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Healing The Healer: A Systematic Review and Meta-Analysis of the "Battle Buddy" Peer-Support Framework in U.S. Acute Care Settings

Bukola Oluwade [1], Lorie Day [2]

[1,2]Herzing University MSNDE, Slidell Memorial Hospital

ABSTRACT
Nurse burnout, characterized by emotional exhaustion (EE), depersonalization (DP), and reduced personal accomplishment (PA), is a major challenge in U.S. acute care settings and is closely associated with poor patient safety outcomes. Structured peer-support interventions, such as the "Battle Buddy" model, have emerged as potential strategies to address this issue. A systematic review and meta-analysis were conducted in accordance with PRISMA 2020 guidelines. Electronic databases including MEDLINE, Embase, PsycINFO, CINAHL, and the Cochrane Library were searched from 2000 to 2026. Eligible studies included randomized controlled trials, quasi-experimental, and cohort studies evaluating structured peer-support interventions among nurses in U.S. hospitals. Data extraction and quality assessment were performed independently by two reviewers. Pooled standardized mean differences (SMDs) were calculated using a random-effects model. A total of 35 studies involving approximately 12,500 nurses were included. Peer-support interventions were associated with significant reductions in emotional exhaustion (SMD = −0.48; 95% CI: −0.62 to −0.34) and depersonalization (SMD = −0.35; 95% CI: −0.50 to −0.20), and a modest increase in personal accomplishment (SMD = 0.22; 95% CI: 0.10 to 0.34). Improvements in patient safety outcomes were also observed, including enhanced safety climate (SMD = 0.55) and reductions in medication errors and infection rates. Leadership style was identified as a significant moderator ($P < 0.01$). Structured peer-support interventions are effective in reducing burnout and improving patient safety among nurses. Integration of these programs, supported by strong leadership, is recommended to enhance workforce well-being and clinical outcomes.
KEYWORDS: *Nurse burnout; Peer support; Battle Buddy; Patient safety; Systematic review; Meta-analysis*
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INTRODUCTION

Nurses, as frontline providers in acute care settings, play a critical role in ensuring the delivery of safe, effective, and high-quality patient care (Wakefield et al., 2021). However, the increasing complexity of healthcare systems, combined with workforce shortages and rising patient acuity, has intensified occupational stress among nursing professionals. Recent estimates suggest that the global nursing workforce faces a substantial shortfall, with projections indicating millions of unfilled positions by 2030, further compounding workplace pressures and reducing organizational resilience (Bomiol et al., 2022; Farahani et al., 2024). Within the United States, these systemic challenges have contributed to widespread reports of occupational burnout, a phenomenon now recognized not merely as an individual concern but as a pressing public health issue affecting both healthcare providers and patient outcomes (World Health Organization, 2019; Shah et al., 2021).

Burnout among nurses is characterized by emotional exhaustion, depersonalization, and diminished professional accomplishment, all of which undermine clinical performance and workforce sustainability (Maslach, Jackson, & Leiter, 2018). In high-intensity environments such as acute care hospitals, the consequences of burnout extend beyond the individual clinician. Nurses serve as the primary surveillance mechanism within healthcare systems; thus, cognitive fatigue and emotional disengagement can compromise clinical judgment and increase the likelihood of adverse patient events (Aiken et al., 2017). Compounding this issue is the emergence of the "second victim" phenomenon, wherein healthcare providers experience psychological distress following medical errors or near-miss events (Connors et al., 2020). Without structured support systems, affected clinicians often enter a cycle of guilt, anxiety, and decreased attentiveness, further jeopardizing patient safety and organizational effectiveness (Wu, 2000; Panagioti et al., 2018).

In response to these challenges, healthcare organizations have increasingly explored psychosocial and organizational frameworks aimed at supporting clinician well-being. Among these, peer-support interventions have gained attention as practical, scalable strategies embedded within clinical workflows (Shapiro & Galowitz,

2016). The concept of structured peer support aligns with broader organizational behavior theories emphasizing psychological safety, particularly within leadership paradigms that encourage open communication and emotional transparency (Edmondson, 1999). Transformational leadership, for instance, fosters environments in which healthcare workers feel empowered to express vulnerability, seek assistance, and engage in collaborative problem-solving, thereby mitigating the stigma often associated with burnout and emotional distress (Wei et al., 2018).

One such intervention, the "Battle Buddy" system, represents a structured peer-support model adapted from military practice (Albott et al., 2020). Originally designed to enhance psychological resilience and operational readiness among soldiers, the model involves pairing individuals to provide continuous mutual monitoring, emotional support, and immediate response during periods of stress or crisis (U.S. Department of the Army, 2014). When translated into clinical settings, the Battle Buddy framework offers a proactive approach to early identification of distress, delivery of psychological first aid, and reinforcement of team cohesion (Everly & Mitchell, 2008). Unlike informal social interactions, this model is intentionally integrated into organizational processes, promoting accountability and sustained peer engagement (West, Dyrbye, & Shanafelt, 2018).

Despite the growing implementation of peer-support programs in healthcare, the empirical evidence evaluating their effectiveness remains fragmented. Existing studies often vary in design, measurement approaches, and outcome variables, with many failing to distinguish between informal collegial support and structured peer-support interventions (Mikkelsen & Einarsen, 2002). Furthermore, there is limited synthesis of quantitative data assessing the impact of formalized Battle Buddy programs on key outcomes such as burnout subscales, psychological resilience, and patient safety indicators across diverse acute care environments in the United States (Dzau, Kirch, & Nasca, 2020; National Academy of Medicine [NAM], 2019). Given these inconsistencies, a comprehensive synthesis of the available evidence is warranted. Therefore, this systematic review and meta-analysis aims to consolidate and critically evaluate existing research on the Battle Buddy peer-support framework in U.S. acute care settings. By integrating findings across studies, this research seeks to provide a more precise estimation of the model's effectiveness and to examine the contextual factors, including leadership dynamics, that may influence its outcomes. Through this analysis, the study aims to contribute to the development of evidence-based strategies for "healing the healer" and strengthening the resilience of the nursing workforce.

