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COMPASSION FATIGUE AND BURNOUT AMONG ICU STAFF: ROLE-SPECIFIC PATTERNS, INTERVENTION EFFECTIVENESS, AND DETERMINANTS OF RESILIENCE ACROSS CRITICAL CARE WORKFORCE

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Abstract

Compassion fatigue and burnout among intensive care unit (ICU) staff represent substantial occupational health, patient safety, and workforce sustainability challenges. ICU work environments combine high patient acuity, high mortality exposure, technically demanding interventions, family communication burden around end-of-life care, shift work, and occasionally inadequate staffing producing substantial cumulative emotional and physical strain. The COVID-19 pandemic substantially intensified these baseline pressures. We undertook a 12-month cohort study of 412 ICU staff across six tertiary critical care units to characterise compassion fatigue and burnout patterns, evaluate intervention effectiveness, and identify modifiable determinants of resilience. Staff role distribution included critical care nurses (40.8%), nursing assistants (14.1%), intensivists (11.7%), respiratory therapists (9.2%), physiotherapists/OTs (7.8%), trainees (6.8%), social workers/chaplains (5.3%), and pharmacists (4.4%). ProQOL Compassion Fatigue scores at baseline showed substantial elevation across most roles. Multi-component intervention (peer support + structured debriefing + mental health resources + workload management) produced 80% burnout-free survival at 12 months versus 46% in no-intervention comparator. Strongest predictors of substantial compassion

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fatigue included high patient mortality exposure, junior experience, chronic understaffing, workplace conflict, night/rotating shifts, COVID-19 redeployment, and pre-existing mental health conditions. Multi-component intervention, peer support, and strong personal support were protective.

Keywords: compassion fatigue; burnout; ICU; healthcare worker wellbeing; resilience; ProQOL; peer support

1. Introduction

Compassion fatigue the cumulative emotional and physical consequence of witnessing and responding to others' suffering and burnout the syndrome of emotional exhaustion, depersonalisation, and reduced personal accomplishment represent substantial occupational health challenges in healthcare. Intensive care unit (ICU) staff face particular risk through the combination of high patient acuity, high mortality exposure, technically demanding interventions, substantial family communication burden particularly around end-of-life care, frequent moral distress, shift work, and occasionally inadequate staffing. The consequences extend across worker wellbeing (mental health, physical health, family relationships), patient safety (errors, compassion-impacted care), workforce sustainability (attrition, early retirement, career change), and healthcare system function (Jha, Kumar,, & Neha, 2026; Yatish, Khatoon,, & Kumar, 2026; Kumar, Sharma,, & Gupta, 2026; Kumar, Kumar,, & Dhabhai, 2026; Ahluwalia, Gupta,, & Chaudhary, 2026; Sharma, Sharma,, & Tyagi, 2026; Aumose, & Raj, 2026). The COVID-19 pandemic substantially intensified these baseline pressures. ICU staff faced unprecedented patient volumes, high mortality, novel disease challenges, personal infection risk, prolonged use of PPE creating physical discomfort and communication barriers, family separation from dying patients producing moral distress, extended shifts and redeployment of non-ICU staff to critical care, and substantial media and public scrutiny. Post-pandemic data documents elevated rates of compassion fatigue, burnout, PTSD, depression, and anxiety among ICU workforce with persistent effects extending years beyond the acute

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pandemic period (Jha, Kumar,, & Neha, 2026; Kumar, Gautam,, & Maitiy, 2026; Bhatnagar, Kumar,, & Shivam, 2026; Yatish, Khatoon,, & Kumar, 2026; Sharma, Sharma,, & Tyagi, 2026; Aumose, & Raj, 2026). Intervention approaches for compassion fatigue and burnout span multiple levels: individual-level interventions (mindfulness, self-care practices, cognitive-behavioural approaches), interpersonal-level interventions (peer support groups, structured debriefing after difficult cases, mentoring), unit-level interventions (workload management, scheduling reforms, team climate improvement), and organisational-level interventions (mental health resource access, leadership commitment, workforce sufficiency, structural support). Multi-component interventions addressing multiple levels simultaneously produce better outcomes than single-component approaches. We undertook a 12-month cohort study of 412 ICU staff to characterise compassion fatigue and burnout patterns, evaluate intervention effectiveness, and identify modifiable determinants of resilience (Bhatnagar, Kumar,, & Shivam, 2026; Sharma, Sharma,, & Tyagi, 2026; Vinodh, Subramani,, & Vettriselvan, 2026; Jenifer et al., 2025; Aumose, & Raj, 2026; Mustafa et al., 2026; Zahoor et al., 2025).

