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# “We just keep pushing through”: a mixed-method study on musculoskeletal discomfort and mental well-being among nurses in resource-limited settings

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## Abstract

**Background** Nurses in under-resourced settings frequently report high levels of musculoskeletal (MSK) discomfort, which significantly affects their mental well-being. While workplace strain is well documented, the combined impact of physical burden and institutional neglect remains underexplored in these environments.

**Aim** The study aims to examine the prevalence of MSK discomfort and its association with psychological well-being among nurses in under-resourced healthcare environments in Northeast India, and to explore the experiential and structural factors contributing to these occupational health risks.

**Methods** A sequential mixed-methods study design was employed, following an explanatory approach. The study commenced with a survey to gather quantitative data. Quantitative data were collected from 216 nurses using the Extended Nordic Musculoskeletal Questionnaire (Extended-NMQ) and the WHO-5 Well-Being Index, the results of which informed the development of subsequent interview questions. Semi-structured interviews were then conducted with 11 nurses to capture experiential and structural factors. This structure enabled deeper contextual understanding and facilitated triangulation across data types.

**Results** Among the participants, 47.2% reported experiencing lower back pain, followed by discomfort in the knees (27.3%) and upper back (25%). Higher levels of MSK discomfort were significantly associated with employment in the public sector and more than ten years of work experience. A strong negative correlation was observed between MSK discomfort and mental well-being. Thematic analysis revealed key stressors: physical depletion, emotional exhaustion, organizational apathy, and limited healthcare access. In response to these challenges, nurses often relied on self-management due to insufficient institutional support. Triangulated findings underscored how structural deficiencies intensified both physical and psychological strain among nurses.

**Conclusions** There is an urgent need for evidence-based occupational health interventions to address ergonomic, psychosocial, and institutional challenges, particularly in low-resource healthcare settings, to safeguard the well-being of frontline nursing staff. This study offers novel understanding from a high-need yet under-researched geographic

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context, namely the northeastern states of India, bridging empirical gaps in MSK health literature through the integration of experiential and structural factors.

**Clinical trial number** Not applicable.

**Keywords** Musculoskeletal discomfort, Nursing workforce, Occupational health, Well-being, Healthcare policy, Mixed methods

## Background

Arduous working conditions that induce physical and mental strain significantly increase the risk of musculoskeletal (MSK) discomfort among employees [1, 2]. Musculoskeletal (MSK) disorders remain a global health concern, affecting approximately 1.71 billion people and constituting a major contributor to workforce absenteeism, lost productivity, and long-term occupational disability [3]. In economic terms, these disorders impose a formidable burden on healthcare systems worldwide, accounting for nearly 30% of all occupational health cases and leading to increased medical expenditures, compensation claims, and rehabilitation costs [4]. This burden is particularly high among healthcare professions, where the physical demands of care delivery place workers at elevated and sustained risk. According to the Global Burden of Disease Study [5], MSK conditions are the leading contributor to global disability, accounting for over 149 million years lived with disability. Low back pain alone affects more than 570 million people globally, while osteoarthritis and neck pain impact 528 million and 222 million, respectively. These conditions disproportionately affect working-age populations, leading to major losses in productivity and quality of life across health systems worldwide.

Among healthcare workers, nurses are particularly vulnerable to MSK discomfort due to the physically demanding nature of their roles, which often involve prolonged standing, repetitive patient handling, and irregular shift work. Empirical evidence indicates that nurses experience higher rates of MSK discomfort compared to many other healthcare professionals, largely due to repetitive strain and limited access to ergonomic resources within their work environments [6–8]. This dynamic is well explained by the Job Demands–Resources (JD-R) model, which posits that elevated job demands, such as physical exertion, time pressure, and emotional intensity can lead to health impairment when not adequately offset by job resources including supportive supervision, ergonomic infrastructure, and institutional autonomy [9]. The cumulative impact of occupational strain contributes to chronic pain and fatigue which directly influences workforce attrition, professional burnout, and persistent shortages in healthcare staffing [10–12]. In more severe cases, MSK conditions may progress into debilitating impairments, compelling nurses to reduce their working

hours, accept reassignment to less physically demanding roles, or exit the profession prematurely [13].

