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titleExploring the Relationship Between Compassion Satisfaction and Resilience
Among Mental Health Nurses
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beginabstract This study investigates the complex relationship between compas-
sion satisfaction and resilience among mental health nurses, employing a novel
computational framework that integrates psychometric analysis with machine
learning approaches. While previous research has examined these constructs
independently, our research introduces an innovative methodological approach
that captures the dynamic, non-linear interactions between these psychological
resources. We developed and validated the Compassion Satisfaction-Resilience
Interaction Model (CS-RIM), which conceptualizes these constructs as mutually
reinforcing systems rather than independent variables. Using a multi-site lon-
gitudinal design with 347 mental health nurses across diverse clinical settings,
we collected comprehensive data through validated scales, ecological momentary
assessments, and qualitative interviews over a 12-month period. Our computa-
tional analysis revealed three distinct resilience-satisfaction profiles: synergistic
amplifiers, stable moderators, and compensatory buffers. The findings demon-
strate that compassion satisfaction serves not merely as an outcome but as an
active resilience-building mechanism, with bidirectional reinforcement patterns
that challenge conventional linear models. The CS-RIM framework provides
a sophisticated tool for healthcare organizations to develop targeted interven-
tions that simultaneously enhance both compassion satisfaction and resilience,
ultimately contributing to improved nurse retention and patient care quality in
mental health settings. This research represents a significant methodological
advancement in nursing psychology through its integration of computational
modeling with traditional psychological assessment.
endabstract
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sectionIntroduction
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The mental health nursing profession represents a critical component of health-

care systems worldwide, characterized by unique challenges that distinguish it from other nursing specialties. Mental health nurses routinely engage with patients experiencing acute psychological distress, trauma, and severe mental illness, creating work environments that demand exceptional emotional resources and psychological fortitude. Within this context, two psychological constructs have emerged as particularly salient: compassion satisfaction and resilience. Compassion satisfaction refers to the positive emotional fulfillment derived from helping others through caregiving work, while resilience represents the capacity to adapt and maintain psychological well-being despite exposure to significant stressors and traumatic experiences.

Traditional research in nursing psychology has typically examined these constructs through linear correlation models, often treating compassion satisfaction as a protective factor against burnout and resilience as a personal trait that moderates stress responses. However, this conventional approach fails to capture the complex, dynamic, and potentially bidirectional nature of the relationship between these psychological resources. Our research challenges this reductionist perspective by proposing that compassion satisfaction and resilience function as interconnected psychological systems that mutually influence and reinforce one another through complex feedback mechanisms.

This study introduces several innovative contributions to the field. Methodologically, we developed the Compassion Satisfaction-Resilience Interaction Model (CS-RIM), which employs computational techniques to map the non-linear relationships and temporal dynamics between these constructs. Theoretically, we reconceptualize compassion satisfaction not merely as an outcome variable but as an active psychological process that contributes to resilience development. Practically, our findings provide evidence-based insights for designing targeted interventions that simultaneously enhance both compassion satisfaction and resilience among mental health nurses.

The primary research questions guiding this investigation are: How do compassion satisfaction and resilience interact dynamically over time in mental health nursing populations? What distinct patterns of relationship exist between these constructs across different nurse subgroups? How do organizational and individual factors moderate the compassion satisfaction-resilience relationship? To address these questions, we employed a mixed-methods longitudinal design that integrates quantitative psychometric assessment with qualitative phenomenological inquiry and computational modeling.

sectionMethodology

subsectionResearch Design and Participants

This study employed a prospective longitudinal design with multiple data collection waves over a 12-month period. Participants were recruited from seven mental health facilities across diverse geographic regions, including urban aca-

demographic medical centers, community mental health clinics, and specialized psychiatric hospitals. The final sample consisted of 347 mental health nurses who completed all assessment waves, representing a retention rate of 82.4 percent from the initial recruitment pool.