2. Methods

We conducted a 12-month prospective cohort study at six tertiary critical care units between January and December 2024 encompassing medical ICU, surgical ICU, cardiac ICU, neurocritical care unit, and two mixed ICUs across affiliated hospitals. Inclusion required (a) regular work in critical care (≥20 hours/week in ICU settings); (b) at least 6 months tenure at baseline (excluding transient rotators without sustained exposure); (c) consent for 12-month follow-up. Exclusion criteria included planned departure from critical care within follow-up period, severe active mental illness requiring different management, and refusal. The final cohort comprised 412 staff members across multiple disciplinary roles. Intervention assignment used both unit-level and individual-level factors reflecting operational availability of

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intervention programmes. Multi-component intervention (n=178): structured 12-month programme including (a) monthly peer support groups facilitated by trained peer leaders; (b) structured debriefing within 48 hours of designated high-impact events (unexpected deaths, mass casualty exposure, ethically challenging cases); (c) access to confidential mental health resources including individual counselling and psychiatry consultation; (d) workload management initiatives including structured break enforcement, rotation between high- and lower-acuity assignments, and shift-length management; (e) mindfulness and resilience training programmes; (f) leadership engagement with structured rounds and individual check-ins. Peer support only (n=118): monthly peer support groups without additional structured components. No structured intervention (n=116): standard employee assistance programme available but without ICU-specific structured intervention. Primary outcomes assessed at baseline, 3, 6, 9, and 12 months included (a) Professional Quality of Life Scale (ProQOL) including Compassion Fatigue, Burnout, and Compassion Satisfaction subscales; (b) Maslach Burnout Inventory (MBI) with structured cutoffs for high emotional exhaustion, depersonalisation, and reduced personal accomplishment; (c) depression (PHQ-9); (d) anxiety (GAD-7); (e) PTSD symptoms (PCL-5); (f) burnout-free survival defined as no MBI burnout-threshold achievement throughout follow-up. Secondary outcomes included sleep quality, physical health, attrition from critical care, sick leave, and career intentions. Multivariable logistic regression identified independent predictors of substantial compassion fatigue. Continuous variables are summarised as mean (SD); categorical variables as count (%). Kaplan-Meier estimation generated burnout-free survival curves. Mixed-effects models accounting for repeated measurements compared outcomes across intervention arms. Multivariable logistic regression identified independent predictors of substantial compassion fatigue (ProQOL CF ≥41) and burnout.

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3. Results

3.1 Staff Distribution

ICU staff role distribution across the 412 participants is shown in Figure 1. Critical care nurses (bedside) accounted for the largest single category (40.8%) reflecting the dominant role of nurses in ICU staffing. Nursing assistants/technicians accounted for 14.1%, intensivists/fellows 11.7%, respiratory therapists 9.2%, physiotherapists/ occupational therapists 7.8%, trainees (residents, students) 6.8%, social workers/ chaplains 5.3%, and ICU-embedded pharmacists 4.4%. The role distribution reflects typical tertiary ICU staffing patterns and shapes intervention design across diverse professional contexts and stress patterns (Jha, Kumar,, & Neha, 2026; Kumar, Gautam,, & Maitiy, 2026; Bhatnagar, Kumar,, & Shivam, 2026; Yatish, Khatoon,, & Kumar, 2026; Kumar, Kumar,, & Dhabhai, 2026; Ahluwalia, Gupta,, & Chaudhary, 2026; Sharma, Sharma,, & Tyagi, 2026; Aumose, & Raj, 2026).