Beyond immediate individual health consequences, MSK discomfort poses systemic risks for healthcare institutions by undermining workforce efficiency, patient safety, and overall institutional performance. Chronic pain and physical fatigue among nurses are associated with increased clinical errors, impaired judgment, and delayed responsiveness to patient needs [14]. High rates of absenteeism and turnover disrupt team cohesion and place additional strain on remaining staff, creating a cycle of diminished care quality and institutional inefficiency [12]. From the perspectives of the JD-R model, this reflects a classic health impairment pathway, wherein elevated job demands unmitigated by sufficient resources, lead to both individual burnout and organizational decline [9]. Hospitals with high nurse-reported MSK often report lower patient safety scores, increased hospitalization costs, and critical challenges in staff retention [15, 16]. This creates a feedback loop: staff shortages and escalating workloads further intensify MSK risk and psychological strain. While the global burden of MSK disorders is substantial, its impact is particularly acute in countries with overstretched healthcare systems such as India. Nurses, who comprise the largest segment of the health workforce, routinely endure long shifts, physically demanding tasks, and minimal institutional safeguards. Unlike many OECD countries where nurses benefit from regulatory protections and ergonomic infrastructure, Indian nurses often operate without formal mechanisms to prevent or manage MSK injuries [17].

In the Indian context, global challenges related to MSK discomfort are exacerbated by chronic systemic limitations. The current nurse-to-population ratio in India stands at 1.96 per 1,000 - well below the World Health Organization's recommended minimum 3 per 1,000 [18]. In several states, particularly in rural areas, this figure is even lower, placing unsustainable strain on nursing staff. Studies indicate that over 67% of Indian nurses report lower back pain, and between 60 and 90% experience MSK discomfort linked to occupational activities—among the highest prevalence rates globally [19, 20]. Despite this, institutional responses have largely focused on alleviating physical strain, overlooking the psychosocial stressors and organizational shortcomings that contribute to MSK conditions. Emerging research shows that

prolonged exposure to MSK discomfort can trigger emotional distress, increase the risk of psychological burnout, and impair job performance – factors that negatively affect both nurses' mental health and quality of patient care [7, 21]. Further studies highlight that the convergence of inadequate ergonomic infrastructure, excessive workloads, and sustained psychological stress fosters a hostile occupational climate, accelerating disengagement, attrition, and poor health outcomes [21, 22].

The Northeast Indian context amplifies the imbalances described by the JD-R model. In this region, institutional demands are steep, while resources – whether infrastructural, supervisory, or emotional – are acutely limited, creating a high-risk occupational climate. Although unrealistic nurse-to-patient ratios (current ration in studied region = 1 per 1000 patient) and limited institutional support are challenges across India, they are particularly pronounced in the northeastern states, especially in rural areas [23]. The healthcare systems in these states operate under more constrained conditions, with poor access to trained professionals and limited public investment in health [24]. Geographic and infrastructural barriers further compound these challenges. The region's mountainous terrain, limited connectivity, and resource scarcity restrict access to primary health centers, community health centers, and professional upskilling opportunities [25]. Unlike their counterparts in metropolitan areas, nurses in the Northeast often work with outdated equipment, minimal institutional support, and high patient loads—conditions that elevate the risk of MSK-related injuries and hinder career progression [24].

As of 2022, over 1,700 subcenters and nearly 100 community health centers in Assam alone were vacant, leaving vast populations underserved. Poor transport infrastructure severely limits access to healthcare facilities and basic ergonomic resources. In rural hospitals, it is common for a single nurse to manage wards of 25–30 patients, often without lifting aids, adjustable beds, or protective gear. These conditions intensify physical strain and contribute to a cycle of fatigue, injury, and attrition [26]. Due to financial and logistical constraints, healthcare institutions in the Northeast often cannot invest in even basic ergonomic solutions, such as adjustable beds, patient-lifting devices, or appropriate footwear [27]. As a result, frontline nurses are exposed to preventable injuries, chronic fatigue, and mental stress under severely compromised working conditions.