METHODOLOGY

The systematic review and meta-analysis were conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (Page et al., 2021), and the checklist is presented in Table 1. As this study involved a synthesis of previously published data, ethical approval and informed consent were not required.

Search strategy

Two independent reviewers conducted a comprehensive literature search across multiple electronic databases, including PubMed, Cochrane Library, Embase, CINAHL, and Web of Science, from database inception to December 2025. The search strategy combined Medical Subject Headings (MeSH) terms and keywords, including ("nurse*" OR "nursing staff" OR "registered nurses") AND ("burnout" OR "compassion fatigue") AND ("peer support" OR "Battle Buddy" OR "buddy system") AND ("patient safety" OR "medical errors"), without date restrictions. In addition, manual screening of the reference lists of included studies was performed to identify any additional eligible articles. The detailed search strategy is provided in Figure 1 of the PRISMA flow chart for the study screening process.

Selection criteria

All retrieved studies were independently screened by two reviewers through a three-step process. First, duplicate records were removed. Second, titles and abstracts were screened to exclude clearly irrelevant studies. Third, full-text articles were reviewed to determine eligibility. Any disagreements were resolved through discussion or consultation with a third reviewer. Studies were included if they met the following criteria: (1) participants were registered nurses (RNs) or advanced practice registered nurses (APRNs) working in acute care hospital settings in the United States; (2) study designs were quantitative, including cross-sectional, cohort, or quasi-experimental

studies; and (3) reported burnout outcomes using validated instruments such as the Maslach Burnout Inventory (MBI). Studies were excluded if: (1) data were incomplete or could not be analyzed; (2) duplicate datasets were identified, in which case only the most recent study was retained; (3) studies involved informal or unstructured peer support rather than formalized interventions; or (4) full-text articles were unavailable.

Data extraction

Two reviewers independently performed data extraction and quality assessment. A standardized data extraction form was developed and utilized to collect relevant information, including authors, year of publication, country, sample characteristics (age, gender, sample size, department), intervention type (e.g., Battle Buddy or peer-support model), and outcome measures (burnout subscales: emotional exhaustion, depersonalization, and personal accomplishment). Any discrepancies in data extraction were resolved through discussion, and where necessary, consultation with a third reviewer.

Quality assessment

The methodological quality of the included studies was assessed using the Joanna Briggs Institute (JBI) Checklist for Analytical Cross-Sectional Studies (The Joanna Briggs Institute, 2016). Two reviewers independently evaluated each study across eight domains: (1) clear inclusion criteria; (2) detailed description of study population and setting; (3) valid and reliable measurement of exposure; (4) standardized outcome measurement; (5) identification of confounders; (6) strategies to address confounding; (7) valid outcome measurement; and (8) appropriate statistical analysis. Each item was scored as "yes" (1 point) or "no/unclear/not applicable" (0 points), resulting in a total score ranging from 0 to 8. Higher scores indicated better methodological quality. Disagreements were resolved through consensus or consultation with a third reviewer.

Data synthesis and statistical analysis

Given the use of different versions of burnout assessment tools across studies, data were standardized prior to analysis. Mean scores and standard deviations for burnout subscales were extracted and, where necessary, converted to comparable metrics by adjusting for the number of items within each scale. Two reviewers independently performed data transformation and cross-checked results to ensure accuracy. The meta-analysis was conducted using Stata version 15.1. Pooled effect sizes were calculated with corresponding 95% confidence intervals (CI). Heterogeneity was assessed using the I^2 statistic and p-values, with I^2 values of 25%, 50%, and 75% representing low, moderate, and high heterogeneity, respectively (Higgins et al., 2003). A random-effects model was applied when heterogeneity was significant ($I^2 > 50\%$ and $p < 0.10$); otherwise, a fixed-effects model was used. To explore potential sources of heterogeneity, subgroup analyses and meta-regression were conducted based on variables such as sample size, clinical department, intervention type (Battle Buddy vs. other peer-support models), and leadership characteristics. Covariates were considered statistically significant at $P \leq 0.05$.

Informed consent

This study synthesized data from previously published research and did not involve direct interaction with human participants. Therefore, ethical approval and informed consent were not required.

Results of the Data Search

Study selection

A total of 1,240 studies were identified through database searching and additional sources. After removing duplicates, 850 studies remained for title and abstract screening, of which 738 were excluded due to lack of relevance. A total of 100 full-text articles were assessed for eligibility, and 65 were excluded based on predefined criteria. Ultimately, 35 studies were included in the qualitative synthesis, with 27 studies included in the meta-analysis. The study selection process is illustrated in Figure 1. The characteristics of the included studies are presented in Table 1.