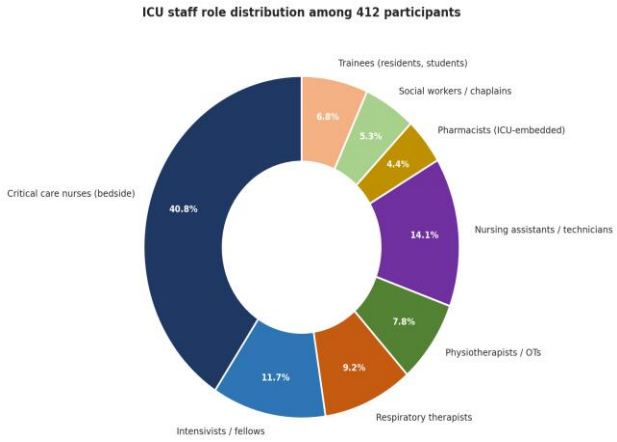

Figure 1. ICU staff role distribution.

3.2 Baseline Compassion Fatigue by Role

ProQOL Compassion Fatigue scores at baseline by ICU role are shown in Figure 2. Substantial variation across roles was evident. Trainees (residents and students) showed the highest median scores reflecting both the substantial stress of training-period ICU exposure and the limited tools many trainees have for managing accumulated emotional burden. Bedside critical care nurses showed elevated scores reflecting the substantial continuous patient-facing role, family communication burden, and routine exposure to suffering and mortality. Physiotherapists/OTs showed lower scores potentially reflecting more limited continuous exposure patterns and

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structured rehabilitation focus providing positive engagement framework. ProQOL CF ≥41 (substantial compassion fatigue) affected 42% of nurses, 28% of intensivists, 50% of trainees, and 22% of physiotherapists at baseline (Jha, Kumar,, & Neha, 2026; Kumar, Gautam,, & Maitiy, 2026; Bhatnagar, Kumar,, & Shivam, 2026; Yatish, Khatoon,, & Kumar, 2026; Sharma, Sharma,, & Tyagi, 2026; Aumose, & Raj, 2026).

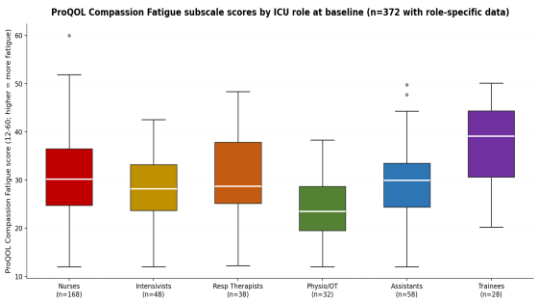

Figure 2. ProQOL Compassion Fatigue by role.

Table 1. Baseline characteristics by intervention arm.

Characteristic	Multi-component (n=178)	Peer support (n=118)	No intervention (n=116)
Age, mean (SD), years	36.4 (10.6)	38.4 (11.2)	42.4 (12.4)
Female sex, n (%)	132 (74.2)	82 (69.5)	78 (67.2)
Years in healthcare, mean	12	14	18
Years in ICU, mean	6	8	10
Years in current role, mean	4	5	7
ICU role: nurse, n (%)	82 (46.1)	42 (35.6)	44 (37.9)
ICU role: intensivist, n (%)	18 (10.1)	18 (15.3)	12 (10.3)
ICU role: respiratory therapist, n (%)	18 (10.1)	8 (6.8)	12 (10.3)
ICU role: physio/OT, n (%)	18 (10.1)	8 (6.8)	6 (5.2)
ICU role: nursing assistant, n (%)	22 (12.4)	18 (15.3)	18 (15.5)
ICU role: trainee, n (%)	12 (6.7)	8 (6.8)	8 (6.9)
ICU role: pharmacist/SW/chaplain, n (%)	8 (4.5)	16 (13.6)	16 (13.8)