Despite the breadth of these challenges, existing research in the Indian context—particularly from the Northeast—remains limited in scope and depth. Most studies have employed quantitative designs that fail to capture the lived experiences, coping strategies, and institutional dynamics underlying occupational health

risks [24]. There is a significant gap in understanding how experiential and structural factors interact to shape nurses' physical and emotional well-being in under-resourced settings. The JD-R framework offers a unifying lens to interpret these multi-level challenges, linking macro-level policy gaps, meso-level organizational limitations, and micro-level psychosocial strain. Using this model, the current study seeks to uncover how specific demand–resource imbalances shape both physical discomfort and psychological well-being in one of India's most resource-constrained healthcare settings. To this end, a sequential mixed-methods approach was adopted to examine the prevalence of MSK discomfort and its association with psychological well-being, while also exploring the experiential and structural factors affecting frontline nurses in the northeastern region of India. Through this, the study aims to inform integrated, context-sensitive interventions that address both ergonomic and psychosocial health risks within this critical yet under-researched population.

### The study

This study was conducted across eight hospitals in the northeastern states of India, encompassing both public and private institutions. These facilities provide services ranging from primary to tertiary care and collectively serve a population of approximately 45.77 million people [26]. The sample includes high-patient-load urban hospitals as well as resource-constrained rural facilities, offering a diverse representation of healthcare environments. In these settings, nurses are routinely responsible for tasks such as lifting, repositioning, and extended bedside care—activities closely linked to increased MSK risk [27, 28]. Although occupational health policies are in place, their implementation remains inconsistent across institutions, influencing both physical exposure and organizational stress. This variability in policy enforcement contributes to uneven protection for nursing staff and highlights the need for standardized, context-sensitive interventions.

This study is conceptually grounded in the JD-R model, as previously discussed. Drawing on this framework, we examine how specific job demands—such as physical workload, shift patterns, and emotional strain—and job resources—such as institutional support, ergonomic provisions, and peer assistance—interact to shape both MSK discomfort and psychological well-being [29, 30]. The JD-R model informed the selection of measurement tools and thematic coding strategies and guided the interpretation of relationships between structural strain, worker experiences, and occupational health outcomes in this under-resourced region.

**Aims**

This study aims to examine the prevalence of MSK discomfort and its psychosocial consequences among the Indian nursing workforce, with a particular focus on workplace challenges and policy implications. The conceptual framework guiding this investigation is illustrated in Fig. 1.

The research questions are as follows:

- What is the prevalence and severity of MSK discomfort among nurses in the northeastern states of India?
- How do nurses perceive the impact of MSK discomfort on their psychological well-being, job performance, and overall workplace experience?
- To what extent does MSK discomfort affect both individual nurses and broader organizational outcomes?

