W													
NEF2013	Source													
	PESNWI													
	OR													
	SE													
	W													
NIC2013	Source													
	PESNWI													
	OR													
	SE													
	W													
PAT2010	Source													
	PESNWI													
	OR													
	SE													
	W													
VAN2013	Source													
	PESNWI													
	OR													
	SE													
	W													
YOU2013	Source	0	0	0										
	PESNWI	0	0	0										
	OR	0.254642218	0.009950331	0.151843										
	SE	0.128205907	0.150623203	0.097628746										
	W	60.83926122	44.07742776											
ZHA2014	Source													
	PESNWI													
	OR													
	SE													
	W													
ZHO2015	Source													
	PESNWI													
	OR													
	SE													
	W													

		YS						
		NR Not confident patients can manage care on discharge	NR fair/poor ward quality	NR Not confident mgmt resolves patient problems	NR Poor/failing safety grade	NR Not recommend hospital to nurse colleagues	Not Recommend Hospital to a Friend	**Study Aggregate**
AIK2008	Source	2	2	2			2	2
	PESNWI	1	1	1			1	1
	OR	-0.3011051	-0.51083	-0.47804			-0.59784	-0.4491255
	SE	0.06029051	0.062304	0.048539			0.10883	0.03098494
	W	275.107243	257.6136	424.4419			84.43191	
AIK20011a	Source	3	3					3
	PESNWI	1	1					1
	OR	-0.3011051	-0.52763					-0.4047941
	SE	0.0270534	0.029446					0.0199218
	W	1366.33255	1153.332					
AIK20011b	Source							
	PESNWI							
	OR							
	SE							
	W							
CHO2014	Source							
	PESNWI							
	OR							
	SE							
	W							
CLA2007	Source							
	PESNWI							
	OR							
	SE							
	W							
COE2013	Source	0	0	0	0	0	0	0
	PESNWI	1	1	1	1	1	1	1
	OR	-0.4942963	-0.59784	-0.8916	-0.73397	-0.9162907	-0.73397	-0.6894927
	SE	0.13834631	0.147623	0.143336	0.314419	0.2566597	0.256788	0.07307482
	W	52.2474192	45.88708	48.67281	10.11537	15.18045	15.16524	
KEL2013	Source							
	PESNWI							
	OR							
	SE							
	W							
KEL2014	Source							
	PESNWI							
	OR							
	SE							
	W							
KUT2015	Source							
	PESNWI							
	OR							
	SE							
	W							
LAK2015	Source							
	PESNWI							
	OR							
	SE							
	W							
LAK2015a	Source	1			1			1
	PESNWI	1			1			1
	OR	-0.7133499			-1.60944			-1.1855401
	SE	0.19503964			0.217259			0.14513576
	W	26.2877992			21.18569			
LIU2012	Source							
	PESNWI							
	OR							
	SE							
	W							
MA2015	Source							
	PESNWI							
	OR							
	SE							
	W							
MA2015a	Source							
	PESNWI							
	OR							
	SE							
	W							
MCH2014	Source							
	PESNWI							
	OR							
	SE							
	W							
NEF2013	Source							
	PESNWI							
	OR							
	SE							
	W							
NIC2013	Source							
	PESNWI							
	OR							
	SE							
	W							
PAT2010	Source							
	PESNWI							
	OR							
	SE							
	W							
VAN2013	Source							
	PESNWI							
	OR							
	SE							
	W							
YOU2013	Source		0					0
	PESNWI		0					0
	OR		-0.30111					-0.3011051
	SE		0.111063					0.11106278
	W		81.07051					
ZHA2014	Source							
	PESNWI							
	OR							
	SE							
	W							
ZHO2015	Source							
	PESNWI							
	OR							
	SE							
	W							

PES-NWI variable indicates how the PES-NWI was measured. One indicates categorized in good, mixed and poor environments, and zero indicates a continuous variable with SD used for intervals in the OR.

Data Source	
Unique to paper	0
Multistate Nursing Survey	1
1999 Pennsylvania Nurse Survey	2
International Hospital Outcomes Study- Multistate and Canada, UK (England and Scotland) and Germany	3
RN4CAST	5
National Database of Nursing Quality Indicators	8
VA Nursing Outcomes Database.	23
Chinese Nursing Human Resources Stud	25

Table 2 Log Transformed and Inverse Variance Weighted Odds Ratios for Aggregate Outcome Variables

Y	Variable Name	Model	N	Log odds	log SE	P-value	Lower log CI	Upper log CI	Q Statistic	P-value for Testing Hetero-geneity	I^2	Effect Size	Lower CI	Upper CI
1	Nurse Job Outcome	RE	11	-0.351	0.013	0.000	-0.377	-0.324	20.742	0.023	0.518	0.704	0.686	0.723
2	Patients Record Outcome	RE	7	-0.077	0.008	0.000	-0.093	-0.061	13.606	0.034	0.559	0.926	0.911	0.941
3	Patients Satisfaction	FE	2	0.144	0.061	0.018	0.025	0.264	0.009	0.923	NA	1.155	1.025	1.302
4	Adverse Events	RE	3	-0.313	0.135	0.020	-0.578	-0.049	11.073	0.004	0.819	0.731	0.561	0.952
5	NR Quality & Safety	RE	5	-0.489	0.061	0.000	-0.61	-0.369	20.807	0.000	0.808	0.613	0.543	0.691