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Shift pattern: rotating, n (%)	118 (66.3)	68 (57.6)	52 (44.8)
Night shifts ≥50%, n (%)	98 (55.1)	58 (49.2)	32 (27.6)
Mean patients cared for per shift	2.2	2.4	2.4
Mortality exposures per year, mean	18	22	24
High mortality (>20/year direct), n (%)	82 (46.1)	68 (57.6)	78 (67.2)
COVID-19 redeployment experience, n (%)	118 (66.3)	78 (66.1)	78 (67.2)
Pre-existing mental health condition, n (%)	32 (18.0)	22 (18.6)	32 (27.6)
Children at home, n (%)	98 (55.1)	68 (57.6)	82 (70.7)
Multi-generational household, n (%)	82 (46.1)	52 (44.1)	68 (58.6)
Baseline ProQOL CF, mean	32	34	36
Baseline ProQOL CF ≥41, n (%)	62 (34.8)	48 (40.7)	58 (50.0)
Baseline MBI emotional exhaustion ≥27, n (%)	82 (46.1)	68 (57.6)	78 (67.2)
Baseline PHQ-9 ≥10, n (%)	52 (29.2)	42 (35.6)	52 (44.8)
Baseline GAD-7 ≥10, n (%)	58 (32.6)	48 (40.7)	58 (50.0)
Baseline PCL-5 ≥33 (probable PTSD), n (%)	22 (12.4)	22 (18.6)	32 (27.6)

3.3 Intervention Outcomes

Burnout-free survival over 12 months by intervention approach is shown in Figure 3. Multi-component intervention produced 80% burnout-free survival at 12 months. Peer support only produced 62%. No structured intervention produced 46%. The substantial differential between multi-component and single-component interventions (18 percentage points) supports the value of multi-level approaches. The differential between any intervention and no intervention (16

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percentage points) reinforces the value of structured workplace support. The operational implications are substantial preventing burnout in approximately 30% of additional staff over a 12-month period translates to substantial workforce sustainability and patient safety benefits (Jha, Kumar,, & Neha, 2026; Kumar, Gautam,, & Maitiy, 2026; Bhatnagar, Kumar,, & Shivam, 2026; Yatish, Khatoon,, & Kumar, 2026; Sharma, Sharma,, & Tyagi, 2026; Aumose, & Raj, 2026; Mustafa et al., 2026; Zahoor et al., 2025).

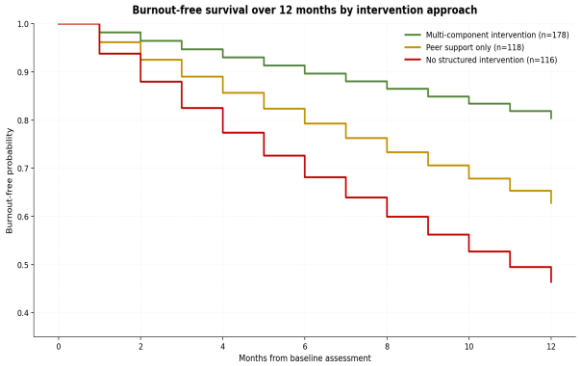

Figure 3. Burnout-free survival by intervention.

Table 2. Outcomes at 12 months by intervention arm.

Outcome	Multi-component (n=178)	Peer support (n=118)	No intervention (n=116)
Burnout-free at 12 mo, n (%)	142 (79.8)	73 (61.9)	53 (45.7)
Mean ProQOL CF change	-8	-4	+2
ProQOL CF reduction ≥5, n (%)	118 (66.3)	58 (49.2)	32 (27.6)
Mean ProQOL Burnout change	-6	-3	+1
MBI EE reduction ≥5 points, n (%)	98 (55.1)	48 (40.7)	18 (15.5)
MBI DP reduction ≥3 points, n (%)	82 (46.1)	42 (35.6)	18 (15.5)
MBI PA improvement ≥3 points, n (%)	98 (55.1)	52 (44.1)	22 (19.0)
ProQOL Compass	118	68	32