**Method**

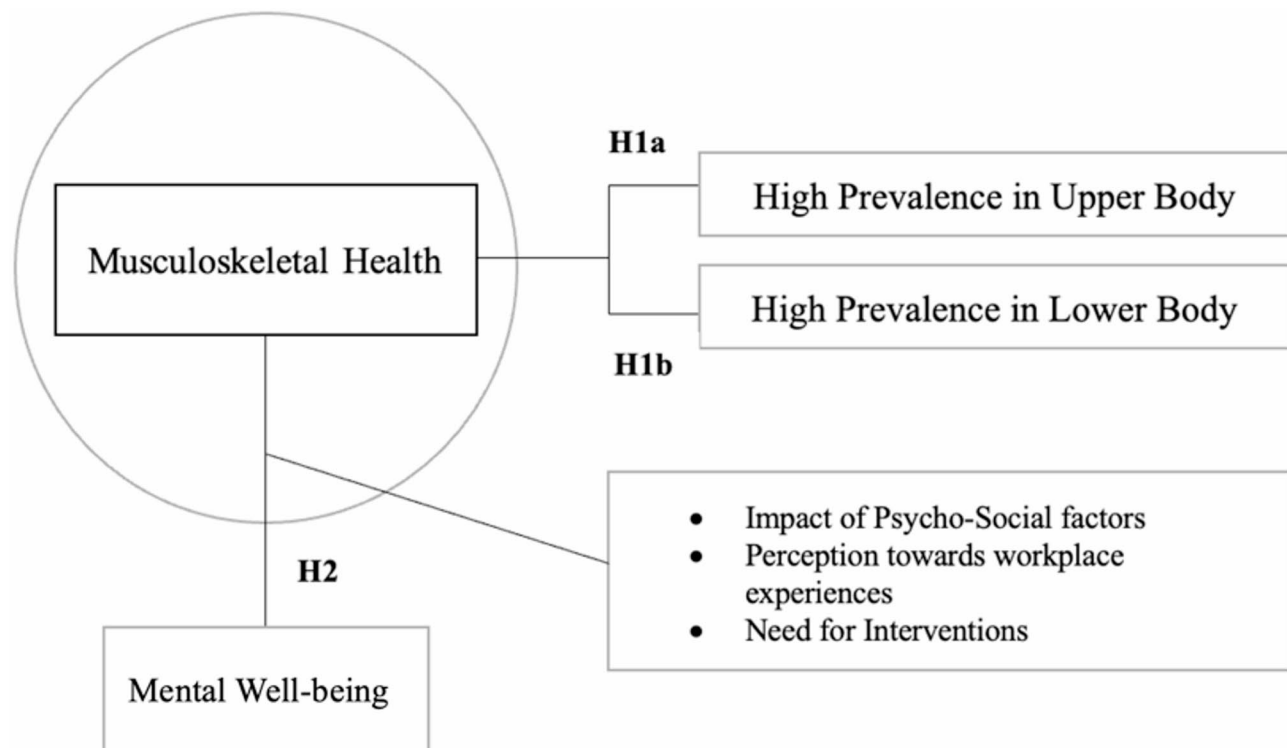
**Study design**

We employed a sequential explanatory mixed-methods design [31] to investigate MSK discomfort among nurses in the northeastern states of India. This design was selected for its suitability in first quantifying the prevalence and severity of MSK discomfort, followed by an in-depth exploration of nurses’ lived experiences to better understand workplace challenges. The study

was conducted in two phases. Phase one involved a cross-sectional survey across eight hospitals, utilizing the Extended Nordic Musculoskeletal Questionnaire (NMQ-E) [32] to assess MSK symptoms and the WHO-5 Mental Well-being Index to measure psychological well-being. Based on the survey findings, a semi-structured interview guide was developed to further explore nurses’ experiences, perceived challenges, and institutional support systems. In phase two, qualitative interviews were conducted with purposively selected nurses from both public and private hospitals, allowing for rich, contextual insights into the occupational health landscape.

**Quantitative study**

In the quantitative phase, we examined the prevalence, severity, and anatomical distribution of MSK discomfort among nurses working across eight hospitals in the northeastern states of India. This phase aimed to identify patterns of MSK symptoms across different body regions and assess variations based on hospital type and demographic characteristics. The sample included nurses from both public and private institutions and from a range of clinical departments, including general medicine, surgery, obstetrics, oncology, pediatrics, and intensive care units. Departments with minimal patient-handling responsibilities, such as administrative units, were excluded to ensure relevance to MSK risk exposure.



**Fig. 1** Conceptual framework of the study

### Instruments

**Musculoskeletal discomfort** was assessed using the Extended Nordic Musculoskeletal Questionnaire (NMQ-E), developed with support from the Nordic Council of Ministers. The NMQ-E is a widely used screening tool in occupational health research that evaluates pain intensity across various body regions. Although not a diagnostic instrument, it comprises 40 dichotomous (yes/no) forced-choice questions targeting nine anatomical sites: neck, shoulders, upper back, elbows, lower back, wrists/hands, hips/thighs, knees, and ankles/feet. A body map is included to assist participants in identifying symptom locations. Participants were asked whether they had experienced MSK pain that disrupted regular activities within the past 12 months or the past 7 days. Additional questions focused on the neck, shoulders, and lower back to gather more detailed information on these commonly affected areas. Furthermore, 25 multiple-choice items were included to assess factors such as injury history, functional limitations at home and work (e.g., changes in job tasks), symptom duration, professional evaluation, and MSK issues in the preceding week [32, 33]. The Cronbach's alpha for the current sample was 0.803, indicating good internal consistency. While the NMQ-E is validated and widely adopted in occupational health research, its reliance on participant recall may introduce recall bias—especially when individuals report symptoms experienced over a 12-month period [34]. The interpretation of pain severity can vary between individuals, potentially limiting the tool's ability to distinguish between transient discomfort and persistent musculoskeletal (MSK) disorders [34, 35]. Nevertheless, the NMQ-E remains one of the most reliable and widely used instruments for epidemiological screening. Recent psychometric evaluations, including a 2024 Persian version [36], demonstrated excellent test–retest reliability ( $ICC > 0.88$  across anatomical sites) and strong internal consistency (Cronbach's  $\alpha > 0.70$  for all regions). Similarly, an Arabic cross-cultural validation study [37] reported kappa values ranging from 0.82 to 1.00 and Cronbach's  $\alpha$  between 0.77 and 0.92 across most body regions. These findings affirm the robustness of the NMQ-E as a screening tool in diverse nursing populations, despite its limitations as a non-diagnostic measure.