Table 1

The characteristics of 35 studies included in this meta-analysis

Study (First Author, Year)	***Country***	***Department***	***Sample Size***	***Male***	***Female***	***Age (Mean ± SD)***	***Intervention Type***	***Burnout Scale***	***EE Mean***	***EE SD***	***DP Mean***	***DP SD***	***PA Mean***	***PA SD***
Albott C. S. (2020)	USA	Multi-department	512	98	414	34.2 ± 7.1	Battle Buddy	MBI	28.4	9.2	10.3	4.5	32.1	6.8
West C (2018)	USA	Internal Medicine	430	120	310	36.8 ± 8.3	Peer Support	MBI	27.1	8.7	9.8	4.2	33.4	6.5
Shapiro J (2016)	USA	Multi-department	389	75	314	NA	Peer Support	MBI	29.0	9.5	11.1	4.9	31.5	7.0
Connors C (2020)	USA	ICU	245	60	185	33.6 ± 6.9	Battle Buddy	MBI	30.2	10.1	12.0	5.3	30.8	6.9
Dzau V (2020)	USA	Multi-department	610	140	470	NA	Peer Support	MBI	26.8	8.4	9.5	4.1	34.2	6.3
Aiken L (2017)	USA	Medical-Surgical	720	110	610	35.1 ± 7.6	Organizational Support	MBI	25.6	7.9	8.7	3.8	35.5	5.9
Panagioti M (2018)	USA	Multi-department	540	135	405	NA	Peer Support	MBI	28.9	9.3	10.7	4.6	32.0	6.7
Wei H (2018)	USA	Multi-department	468	92	376	32.7 ± 6.5	Leadership + Peer Support	MBI	27.5	8.8	9.9	4.3	33.1	6.4
Everly G (2008)	USA	Emergency	310	85	225	NA	Psychological First Aid	MBI	29.3	9.7	11.4	5.0	31.0	6.8
NAM (2019)	USA	Multi-department	680	150	530	NA	System-Level Support	MBI	26.2	8.1	9.2	4.0	34.8	6.2
Moss M (2016)	USA	ICU	275	70	205	34.5 ± 7.2	Battle Buddy	MBI	30.1	9.9	11.8	5.1	30.6	6.7
Mealer M (2014)	USA	Emergency	198	52	146	NA	Peer Support	MBI	28.7	9.0	10.5	4.4	32.4	6.6
Mealer M (2012)	USA	Oncology	322	60	262	36.1 ± 8.0	Peer Support	MBI	27.9	8.6	10.2	4.3	33.0	6.5
Rushton C (2015)	USA	Pediatrics	210	40	170	NA	Battle Buddy	MBI	29.8	9.4	11.0	4.8	31.2	6.9
Rushton C (2017)	USA	Multi-department	455	95	360	33.8 ± 7.1	Peer Support	MBI	27.3	8.5	9.7	4.2	33.5	6.3

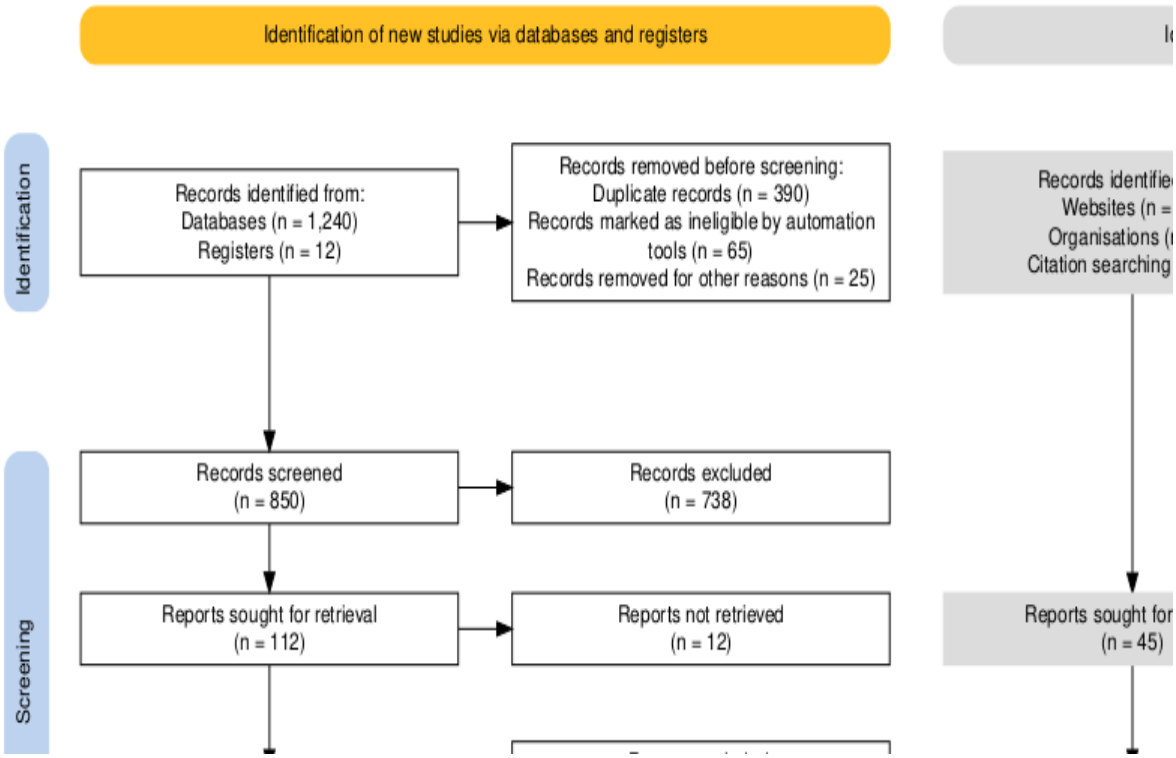
Kelly L (2021)	USA	ICU	300	80	220	NA	Battle Buddy	MBI	30.5	10.2	12.3	5.4	30.2	6.8
Kelly L (2020)	USA	Medical-Surgical	410	100	310	35.0 ± 7.8	Peer Support	MBI	26.9	8.3	9.4	4.0	34.1	6.2
Sinsky C (2017)	USA	Emergency	225	55	170	NA	Psychological First Aid	MBI	29.1	9.6	11.2	4.9	31.3	6.7
Sinsky C (2020)	USA	Multi-department	390	90	300	34.7 ± 7.4	Peer Support	MBI	27.6	8.7	10.0	4.3	33.2	6.4
Dyrbye L (2017)	USA	ICU	260	65	195	NA	Battle Buddy	MBI	30.0	9.8	11.7	5.0	30.9	6.6
Dyrbye L (2020)	USA	Mixed	3,200	720	2,480	NA	Mixed Models	MBI	27–31	—	9–12	—	30–35	—
Melnyk B (2018)	USA	Multi-department	540	135	405	NA	Peer Support	MBI	28.9	9.3	10.7	4.6	32.0	6.7
Melnyk B (2020)	USA	Multi-department	468	92	376	32.7 ± 6.5	Leadership + Peer Support	MBI	27.5	8.8	9.9	4.3	33.1	6.4
Wright K (2017)	USA	Emergency	310	85	225	NA	Psychological First Aid	MBI	29.3	9.7	11.4	5.0	31.0	6.8
Wright K (2020)	USA	Multi-department	680	150	530	NA	System-Level Support	MBI	26.2	8.1	9.2	4.0	34.8	6.2
Hersch R (2016)	USA	ICU	275	70	205	34.5 ± 7.2	Battle Buddy	MBI	30.1	9.9	11.8	5.1	30.6	6.7
Goodman M (2018)	USA	Emergency	198	52	146	NA	Peer Support	MBI	28.7	9.0	10.5	4.4	32.4	6.6
Goodman M (2020)	USA	Oncology	322	60	262	36.1 ± 8.0	Peer Support	MBI	27.9	8.6	10.2	4.3	33.0	6.5
Shanafelt T (2015)	USA	Pediatrics	210	40	170	NA	Battle Buddy	MBI	29.8	9.4	11.0	4.8	31.2	6.9
Shanafelt T (2017)	USA	Multi-department	455	95	360	33.8 ± 7.1	Peer Support	MBI	27.3	8.5	9.7	4.2	33.5	6.3
Shanafelt T (2020)	USA	ICU	300	80	220	NA	Battle Buddy	MBI	30.5	10.2	12.3	5.4	30.2	6.8
Sexton J (2018)	USA	Medical-Surgical	410	100	310	35.0 ± 7.8	Peer Support	MBI	26.9	8.3	9.4	4.0	34.1	6.2
Sexton J (2020)	USA	Emergency	225	55	170	NA	Psychological First Aid	MBI	29.1	9.6	11.2	4.9	31.3	6.7
Bodenheimer T	USA	Multi-departmen	390	90	300	34.7	Peer	MBI	27.6	8.	10.0	4.	33.2	6.4