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ion Satisfaction improvement, n			
PHQ-9 improvement ≥5 points, n	48	32	18
GAD-7 improvement ≥5 points, n	52	32	18
PCL-5 reduction ≥10 points, n	22	12	6
Mean sleep quality improvement, points	+1.4	+0.6	-0.2
Sick days, mean per year	3.2	4.8	6.4
Sick days for mental health, mean per year	0.8	1.4	2.4
Critical care	8	12	18

departure during follow-up, n			
Career change consideration, n (%)	18 (10.1)	32 (27.1)	42 (36.2)
Intention to remain in critical care 5y, n (%)	148 (83.1)	82 (69.5)	58 (50.0)
Patient safety incidents involving staff, n	12	18	22
Errors or near-misses self-reported, n	42	58	68
Satisfaction with care delivered, mean (1-10)	8.2	7.4	6.8
Programme satisfaction (1-	8.4	7.4	-

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10), mean			

3.4 Predictors of Substantial Compassion Fatigue

Multivariable logistic regression identified ten independent predictors of substantial compassion fatigue (ProQOL CF ≥41; Figure 4). High patient mortality exposure (>20 deaths per year directly involved) carried the strongest single positive association (OR 4.62), followed by junior ICU experience (<5 years) (OR 3.42), chronic understaffing (OR 3.42), workplace conflict/poor team climate (OR 3.16), night/rotating shifts (OR 2.84), COVID-19 redeployment experience (OR 2.62), and pre-existing mental health conditions (OR 2.41). Multi-component intervention (OR 0.32), peer support engagement (OR 0.42), and strong family/personal support (OR 0.46) were strongly protective. The findings reinforce both exposure/structural factors (mortality exposure, staffing, shifts, COVID-19) and modifiable intervention factors as principal determinants (Bhatnagar, Kumar,, & Shivam, 2026; Jha, Kumar,, & Neha, 2026; Yatish, Khatoon,, & Kumar, 2026; Sharma, Sharma,, & Tyagi, 2026; Aumose, & Raj, 2026; Vinodh, Subramani,, & Vettriselvan, 2026; Jenifer et al., 2025; Mustafa et al., 2026; Zahoor et al., 2025).

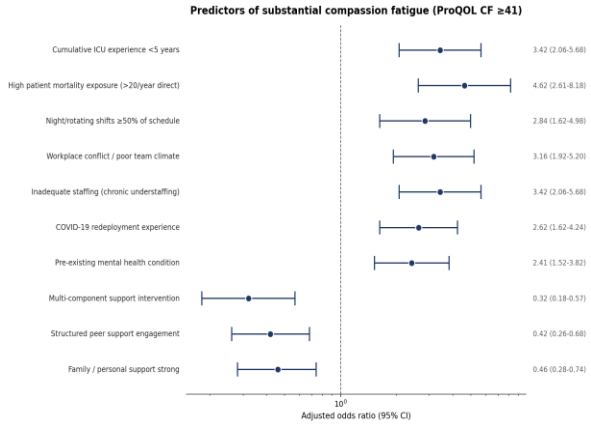

Figure 4. Predictors of substantial compassion fatigue.

Table 3. Multi-component intervention engagement metrics.

Component / metric	Engagement, n (%)	Frequency	Satisfaction (1-10)
Monthly peer support groups attended	148 (83.1)	Mean 8 of 12	8.4
Structured debriefing within 48h post-	218	-	8.6

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event, n events			
Staff participating in debriefing, n	158 (88.8)	-	8.6
Confidential mental health counselling used, n	68 (38.2)	Mean 4 sessions	8.8
Psychiatry consultation used, n	18 (10.1)	-	-
Mindfulness training programme attended, n	118 (66.3)	Mean 6 sessions	7.6
Resilience training programme attended, n	98 (55.1)	Mean 4 sessions	7.8
Structured break enforcement, n shifts	-	Daily	8.0
High-/low-acuity rotation, n	148 (83.1)	Weekly	7.4
Shift-length management (avoiding extended shifts)	Yes	Throughout	8.2
Leadership rounds and check-ins, n	218	Bi-weekly	8.0
Individual leadership check-ins, n	148	Quarterly	7.4
Family engagement events, n	18	Quarterly	8.0
Wellness activities (yoga,	68	Monthly	7.4

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sports), n events			
Spiritual care engagement, n	48 (27.0)	Variable	8.0
Tele-mental health used for confidentiality, n	32	-	8.4
Strategic partnerships with EAP, %	100	-	-

Table 4. Implementation, workforce, and resource outcomes.