**Mental well-being** was assessed using the WHO-5 Mental Well-Being Index, a five-item self-administered instrument developed by the WHO Regional Office for Europe in 1998 under the DEPCARE project. The scale is designed to measure current mental well-being, particularly in healthcare settings. Participants rate five positively worded statements such as “*I have felt cheerful and in good spirits*” and “*I woke up feeling fresh and rested*” - based on their experiences over the past two weeks. Responses are scored on a 6-point Likert scale ranging

from 0 (“*At no time*”) to 5 (“*All of the time*”). The total raw score is multiplied by four to yield a percentage score ranging from 0 (indicating absence of well-being) to 100 (indicating optimal well-being) [38]. In the current study, the WHO-5 demonstrated good internal consistency, with Cronbach's alpha of 0.816. Although the WHO-5 primarily captures positive aspects of well-being and does not directly assess symptoms of anxiety or depression, it remains a widely validated and reliable tool across diverse populations and clinical settings [39, 40]. Its brevity and emphasis on positive affect make it especially well-suited for occupational health research and large-scale assessments of mental well-being in healthcare environments [41].

### Data collection

We collected quantitative data over a three-month period (November 2022–February 2023). Nurses were invited to participate through seminar briefings, during which the study objectives, participation procedures, and confidentiality measures were explained. Participation was entirely voluntary, and informed consent was obtained prior to data collection. To minimize disruption to clinical duties, participants completed a self-administered questionnaire during their break periods. The questionnaire booklet included an informed consent form, a demographic checklist, the Extended Nordic Musculoskeletal Questionnaire (NMQ-E), and the WHO-5 Mental Well-Being Index. A total of 300 paper-based booklets were distributed, as recommended by hospital administrations due to limited internet connectivity in remote areas. Regular follow-ups were conducted to encourage participation, and completed questionnaires were collected onsite and securely stored for analysis. A total of 216 complete responses were received, yielding a response rate of 72%.

### Quantitative data analysis

We used Jamovi 2.6.26 to analyze the survey data. All completed paper-based questionnaires were manually entered into an electronic database and verified for accuracy prior to statistical processing. An external audit was conducted to ensure the integrity of data collection procedures and to minimize potential bias in participant responses. Descriptive statistics were calculated to summarize participant demographics, workplace characteristics, and the prevalence of MSK discomfort across different body regions. Categorical variables are reported as frequencies (n) and percentages (%), while continuous variables are presented as means (M) and standard deviations (SD).

The NMQ-E was used to categorize symptoms based on location, frequency, and severity. The WHO-5 Mental Well-Being Index was scored according to standard

guidelines, with higher scores indicating better psychological well-being. No missing values were identified. Differences in MSK discomfort were examined across gender, hospital sector, age group, and seniority level using independent t-tests and one-way ANOVA, with effect sizes (Cohen's  $d$  and  $\eta^2$ ) reported where applicable. A multiple linear regression analysis was conducted to identify significant predictors of MSK discomfort, with age, hospital sector, seniority, gender, and well-being scores entered as independent variables. Model assumptions—including normality, homoscedasticity, and multicollinearity, were tested prior to interpretation [42]. Statistical significance was set at  $p < 0.05$  for all analyses [43].

### Qualitative study

We employed a phenomenological approach [44] to explore the lived experiences of nurses with MSK discomfort, focusing on how they perceive and navigate their impact on their psychological well-being and professional responsibilities. A semi-structured interview guide was developed based on key findings from the quantitative phase (see Table 1). Using purposive sampling, we selected nurses who reported high MSK discomfort—defined as pain in three or more body regions

**Table 1** Semi-structured interview guide

1. Can you please talk about your educational background and work experience as a nurse?
2. Have you ever experienced any muscle pain while working as a nurse?
3. What do you think are the major physical stressors faced by you at the hospital?
4. Can you describe some of the physically demanding tasks you perform as a nurse?
  - a. How often do you lift heavy objects or engage in repetitive motion during your workday?
5. What do you think are the major emotional stressors faced by you at the hospital?
6. Have you ever experienced stress or anxiety related to your work as a nurse?
  - a. How do you handle these feelings?
  - b. Do you think they have affected your physical health in any way?
7. How do you manage stress and burnout as a nurse?
8. Can you describe the environment at the hospital?
  - a. Does the environment impact your health?
  - b. If yes, can you please elaborate
9. Could you comment on the physical and psychological support that you received from the hospital?
10. Do you feel like you have a strong support system at work, including support from colleagues and supervisor?
11. Could you comment on your workload, working hours, and your health as a nurse in the hospital?
12. Do you think that your workplace provides enough resources and support to manage stress and burnout?
13. Have you ever received support for stress or burnout while working at the hospital or any external resources?