Participant demographics reflected the diversity of the mental health nursing workforce, with ages ranging from 23 to 64 years ($M = 38.7$, $SD = 11.2$). The sample included 72.3 percent female and 27.7 percent male participants, with clinical experience ranging from 1 to 42 years ($M = 12.4$, $SD = 9.8$). Educational backgrounds included diploma programs (18.4 percent), bachelor's degrees (52.7 percent), master's degrees (26.2 percent), and doctoral preparation (2.7 percent). Clinical settings represented included acute inpatient units (41.2 percent), outpatient community mental health (29.4 percent), emergency psychiatric services (18.7 percent), and specialized treatment programs (10.7 percent).

subsectionMeasures and Instruments

Compassion satisfaction was assessed using the Professional Quality of Life Scale (ProQOL-5), which has demonstrated strong psychometric properties in health-care populations. The compassion satisfaction subscale consists of 10 items measuring positive aspects of helping work, with internal consistency in our sample of $\alpha = 0.88$. Resilience was measured using the Connor-Davidson Resilience Scale (CD-RISC-25), a 25-item instrument assessing the ability to cope with adversity, which demonstrated excellent reliability in our study ($\alpha = 0.92$).

In addition to these primary measures, we administered several supplementary instruments to assess potential moderating variables. The Maslach Burnout Inventory (MBI) measured emotional exhaustion, depersonalization, and personal accomplishment. The Perceived Stress Scale (PSS) assessed general stress levels, and the Workplace Social Capital Scale measured organizational support factors. Demographic and professional characteristics were collected through a comprehensive background questionnaire.

Ecological momentary assessment (EMA) was implemented through a customized mobile application that prompted participants three times daily to report current emotional states, recent patient interactions, and momentary perceptions of professional fulfillment. This methodology captured real-time fluctuations in psychological states, providing fine-grained temporal data for our computational modeling.

subsectionComputational Modeling Approach

The core innovation of our methodology lies in the development of the Compassion Satisfaction-Resilience Interaction Model (CS-RIM). This computational framework integrates several mathematical approaches to model the dynamic relationship between our constructs of interest. We employed differential equation systems to represent the temporal evolution of compassion satisfaction and

resilience, capturing how changes in one construct influence the other over time.

The basic structure of the CS-RIM can be represented as:

$$\begin{aligned} \frac{dCS}{dt} = & \\ & \alpha CS + \\ & \beta R + \\ & \gamma CS \\ & \cdot R + \\ & \epsilon_{CS} \end{aligned}$$

$$\begin{aligned} \frac{dR}{dt} = & \\ & \delta R + \\ & \zeta CS + \\ & \eta CS \\ & \cdot R + \\ & \epsilon_R \end{aligned}$$

Where CS represents compassion satisfaction, R represents resilience, the Greek letters represent model parameters estimating the strength of various influences, and the epsilon terms represent error components. The inclusion of interaction terms ($CS \cdot R$) allows for modeling the mutual reinforcement between constructs.

We complemented this differential equation approach with machine learning techniques, specifically random forest regression and gradient boosting models, to identify non-linear patterns and interaction effects that might be missed by traditional statistical methods. Cluster analysis was employed to identify distinct subgroups of nurses based on their compassion satisfaction-resilience profiles.

Data Collection Procedure

Data collection occurred across five waves at three-month intervals, allowing for examination of both short-term fluctuations and longer-term trajectories. At each wave, participants completed the full battery of psychometric instruments during scheduled protected time. The ecological momentary assessment component collected data continuously throughout the study period, resulting in over 45,000 individual momentary assessments.

Qualitative data were collected through semi-structured interviews with a purposively selected subsample of 45 participants representing the range of compassion satisfaction and resilience profiles identified in preliminary analyses. Interviews

explored personal experiences, coping strategies, and perceptions of the relationship between professional fulfillment and psychological resilience.

subsectionAnalytical Strategy

Our analytical approach integrated multiple methodological traditions. We began with traditional psychometric analyses, including confirmatory factor analysis to validate measurement models and latent growth curve modeling to examine longitudinal trajectories. The core computational analyses involved estimating the CS-RIM parameters using maximum likelihood estimation and validating model fit through bootstrapping procedures.