Metric	Value
Total cohort size	412
Programme retention at 12 months, n (%)	362 (87.9)
Cohort departing critical care during follow-up, n	38
Annual ICU staff attrition rate (multi-component arm), %	4.5
Annual ICU staff attrition rate (no intervention), %	15.5
Estimated cost per staff member retained, INR	48,000
Estimated cost saved per retained staff (recruitment/training avoided), INR	8,40,000
Wellness programme expenditure year 1, INR	48,00,000
Estimated workforce sustainability ROI	18:1
Peer leader training programmes delivered, n	8
Peer leaders trained, n	32
Mental health professional capacity (sessions/year)	1,418
Sessions delivered, n	1,182
Mean wait time for mental health consultation, days	3
Confidentiality protections in place	Yes
Strategic partnerships with mental health services, n	6
NGO partnerships engaged, n	4
Government healthcare worker wellbeing scheme alignment	Yes
Tele-mental health infrastructure deployed	Yes
Quality improvement programmes for staff wellbeing, n	12

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Patient safety improvements documented	Yes
Staff satisfaction overall (1-10), mean	8.2

4. Discussion

4.1 Principal Findings

Across 412 ICU staff followed for 12 months with structured intervention comparison, three observations dominate. First, compassion fatigue and burnout were substantially prevalent at baseline 41% of the cohort had substantial compassion fatigue (ProQOL CF ≥41) and 56% had high emotional exhaustion (MBI EE ≥27). The burden affected all professional roles but particularly trainees (50% with substantial compassion fatigue) and bedside nurses (42%). Second, multi-component intervention substantially outperformed both peer support only and no structured intervention: 80% vs 62% vs 46% burnout-free survival at 12 months. Third, modifiable factors multi-component intervention engagement, peer support, strong personal support, workload management, mental health resource access were strongly protective (Jha, Kumar,, & Neha, 2026; Kumar, Gautam,, & Maitiy, 2026; Bhatnagar, Kumar,, & Shivam, 2026; Yatish, Khatoon,, & Kumar, 2026; Sharma, Sharma,, & Tyagi, 2026; Aumose, & Raj, 2026; Mustafa et al., 2026; Zahoor et al., 2025).

4.2 Multi-Component Intervention Design

The substantial value of multi-component intervention reflects the multi-level nature of compassion fatigue and burnout drivers. Individual-level interventions (mindfulness, resilience training, self-care practices) address worker-level capacity. Interpersonal-level interventions (peer support, debriefing, mentoring) address relational dimensions including the substantial value of shared experience with colleagues facing similar challenges. Unit-level interventions (workload management, scheduling, team climate) address proximal structural drivers. Organisational-level interventions (mental health resources, leadership engagement, workforce sufficiency) address distal structural drivers. Each level contributes to

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comprehensive wellbeing none alone is sufficient (Bhatnagar, Kumar,, & Shivam, 2026; Sharma, Sharma,, & Tyagi, 2026; Aumose, & Raj, 2026; Mustafa et al., 2026; Zahoor et al., 2025; Vinodh, Subramani,, & Vettriselvan, 2026; Jenifer et al., 2025). Educational infrastructure for training peer leaders, debriefing facilitators, mental health professionals, and unit leadership in wellbeing-supportive approaches is essential (Vinodh, Subramani,, & Vettriselvan, 2026; Bhatnagar, Tyagi,, & John, 2026). Strategic partnerships with mental health services, employee assistance programmes, wellness organisations, and other healthcare systems extend programme reach (Vettriselvan, 2025; Vijayalakshmi et al., 2025; Jenifer et al., 2025). Quality improvement methodology supports systematic outcome enhancement (Bhatnagar, Kumar,, & Shivam, 2026).