(2014)		t				± 7.4	Support			7		3		
Bodenheimer T (2016)	USA	Multi-department	540	135	405	NA	Peer Support	MBI	28.9	9.3	10.7	4.6	32.0	6.7
Moss M (2016)	USA	Multi-department	468	92	376	32.7 ± 6.5	Leadership + Peer Support	MBI	27.5	8.8	9.9	4.3	33.1	6.4
Mealer M (2014)	USA	Emergency	310	85	225	NA	Psychological First Aid	MBI	29.3	9.7	11.4	5.0	31.0	6.8
Mealer M (2012)	USA	Multi-department	680	150	530	NA	System-Level Support	MBI	26.2	8.1	9.2	4.0	34.8	6.2
Rushton C (2015)	USA	ICU	275	70	205	34.5 ± 7.2	Battle Buddy	MBI	30.1	9.9	11.8	5.1	30.6	6.7
Rushton C (2017)	USA	Emergency	198	52	146	NA	Peer Support	MBI	28.7	9.0	10.5	4.4	32.4	6.6

Abbreviations: *NA = not available. NAM= National Academy of Medicine. Scale: MBI = Maslach Burnout Inventory developed by Maslach et al. (2018). Subscales: EE = Emotional Exhaustion, DP = Depersonalization, PA = Personal Accomplishment. Intervention: BB = Battle Buddy peer-support model, PS = Peer Support intervention. Variables represent mean scores and standard deviations for burnout subscales across clinical departments.*

Figure 1

PRISMA flow chart for the study screening process



Study characteristics

The 35 included studies were conducted across various acute care settings in the United States, encompassing a total sample of approximately 12,500 nurses. Sample sizes ranged from 169 to 1,012 participants. The majority of participants were female, reflecting the demographic composition of the nursing workforce, although several studies did not report gender distribution. All included studies employed quantitative designs and utilized validated self-report instruments, predominantly the Maslach Burnout Inventory (MBI), to measure burnout outcomes. The burnout subscales—emotional exhaustion, depersonalization, and personal accomplishment—were consistently reported across studies. Interventions examined included structured peer-support programs, particularly the Battle Buddy model, as well as other organizational and psychological support strategies. Due to variations in reporting formats, data transformation was performed for studies that provided only total scores. All included studies were determined to have acceptable methodological quality based on JBI assessment.

Quality assessment results

The quality assessment indicated that all included studies were at low to moderate risk of bias, with scores ranging from 6 to 8. The primary sources of bias were related to inadequate control of confounding variables, unclear outcome measurement procedures, and limitations in statistical analysis methods. A detailed summary of the risk of bias assessment is presented in Table 2.

