INPLASY

Predictive Modeling of Compassion Fatigue in Nurses: A Systematic Review and Meta-Analysis

INPLASY202590123
doi: 10.37766/inplasy2025.9.0123
Received: 30 September 2025
Published: 30 September 2025

Zhang, HL; Xia, ZY.

Corresponding author:
Huiling Zhang

1101090886@qq.com

Author Affiliation:
School of Nursing, Anhui University of Chinese Medicine.

ADMINISTRATIVE INFORMATION

Support - This work was supported by Anhui Provincial Higher Education Institution Key Project of Natural Science Research No.2023AH050774; Anhui Provincial Higher Education Quality Engineering Project: 2023jyxm0354.

Review Stage at time of this submission - Preliminary searches.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202590124

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 30 September 2025 and was last updated on 30 September 2025.

INTRODUCTION

Review question / Objective Assess the effectiveness and reliability of existing predictive models in identifying and forecasting the risk of compassion fatigue in nursing populations.

Analyze the various predictive factors (e.g., psychological resilience, social support, job satisfaction, workplace violence) that contribute to the development of compassion fatigue, with a particular focus on their role across diverse nursing settings.

Compare different modeling techniques (such as logistic regression, machine learning algorithms like random forest, and XGBoost) used in these studies to predict compassion fatigue, evaluating their strengths, limitations, and practical applications in clinical environments.

Provide recommendations for improving future predictive modeling approaches and suggest practical, context-sensitive interventions that can mitigate compassion fatigue in nursing practice.

Condition being studied This review focuses on compassion fatigue in nursing populations across various clinical contexts, including emergency departments, oncology units, gynecology, and palliative care settings, where nurses are frequently exposed to high-intensity emotional demands. The study examines how different predictive models identify risk factors—such as psychological resilience, social support, job satisfaction, workplace violence, and coping strategies—that influence the onset and severity of compassion fatigue.

By systematically synthesizing these findings, the review seeks to clarify the predictive mechanisms of compassion fatigue and provide evidence-

based insights to guide prevention and intervention strategies in nursing practice.

METHODS

Participant or population The participants in this review are nurses across diverse clinical and educational settings, including but not limited to:

Clinical nurses working in hospitals (e.g., emergency departments, oncology, gynecology, intensive care, and palliative care units).

Nursing students undergoing clinical training or internships.

Specialized nursing groups who are at heightened risk of compassion fatigue due to frequent exposure to patient suffering, trauma, or high-intensity emotional labor.

No restrictions are placed on age, gender, professional title, or geographic region. Both registered nurses and student nurses are eligible for inclusion, provided the studies involve the development or validation of predictive models for compassion fatigue.

Intervention The interventions (or exposures) considered in this review are predictive modeling approaches developed to identify the risk of compassion fatigue among nurses. These include:

Traditional statistical methods such as logistic regression, multivariate regression, and nomogram construction.

Machine learning algorithms including random forest, XGBoost, latent profile analysis (LPA), and other advanced computational approaches.

Model validation techniques such as cross-validation, ROC curve analysis, calibration curves, and SHAP analysis.

Comparator The comparators in this review will include different predictive modeling approaches used to assess the risk of compassion fatigue in nurses. These comparisons will focus on evaluating the predictive accuracy, performance, and validity of each model. Comparators may include:

Traditional statistical models like logistic regression and multivariate regression.

Machine learning models such as random forest, support vector machine, and XGBoost.

Hybrid models that combine statistical and machine learning approaches.

These comparisons aim to determine which modeling technique provides the most reliable and accurate predictions for compassion fatigue.

Study designs to be included This review will include quantitative studies that focus on the development and validation of predictive models for compassion fatigue in nurses. Eligible study designs will include:Cross-sectional studies examining the association between risk factors and compassion fatigue.Cohort studies following nurses over time to assess the onset of compassion fatigue and risk factors.Randomized controlled trials (RCTs) that assess interventions based on predictive models.Model validation studies that evaluate the performance of predictive models.

Eligibility criteria Studies will be included if they meet the following eligibility criteria:

Population: Nurses or healthcare professionals exposed to compassion fatigue.

Intervention: Development or application of predictive models to assess compassion fatigue.

Outcome: Reporting of predictive performance metrics (e.g., AUC, accuracy, sensitivity, specificity).

Study design: Quantitative studies, including cohort studies, RCTs, and cross-sectional studies.

Studies will be excluded if they are:

Qualitative studies without predictive modeling components.

Studies focused on populations other than healthcare professionals.

Studies that do not report relevant predictive outcomes.

Information sources The information sources for this review will include:

Electronic databases: PubMed, Cochrane Library, Scopus, Web of Science, and other relevant databases.

Grey literature: Conference abstracts, theses, and dissertations related to predictive modeling of compassion fatigue.

Other sources: Reference lists of relevant studies, expert opinions, and unpublished data.

Main outcome(s) The main outcomes to be assessed include:

Predictive accuracy: Measured using metrics such as AUC (Area Under the Curve), sensitivity, specificity, and precision.

Model validation performance: Including cross-validation, calibration, and external validation studies.

Risk stratification: The ability of the model to classify nurses into different risk categories for compassion fatigue.

Quality assessment / Risk of bias analysis The quality of the included studies will be assessed using established tools such as:

The Newcastle-Ottawa Scale (NOS) for cohort studies.

The Cochrane Risk of Bias Tool for RCTs.

The QUADAS-2 tool for diagnostic accuracy studies.

Assessment of reporting quality for predictive modeling studies.

Each study will be assessed for potential risks of bias, including selection bias, performance bias, detection bias, and reporting bias.

Strategy of data synthesis Data synthesis will involve:

Qualitative synthesis: Describing the models and their methodologies.

Quantitative synthesis: If possible, performing a meta-analysis to pool predictive performance metrics (e.g., AUC) across studies.

Descriptive statistics: Summarizing model characteristics, validation methods, and outcome measures.

Subgroup analysis Subgroup analyses will be conducted to explore potential variations in predictive performance across:

Nurse specialties (e.g., emergency room, oncology, ICU).

Regions or countries: Assessing if geographic location affects model performance.

Model types: Comparing machine learning models with traditional statistical models.

Risk factors: Identifying differences in predictive accuracy based on specific risk factors (e.g., work environment, emotional support).

Sensitivity analysis Sensitivity analysis will be performed to assess the robustness of the findings by varying key study characteristics:

Model types: Examining whether results change based on model selection.

Inclusion criteria: Testing the impact of varying inclusion criteria (e.g., study design, population characteristics).

Risk of bias: Evaluating the influence of studies with high risk of bias on the overall results.

Country(ies) involved China.

Keywords Compassion Fatigue; Nurses ; Predictive Modeling.

Contributions of each author

Author 1 - Huiling Zhang - drafted the manuscript.
Email: 1101090886@qq.com
Author 2 - Zheyuan Xia.
Email: 289498102@qq.com