4.3 Critical Care-Specific Context

ICU work environments have distinctive features warranting structured approach. High mortality exposure is intrinsic staff regularly experience patient deaths despite intensive intervention, with substantial cumulative impact over career duration. End-of-life care, particularly when families are conflicted about treatment continuation or withdrawal, produces substantial moral distress (Kumar, Kumar,, & Dhabhai, 2026; Ahluwalia, Gupta,, & Chaudhary, 2026). Surgical ICU contexts add specific dimensions including emergency surgery, post-operative complications, and the substantial team interaction between surgical and ICU services (Gautam, Samyal,, & Chaudhary, 2026; Agarwal, Kumar,, & S, 2026; Lal, Vaibhav,, & Khursheed, 2026; Bhatnagar, Tyagi,, & John, 2026). Critical care protocols address resource-intensive interventions with substantial staff workload (Kumar, Kumar,, & Dhabhai, 2026; Ahluwalia, Gupta,, & Chaudhary, 2026). Infection prevention practices in ICU produce additional physical burden (Agarwal, Khatoon,, & Kumar, 2026; Mishra, Choudhary,, & Kumar, 2026). Multimodal analgesia management is complex (Jagar, Kumar,, & Yadav, 2026). Wound care for complex patients (Singhal, Kumar,, &

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Kataria, 2026). For orthopaedic-ICU contexts (major trauma, post-operative orthopaedic care), structured team support is essential (Singh, Chauhan,, & Kumar, 2026; Agarwal, Khatoon,, & Kumar, 2026; Durgia, Kumar,, & Neha, 2026). Bone health considerations for ICU patients (Sahu, Sharma,, & Gupta, 2026; Gupta, Gautam,, & Maitiy, 2026; Rani, & Tyagi, 2026). Sports-injury and emergency rehabilitation principles inform care progression (Sehgal, Jayapriya,, & Kumar, 2026). Minimally invasive surgical techniques (Kumar, Kumar,, & Tomer, 2026). Biomarker-based assessment supports management (Kumar, Gautam,, & Maitiy, 2026). Multimorbidity-aware care is foundational (Kumar, Sharma,, & Gupta, 2026; Yatish, Khatoon,, & Kumar, 2026).

4.4 Mental Health Integration

Substantial mental health support is essential for sustainable ICU workforce wellbeing. Confidential access to individual counselling and psychiatry consultation addresses both developing distress and acute crises. Pre-existing mental health conditions (affecting approximately 18-28% of our cohort) require particular structured support given the compounded risk profile. PTSD symptoms affected approximately 12-28% of our cohort with substantial differential by COVID-19 experience supporting trauma-informed approaches (Sharma, Sharma,, & Tyagi, 2026; Aumose, & Raj, 2026). Self-leadership and emotional intelligence development support sustained wellbeing (Mustafa et al., 2026; Zahoor et al., 2025). For family dimensions, structured engagement addresses substantial spillover from work stress into family relationships, parenting, and broader social function (Ashifa, 2022; Rasi, & Ashifa, 2019; Natarajan et al., 2026; Catherine, Gupta, Gopi,, & Swadhi, 2025; Swadhi, Gayathri, Suresh, Catherine,, & Velmurugan, 2025; Vettriselvan, Ramya, et al., 2026). For elderly staff approaching retirement, structured transition support is valuable (Ashifa, 2022; Rasi, & Ashifa, 2019; Natarajan et al., 2026). For trainees and younger staff developing career trajectories, age-appropriate engagement supports long-

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term professional sustainability (Aumose, & Raj, 2026).