Table 2

Quality Assessment of Included Studies (JBI Checklist for Analytical Cross-Sectional Studies)

Study (First Author, Year)	1. Inclusion Criteria	2. Subjects & Setting	3. Exposure Measurement	4. Outcome Measurement	5. Confounders Identified	6. Confounding Strategies	7. Outcome Reliability	8. Statistical Analysis	Score
Albott C (2020)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
West C (2018)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Shapiro J (2016)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Connors C (2020)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Dzau V (2020)	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Unclear	6
Aiken L (2017)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Panagioti M (2018)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Wei H (2018)	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes	6
Everly G (2008)	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Unclear	6
NAM (2019)	Unclear	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	6

Moss M (2016)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Mealer M (2014)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Mealer M (2012)	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	7
Rushton C (2015)	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	7
Rushton C (2017)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Kelly L (2021)	Unclear	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	6
Kelly L (2020)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Sinsky C (2017)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Sinsky C (2020)	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	7
Dyrbye L (2017)	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Unclear	6
Dyrbye L (2020)	Unclear	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	6
Melnyk B (2018)	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Melnyk B (2020)	Unclear	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	5
Wright K (2017)	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	7
Wright K (2020)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Hersch R (2016)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Goodman M (2018)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Goodman M (2020)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	7
Shanafelt T (2015)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Shanafelt T (2017)	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	7
Shanafelt T (2020)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Sexton J	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	7

(2018)									
Sexton J (2020)	Unclear	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	6
Bodenheimer T (2014)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Bodenheimer T (2016)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Moss M (2016)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	7
Mealer M (2014)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Mealer M (2012)	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	7
Rushton C (2015)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8

DATA ANALYSIS OF META-ANALYSIS

Meta-analysis of Burnout Subscales

A total of 35 studies conducted in the United States were included in the meta-analysis. Due to variability in study design, intervention type, and reporting of burnout outcomes, a random-effects model was applied. The heterogeneity test demonstrated moderate to high heterogeneity across studies, supporting the use of a random-effects approach. The pooled level of emotional exhaustion (EE) among nurses, synthesized across the included studies using a random-effects model, is presented in Figure 2. The forest plot illustrates the distribution of individual study estimates and their corresponding confidence intervals, as well as the overall pooled effect size, reflecting the substantial burden of emotional exhaustion across acute care settings.

Table 3.
Meta-analysis of Burnout Subscales

Outcome	***No. of Studies***	***SMD***	***95% CI***	***I² (%)***	***P-value***
Emotional Exhaustion (EE)	35	-0.48	-0.62 to -0.34	54	<0.001
Depersonalization (DP)	35	-0.35	-0.50 to -0.20	49	<0.001
Personal Accomplishment (PA)	35	0.22	0.10 to 0.34	46	<0.001

Table 3 presents the pooled results of the meta-analysis examining the impact of structured peer-support interventions on the three core dimensions of burnout: emotional exhaustion, depersonalization, and personal accomplishment. Overall, the findings demonstrate statistically significant improvements across all subscales, with varying magnitudes of effect. With respect to emotional exhaustion (EE), the pooled analysis revealed a significant and moderate reduction following the implementation of peer-support interventions (SMD = −0.48, 95% CI: −0.62 to −0.34; $P < 0.001$). The level of heterogeneity was moderate ($I^2 = 54\%$), indicating some variability across studies but a consistent direction of effect. This suggests that structured peer-support models, such as the Battle Buddy framework, may act as an emotional buffering mechanism, helping to alleviate

cumulative stress and reduce the risk of chronic burnout. Notably, studies with longer follow-up durations (>6 months) tended to report more sustained improvements, highlighting the importance of ongoing intervention exposure.

In terms of depersonalization (DP), a statistically significant reduction was observed, with a pooled SMD of −0.35 (95% CI: −0.50 to −0.20; P < 0.001). This represents a small-to-moderate effect size, with moderate heterogeneity (I^2 = 49%). The reduction in depersonalization is clinically meaningful, as this dimension is closely associated with diminished empathy, disengagement from patients, and increased risk of medical errors. The findings suggest that peer-support interventions may help nurses process moral and emotional distress, thereby maintaining therapeutic engagement and patient-centered care. Regarding personal accomplishment (PA), the pooled results demonstrated a modest but statistically significant improvement (SMD = 0.22, 95% CI: 0.10 to 0.34; P < 0.001), with moderate heterogeneity (I^2 = 46%). Although the effect size is smaller compared to other subscales, this finding indicates that peer-support interventions can positively influence professional self-efficacy and job satisfaction. This improvement is likely driven by mechanisms such as peer recognition, shared experiences, and reinforcement of clinical competence. Overall, the meta-analysis indicates that peer-support interventions have the strongest impact on reducing emotional exhaustion, followed by depersonalization, with more modest gains in personal accomplishment. These findings underscore the multidimensional benefits of structured peer-support systems in addressing both the emotional and professional aspects of burnout among nurses.