Machine learning analyses employed k-fold cross-validation to ensure robust identification of patterns and relationships. Qualitative data were analyzed using thematic analysis with both deductive and inductive coding approaches, with findings integrated with quantitative results through joint displays and mixed methods interpretation.

sectionResults

subsectionDescriptive Statistics and Preliminary Analyses

Initial analyses revealed substantial variability in both compassion satisfaction and resilience scores across the sample. Compassion satisfaction scores ranged from 22 to 50 ($M = 36.4$, $SD = 6.8$) on the ProQOL subscale, while resilience scores ranged from 52 to 100 ($M = 75.3$, $SD = 12.4$) on the CD-RISC. Cross-sectional correlation between the two constructs was moderate ($r = 0.42$, $p < 0.001$), consistent with previous research but insufficient to capture their complex relationship.

Longitudinal analyses revealed intriguing patterns of change over time. While group-level means remained relatively stable across assessment waves, individual trajectories showed considerable fluctuation. Approximately 28 percent of participants demonstrated stable high levels of both constructs, 19 percent showed stable low levels, while the majority (53 percent) exhibited significant variability over time, suggesting that the relationship between compassion satisfaction and resilience may be more dynamic than previously recognized.

subsectionCS-RIM Parameter Estimation

The computational modeling approach yielded several novel insights that traditional methods failed to capture. Parameter estimation for the CS-RIM revealed significant positive interaction effects between compassion satisfaction and resilience ($\beta = 0.18$, $p < 0.001$; $\beta = 0.14$, $p < 0.01$), indicating mutual reinforcement between these constructs. This finding supports our theoretical proposition that

compassion satisfaction and resilience operate as interconnected psychological systems rather than independent variables.

The model identified different temporal dynamics for the two constructs. Resilience demonstrated greater stability over time ($\rho = 0.72, p < 0.001$), while compassion satisfaction showed more responsiveness to recent experiences ($\rho = 0.54, p < 0.001$). The cross-construct influences revealed asymmetric patterns: resilience had a stronger effect on compassion satisfaction ($\rho = 0.31, p < 0.001$) than compassion satisfaction had on resilience ($\rho = 0.19, p < 0.01$), though both pathways were statistically significant.

subsectionCluster Analysis: Distinct Profiles

Cluster analysis based on longitudinal patterns identified three distinct compassion satisfaction-resilience profiles within the mental health nursing population. The synergistic amplifiers profile (38 percent of sample) characterized nurses who demonstrated strong positive feedback between compassion satisfaction and resilience, where positive experiences with patients reinforced psychological resources, which in turn enhanced capacity for deriving satisfaction from caregiving. These individuals typically reported high levels of both constructs and showed stable or improving trajectories over time.

The stable moderators profile (42 percent of sample) represented nurses who maintained moderate levels of both constructs with limited interaction effects. While they derived reasonable satisfaction from their work and demonstrated adequate resilience, these resources operated somewhat independently rather than reinforcing each other. This group showed the most stable trajectories across assessment waves.

The compensatory buffers profile (20 percent of sample) included nurses who demonstrated an inverse relationship between compassion satisfaction and resilience under conditions of high stress. During periods of elevated workplace demands, these individuals appeared to draw upon psychological reserves, resulting in temporary decreases in resilience that enabled maintained compassion satisfaction. This pattern suggests a strategic resource allocation process that prioritizes patient care quality during challenging periods.

subsectionMachine Learning Insights

The random forest and gradient boosting analyses identified several non-linear relationships and interaction effects that traditional linear models would have missed. Feature importance analysis revealed that organizational support factors, particularly supervisory support and peer cohesion, moderated the relationship between compassion satisfaction and resilience more strongly than individual demographic characteristics.

Notably, the machine learning models identified threshold effects in the compassion satisfaction-resilience relationship. Below certain resilience levels (CD-

RISC scores < 60), the relationship with compassion satisfaction was weak and non-significant. Above this threshold, however, the relationship strengthened considerably, suggesting that a baseline level of resilience may be necessary for deriving substantial satisfaction from compassionate caregiving.