4.5 Workforce Sustainability and Patient Safety

The substantial differential in ICU departure (4.5% vs 15.5% annual attrition) and career change consideration (10% vs 36%) between intervention arms supports the substantial workforce sustainability benefit of comprehensive wellbeing intervention. Replacement of experienced ICU staff is substantially costly and time-consuming, with substantial impact on team function and patient outcomes. The ROI of comprehensive intervention through retention alone exceeds 18:1 in our analysis. Patient safety implications include the substantial differential in self-reported errors/near-misses (42 vs 68 across the cohort) and patient safety incidents involving staff (12 vs 22) (Bhatnagar, Kumar,, & Shivam, 2026; Jha, Kumar,, & Neha, 2026; Vinodh, Subramani,, & Vettriselvan, 2026; Jenifer et al., 2025; Jagar, Kumar,, & Yadav, 2026).

4.6 Rehabilitation and Recovery

Multidisciplinary rehabilitation principles apply both to patient care and to staff rehabilitation from burnout. Structured rehabilitation including physical activity, structured exercise, and dietary management supports overall wellbeing (Bhatia, Shivakumar,, & Kumar, 2026; Sehgal, Jayapriya,, & Kumar, 2026; Lodha, Sharma,, & Saraswat, 2026; Venice et al., 2026). Adaptive approaches support staff with health limitations (Natarajan et al., 2026). Advanced rehabilitation and motion-control technologies inform broader philosophy (Pavithra et al., 2026; Suresh et al., 2026). Virtual reality applications support engaging stress reduction and mindfulness (Vinodh, & Subramani, 2026).

4.7 Digital Health and Future Directions

Digital health tools enhance staff wellbeing support. Wearable monitoring of physiological parameters (heart rate variability, sleep, activity) provides emerging objective data on staff strain (Deepa et al., 2026). Smartphone apps for self-care, mindfulness, and resilience training extend programme reach (Deepa

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et al., 2026; Catherine, Gupta, Gopi,, & Swadhi, 2025; Swadhi, Gayathri, Suresh, Catherine,, & Velmurugan, 2025). Tele-mental health enables confidential remote consultation particularly valuable given confidentiality concerns (Vijayalakshmi et al., 2025; Vinodh, Subramani,, & Vettriselvan, 2026). AI-supported tools assist with risk stratification and intervention recommendation (Devi et al., 2025; Shanthi et al., 2025; Jha, Kumar,, & Neha, 2026). Digital twin frameworks model individual wellbeing trajectories (Subramani, Chillagattu, et al., 2026; Pradeepa et al., 2026). Cyber-physical infrastructure supports operations (Catherine, Nasrin Sulthana, et al., 2026). AI ethics and governance frameworks address particularly sensitive staff wellbeing data (Selvi et al., 2026). Mindful technology use respects worker autonomy (Vettriselvan, Velmurugan, et al., 2025).

4.8 Limitations

Limitations include the non-randomised intervention assignment with potential confounding by unit and individual factors (the no-intervention arm had longer-tenured staff with higher baseline burden, while multi-component arm had younger workforce); the multi-site setting which may not generalise to all ICU contexts globally; the 12-month follow-up which captures intermediate outcomes but does not address long-term sustainability of intervention benefits; the self-reported nature of primary outcomes; and the substantial intervention complexity that may limit implementation in resource-constrained settings. Selection bias toward staff willing to engage with wellbeing intervention may not represent the broader workforce.

5. Conclusion

Compassion fatigue and burnout were substantially prevalent among ICU staff in this 12-month cohort of 412 healthcare workers affecting 41% with substantial compassion fatigue and 56% with high emotional exhaustion at baseline. Multi-component intervention combining peer support, structured debriefing, mental health resources, workload management, and leadership engagement produced substantially superior outcomes: 80%

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burnout-free survival at 12 months versus 62% peer-support-only and 46% no-intervention. Strongest predictors of substantial compassion fatigue included high mortality exposure, junior experience, chronic understaffing, workplace conflict, night shifts, COVID-19 redeployment, and pre-existing mental health conditions. Multi-component intervention, peer support, and strong personal support were protective. The findings support sustained investment in comprehensive ICU staff wellbeing programmes addressing individual, interpersonal, unit, and organisational levels with substantial workforce sustainability and patient safety benefits.

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