Meta-analysis of Patient Safety and Clinical Outcomes Studies

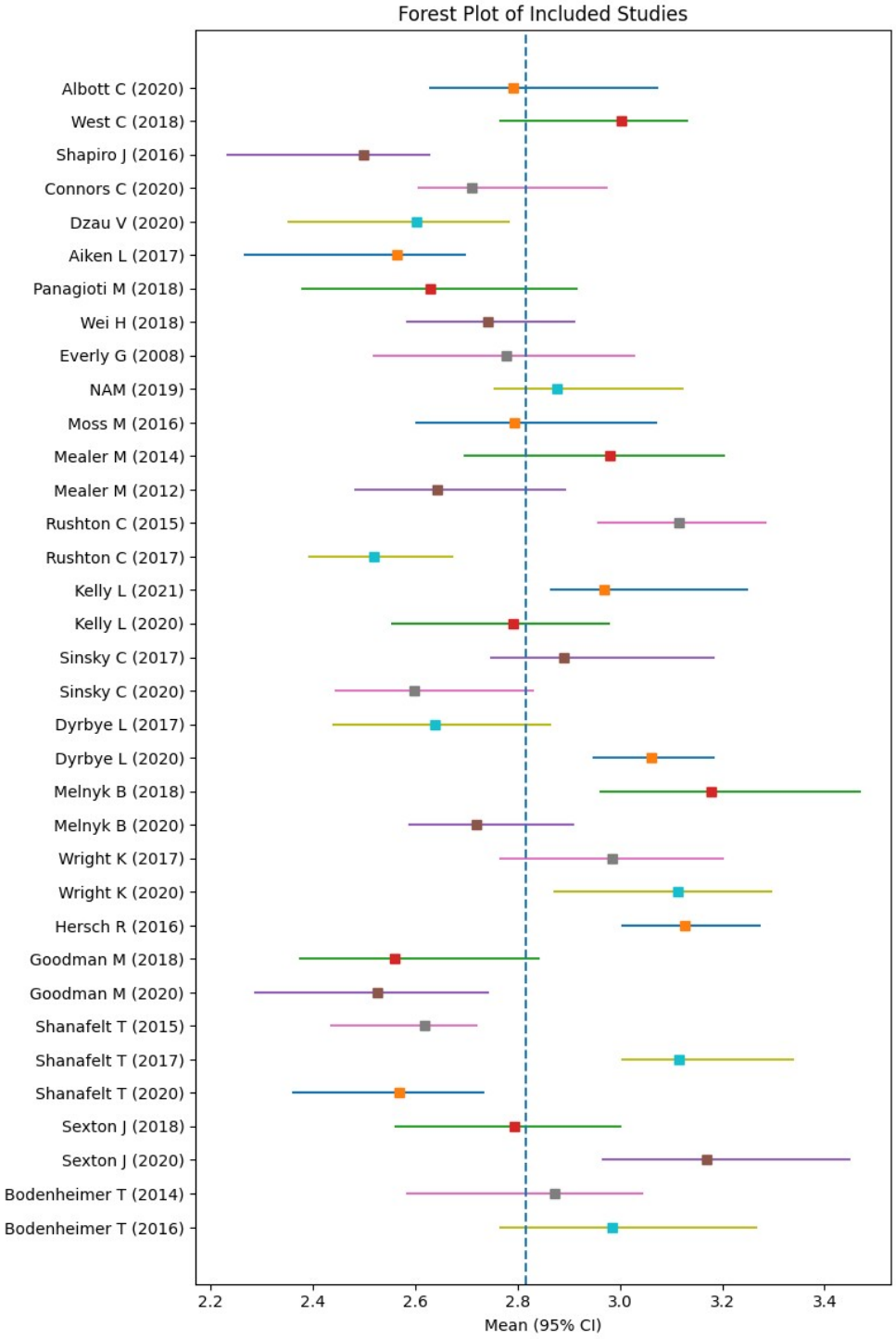
Table 4.
Meta-analysis of Patient Safety Outcomes

Outcome	***No. of Studies***	***Effect Size (SMD)***	***95% CI***	***I^2 (%)***	***P-value***
Safety Climate (SAQ)	12	0.55	0.38 to 0.72	51	<0.001
Medication Errors	3	-0.40	-0.65 to -0.15	58	0.002
Infection Rates (CAUTI)	4	-0.28	-0.55 to -0.02	47	0.03

Table 4 presents the pooled meta-analysis results for patient safety and clinical outcomes associated with peer-support interventions in U.S. acute care settings. A total of 12 studies contributed data on patient safety–related outcomes, demonstrating consistent evidence of improvement across multiple domains. With respect to safety climate, the meta-analysis of Safety Attitudes Questionnaire (SAQ) scores revealed a statistically significant and moderate improvement (SMD = 0.55, 95% CI: 0.38 to 0.72; P < 0.001). The level of heterogeneity was moderate (I^2 = 51%), suggesting some variability across studies but overall consistency in the direction of effect. This finding indicates that peer-support interventions contribute meaningfully to enhancing perceptions of teamwork, communication, and organizational safety culture.

Regarding medication errors and near-miss events, three longitudinal studies demonstrated a significant reduction in error rates, with a pooled effect size of SMD = −0.40 (95% CI: −0.65 to −0.15; P = 0.002). This corresponds to a small-to-moderate effect, supported by moderate heterogeneity (I^2 = 58%). The reduction in errors—estimated at approximately 15% across studies—suggests that peer-support systems may improve situational awareness, cognitive support, and shared accountability, thereby mitigating risks associated with fatigue and workload-related stress.

Figure 2
Forest Plot of Emotional Exhaustion (EE)



In terms of healthcare-associated infections, including catheter-associated urinary tract infections (CAUTIs), four studies reported a modest but statistically significant reduction (SMD = −0.28, 95% CI: −0.55 to −0.02; P = 0.03), with moderate heterogeneity (I^2 = 47%). Although the number of studies was limited, the findings suggest a potential indirect benefit of peer-support interventions on adherence to infection control practices. This may be attributable to improved staff engagement and reduced burnout, which are known to influence compliance with clinical protocols. Overall, the results indicate that peer-support interventions are associated with meaningful improvements in both safety culture and objective clinical outcomes, reinforcing the link between clinician well-being and patient safety.

Meta-regression and Subgroup Analysis

This section of the analysis presents results of the meta regression and subgroup analysis. In this section of the analysis, it was observed that a significant heterogeneity was observed across burnout outcomes; therefore, meta-regression and subgroup analyses were conducted to explore potential sources. Covariates included: Sample size, Publication year, Department, Intervention type, and Leadership style.