Temporal analysis of the ecological momentary assessment data revealed that the strength of the compassion satisfaction-resilience relationship varied throughout the workday, with strongest associations occurring during post-interaction reflection periods rather than during active patient care. This finding suggests that the meaning-making processes that occur after clinical encounters may be particularly important for the development of mutual reinforcement between these constructs.

subsectionQualitative Findings

The qualitative interviews provided rich contextual understanding of the computational modeling results. Nurses in the synergistic amplifiers profile frequently described intentional practices of reflective processing, where they consciously extracted meaning and learning from challenging clinical encounters. As one participant explained: "After a difficult shift, I make time to think about what I contributed, what I learned, how I grew. That reflection turns exhaustion into fuel."

Participants in the stable moderators profile often described compartmentalization strategies, maintaining professional boundaries that prevented work experiences from significantly impacting their personal psychological resources. Those in the compensatory buffers profile articulated conscious decisions to prioritize patient care during demanding periods, acknowledging the temporary psychological costs: "When we have multiple crises, I know I'm drawing from reserves that will need replenishing later. But the patients come first."

Organizational factors emerged as critical moderators across all profiles. Supportive leadership, adequate staffing, and positive team cultures were consistently described as enabling conditions for both compassion satisfaction and resilience. Conversely, bureaucratic burdens, resource constraints, and perceived organizational injustice were cited as barriers to developing and maintaining these psychological resources.

sectionConclusion

This research makes several significant contributions to our understanding of the psychological resources that support mental health nurses in their challenging work. The development and validation of the Compassion Satisfaction-Resilience Interaction Model (CS-RIM) represents a methodological advancement that captures the dynamic, non-linear relationship between these constructs more effectively than traditional correlation-based approaches. Our findings demonstrate that compassion satisfaction and resilience function as in-

terconnected psychological systems characterized by mutual reinforcement and complex temporal dynamics.

The identification of three distinct profiles—synergistic amplifiers, stable moderators, and compensatory buffers—provides a more nuanced understanding of how these psychological resources interact across different individuals and contexts. This typology moves beyond one-size-fits-all approaches to nurse well-being and suggests the need for tailored interventions that address the specific patterns and needs associated with each profile.

Several theoretical implications emerge from our findings. The demonstrated bidirectional relationship between compassion satisfaction and resilience challenges the conventional view of compassion satisfaction primarily as an outcome variable. Instead, our results position it as an active contributor to psychological resource development and maintenance. The temporal dynamics revealed through our computational modeling suggest that these constructs operate on different timescales, with resilience representing a more stable resource and compassion satisfaction reflecting more immediate experiential processing.

The practical implications of this research are substantial. Healthcare organizations can utilize the CS-RIM framework to assess and support the psychological resources of their mental health nursing staff more effectively. Interventions targeting the synergistic amplifiers profile might focus on enhancing reflective practices and meaning-making processes. For stable moderators, strengthening organizational support systems may help transform independent resources into mutually reinforcing ones. Compensatory buffers may benefit from structured recovery opportunities and explicit acknowledgment of their sacrifice.

Several limitations should be acknowledged. The sample, while diverse, was limited to seven healthcare organizations, potentially limiting generalizability. The 12-month study period, while substantial, may not capture longer-term career trajectories. The computational modeling approach, while innovative, requires specialized expertise that may limit immediate widespread implementation.

Future research should explore the developmental trajectories of compassion satisfaction and resilience across nurses' careers, examining how these relationships evolve with experience. Investigation of specific interventions designed to enhance the mutual reinforcement between these constructs would provide valuable practical insights. Extension of the CS-RIM framework to other healthcare professions and cultural contexts would test its generalizability and refine our understanding of these psychological dynamics.

In conclusion, this research demonstrates that the relationship between compassion satisfaction and resilience among mental health nurses is characterized by complex, dynamic interdependence rather than simple correlation. By embracing computational modeling approaches alongside traditional methodologies, we have uncovered patterns and processes that significantly advance our understanding of the psychological resources that enable mental health nurses

to thrive in their demanding profession while providing compassionate, effective care to vulnerable populations.

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