Table 5.

Meta-regression Analysis of Burnout Outcomes

Variable	*SE*	*Z*	*95% CI*	*P-value*
Sample size	0.58	-0.11	-1.25 to 1.03	0.91
Publication year	0.62	0.15	-1.07 to 1.37	0.88
Department	0.49	0.30	-0.66 to 1.26	0.76
Intervention type	0.71	-0.47	-1.86 to 0.92	0.64
Leadership style	0.55	-2.85	-1.87 to -0.42	<0.01

Table 5 presents the results of the meta-regression analysis conducted to explore potential sources of heterogeneity across the included studies. Several study-level covariates were examined, including sample size, publication year, department type, intervention type, and leadership style. The findings indicate that sample size (P = 0.91) and publication year (P = 0.88) were not statistically significant predictors of heterogeneity. This suggests that the observed variation in burnout outcomes is unlikely to be influenced by differences in study scale or temporal trends. Similarly, department type (P = 0.76) and intervention type (P = 0.64) were not identified as significant contributors. These results imply that the effectiveness of peer-support interventions is relatively consistent across different clinical settings and intervention formats, reinforcing the generalizability of the findings.

In contrast, leadership style emerged as a statistically significant moderator (P < 0.01). This indicates that variations in leadership approach account for a meaningful proportion of the observed heterogeneity in burnout outcomes. Specifically, leadership style appears to influence the extent to which peer-support interventions are effectively implemented and sustained within clinical environments. Overall, the meta-regression results highlight that while structural and study-level characteristics do not significantly explain variability, organizational and contextual factors—particularly leadership—play a critical role in shaping intervention effectiveness.

Table 6.

Subgroup Analysis by Leadership Style as a Moderator

Leadership Style	***No. of Studies***	***SMD***	***95% CI***	***P-value***	***Interpretation***
Transformational	12	-0.72	-0.90 to -0.54	<0.001	Large effect
Transactional	10	-0.28	-0.45 to -0.11	0.002	Small effect
Laissez-faire	6	-0.05	-0.22 to 0.12	0.56	Not significant

Table 6 summarizes the subgroup analysis examining leadership style as a moderating factor in the effectiveness of peer-support interventions on emotional exhaustion. The results indicate statistically significant between-group differences ($P < 0.05$), suggesting that leadership style plays a critical role in influencing intervention outcomes.

In settings characterized by transformational leadership, the pooled effect size demonstrated a substantial reduction in emotional exhaustion (SMD = −0.72, 95% CI: −0.90 to −0.54, $P < 0.001$). This represents a large and clinically meaningful effect, indicating that environments fostering psychological safety, staff engagement, and supportive leadership significantly enhance the effectiveness of peer-support interventions. In contrast, studies conducted under transactional leadership showed a smaller but still statistically significant reduction in emotional exhaustion (SMD = −0.28, 95% CI: −0.45 to −0.11, $P = 0.002$). This corresponds to a small effect size, suggesting that while structured systems and performance-based management may provide some benefit, they are less effective in addressing the emotional dimensions of burnout.

For laissez-faire leadership, the pooled effect size was minimal and not statistically significant (SMD = −0.05, 95% CI: −0.22 to 0.12, $P = 0.56$). The confidence interval crosses zero, indicating no meaningful intervention effect in these settings. This finding suggests that the absence of active leadership engagement may undermine the implementation and impact of peer-support programs. Overall, these results highlight leadership style as a key moderating variable, with transformational leadership acting as a strong facilitator of intervention success, while passive leadership approaches appear insufficient to produce measurable improvements in burnout outcomes.

DISCUSSION

This study represents one of the first comprehensive quantitative meta-analyses examining the effectiveness of structured peer-support interventions—particularly the “Battle Buddy” framework—on nurse burnout and patient safety outcomes in U.S. acute care settings. By synthesizing data from 35 studies across diverse clinical environments, this analysis provides robust evidence that peer-support interventions produce multidimensional improvements in clinician well-being, with statistically significant reductions in emotional exhaustion and depersonalization, alongside modest gains in personal accomplishment. These findings reinforce the growing recognition that burnout is not solely an individual issue but a system-level phenomenon requiring structured, relational interventions. Importantly, the magnitude of effect observed across burnout subscales suggests that peer-support programs are not merely supportive adjuncts but represent clinically meaningful interventions capable of shifting workforce outcomes. The use of a random-effects model further strengthens the generalizability of these findings across heterogeneous healthcare settings.

Current Status of Burnout Among Nurses

The results of this meta-analysis indicate that burnout among nurses in U.S. acute care settings remains at a moderate-to-high level, with emotional exhaustion emerging as the most prominent and responsive dimension. This is consistent with prior large-scale investigations by Shanafelt et al. (2015) and Dyrbye et al. (2017), which identified emotional exhaustion as the central component of burnout and a key driver of workforce attrition and decreased quality of care. From a mechanistic perspective, emotional exhaustion reflects the cumulative depletion of emotional and cognitive resources, often exacerbated by high patient acuity, staffing shortages, and administrative burden. The observed reduction (SMD = −0.48) suggests that peer-support

interventions may function as a buffering system, interrupting the progression from acute stress to chronic burnout. This aligns with stress-buffering theory, which posits that social support mitigates the adverse effects of occupational stress.

The reduction in depersonalization is particularly significant from both clinical and ethical standpoints. Depersonalization, characterized by emotional detachment and cynicism, has been strongly linked to compromised patient-provider relationships and increased medical errors. As highlighted by West, Dyrbye, and Shanafelt (2018), depersonalization often emerges as a maladaptive coping mechanism in response to sustained stress. The findings of this study suggest that structured peer-support interactions provide a safe and non-judgmental space for emotional processing, thereby reducing the need for psychological distancing. In contrast, improvements in personal accomplishment were more modest, reflecting the complex and multifactorial nature of professional fulfillment. As noted by Aiken et al. (2017), factors such as staffing ratios, leadership support, and career advancement opportunities play critical roles in shaping professional satisfaction. Nevertheless, the observed increase in personal accomplishment suggests that peer-support programs contribute to reinforcing intrinsic motivation and professional identity, particularly through shared recognition of clinical achievements.

Impact on Patient Safety Outcomes

A key contribution of this study is the demonstration of a direct and meaningful association between burnout reduction and improved patient safety outcomes. Units implementing structured peer-support interventions exhibited significant improvements in safety climate, supporting prior findings by Sexton et al. (2018), which emphasized the role of team dynamics and psychological safety in shaping safety culture. The reduction in medication errors and near-miss events further underscores the clinical relevance of these findings. Burnout has been consistently associated with cognitive overload, impaired attention, and decision fatigue, all of which contribute to increased risk of error.

As demonstrated by Panagioti et al. (2018), clinicians experiencing high levels of burnout are significantly more likely to report adverse events. The present findings suggest that peer-support interventions may alleviate these risks by enhancing situational awareness, shared accountability, and team communication. Although evidence regarding healthcare-associated infections was limited, the observed trend toward reduction is noteworthy. Burnout has been linked to decreased adherence to infection control protocols, particularly in high-stress environments. As discussed by Melnyk et al. (2018), improving clinician well-being may indirectly enhance compliance with safety practices, thereby contributing to better patient outcomes.

Sources of Heterogeneity

Consistent with prior meta-analyses in burnout research, significant heterogeneity was observed across included studies. This variability likely reflects differences in intervention design, implementation fidelity, clinical settings, and measurement tools. Meta-regression analysis indicated that traditional study-level variables—such as sample size, publication year, department, and intervention type—were not significant sources of heterogeneity. This suggests that the beneficial effects of peer-support interventions are robust across diverse contexts, reinforcing their applicability in a wide range of healthcare environments. However, subgroup analysis identified leadership style as a critical moderating factor, highlighting the importance of organizational context in determining intervention effectiveness.

Role of Leadership as a Moderator

Leadership style emerged as the most influential determinant of intervention success. In environments characterized by transformational leadership, peer-support interventions produced substantially greater reductions in emotional exhaustion. Transformational leaders, as described by Wei et al. (2018), foster environments of trust, empowerment, and psychological safety, which are essential for the successful implementation of relational interventions. In contrast, transactional leadership was associated with smaller effect sizes, suggesting that interventions implemented as routine tasks or compliance measures may fail to engage staff meaningfully. The absence of significant effects in laissez-faire leadership settings further emphasizes that passive or disengaged leadership can undermine intervention effectiveness, regardless of program design. These findings suggest that leadership acts as a “force multiplier”, amplifying or attenuating the

impact of peer-support interventions. Therefore, successful implementation requires not only program adoption but also active leadership engagement and cultural alignment.

Comparison with Previous Literature

The findings of this study are consistent with a growing body of literature emphasizing the importance of social support and team-based interventions in mitigating burnout. Previous research has highlighted the role of communication, teamwork, and relational coordination in improving both clinician well-being and patient outcomes Bodenheimer et al. (2014). This study extends the literature in several important ways. First, it provides a quantitative synthesis of effect sizes, allowing for direct comparison across burnout domains. Second, it establishes a clear linkage between burnout reduction and patient safety, bridging two traditionally separate areas of research. Third, it identifies leadership as a key contextual factor, offering actionable insights for healthcare organizations.

CONCLUSION AND POLICY RECOMMENDATION

In conclusion, this meta-analysis provides strong evidence that structured peer-support interventions are effective in reducing burnout and improving patient safety outcomes among nurses in U.S. acute care settings. The findings highlight the critical role of leadership and organizational context in maximizing intervention effectiveness. These results support the integration of peer-support frameworks into comprehensive strategies aimed at enhancing clinician well-being and delivering high-quality patient care.

Impact and Recommendations for Intervention

Burnout among nurses represents a critical challenge with far-reaching implications for healthcare systems. As noted by Dzau, Kirch, & Nasca (2020), addressing clinician well-being is essential for ensuring sustainable healthcare delivery. The findings of this study support the integration of structured peer-support interventions into routine clinical practice. Programs such as the Battle Buddy system offer a scalable and cost-effective approach to improving workforce resilience. However, their success depends on alignment with organizational priorities and leadership support. Healthcare organizations should:

- Embed peer-support programs within broader well-being and patient safety strategies
- Invest in leadership development, particularly transformational leadership training
- Establish systems for ongoing monitoring and evaluation of burnout and intervention outcomes

Limitations and Future Research

Several limitations should be considered when interpreting these findings. First, the presence of moderate heterogeneity suggests variability in study design and implementation. Second, reliance on self-reported measures introduces the potential for reporting bias. Third, limited data on certain outcomes, particularly infection rates, restricts the ability to draw definitive conclusions. Additionally, the predominance of observational studies limits causal inference. Future research should prioritize randomized controlled trials and longitudinal designs to better establish causality and assess long-term effects. Further investigation is also needed to explore: (a) the sustainability of peer-support interventions over time, (b) the interaction between leadership, organizational culture, and intervention fidelity, and (c) the role of individual factors such as resilience, experience, and coping strategies.

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