affecting daily activities for more than seven days in the past year—and low mental well-being, indicated by a WHO-5 score of  $\leq 50\%$ . This sampling strategy was chosen to ensure rich, relevant insights from participants who met clearly defined inclusion criteria and were likely to reflect the phenomenon under investigation [45]. Given the study's aim to understand the psychosocial and structural context of MSK discomfort, nurses with more severe physical and psychological symptoms were prioritized to capture a diverse range of lived experiences. Interviews were conducted in-person within hospital premises in private settings, or via telephone when necessary. All interviews were audio-recorded with participant consent, transcribed verbatim, and analyzed using thematic analysis [46]. To enhance the reliability of findings, investigator triangulation was applied, and an external review of the coding framework was conducted to ensure credibility and consistency in interpretation.

### Data collection

Semi-structured interviews were conducted face-to-face with 11 nurses from various hospital wards, including general medicine, surgery, obstetrics, oncology, and intensive care units. The sample included participants of different sexes and hospital types (public and private). Each interview lasted between 30 and 45 min and was conducted in a single session between March and April 2023. All interviews were conducted in English, in private hospital cabins to prevent disruptions and ensure confidentiality. Participants were selected based on the following inclusion criteria:

- (1) At least one year of clinical experience in hospital settings,
- (2) Reported MSK discomfort in three or more body regions affecting daily activities for more than seven days in the past year, and,
- (3) No preexisting MSK disorders.

The semi-structured interview guide was developed based on key findings from the quantitative survey and was validated by three subject matter experts in nursing, public health, and pain research. To ensure clarity and contextual relevance, the guide was pilot tested with two nursing students. Feedback from the pilot phase was used to refine the wording, structure, and flow of the questions, enhancing the guide's overall clarity and applicability.

Given the demanding schedules of nurses, prior permission was obtained from the nursing superintendent, followed by approvals from ward head nurses to schedule interviews at convenient times. Interviews were conducted during nurses' recess periods or when patient loads were manageable, minimizing disruption to clinical

responsibilities. All interviews were conducted by the lead author, a health psychologist and MSc graduate, ensuring consistency in approach and rapport. Interviews continued until data saturation was reached [47], defined as the point at which no new themes emerged from additional participants. To minimize interviewer bias, a piloted semi-structured guide with open-ended prompts was used, allowing participants to speak freely and reflectively. The interviewer maintained a neutral tone and avoided leading questions throughout the process [48]. Participants were assured that their responses would remain confidential and would not influence their work environment or evaluations, fostering a safe space for candid sharing [49]. Reflexive journaling was maintained after each interview to document potential preconceptions, emotional reactions, and contextual observations, thereby enhancing transparency and reflexivity in the research process [50].

**Qualitative data analysis**

We employed reflexive thematic analysis [46], using both manual and software-assisted coding via MAXQDA v.24 Analytics. Verbatim interview transcripts were stored and organized in Excel, structured according to the semi-structured interview guide. An inductive approach was applied, allowing themes to emerge organically from the data rather than being pre-imposed. This process led to the identification of four overarching themes and eight subthemes. Coding was conducted independently by two researchers of this study using manual methods. Software-assisted coding was also used to enhance analytical rigor. Inter-coder reliability was assessed using Cohen’s kappa ( $\kappa=0.78$ ), indicating substantial agreement between coders [51]. Final themes were refined through iterative discussions to ensure a comprehensive and coherent interpretation of the data.

**Rigor and reflexivity**

To ensure analytical rigor, we employed both investigator and theoretical triangulation. Two independent researchers of this study conducted coding separately to cross-verify emerging themes. MAXQDA v.24 Analytics was used to support systematic coding and theme development, reducing subjectivity and enhancing consistency. Positionality was addressed by operationally defining each code, ensuring transparency in interpretation. Peer

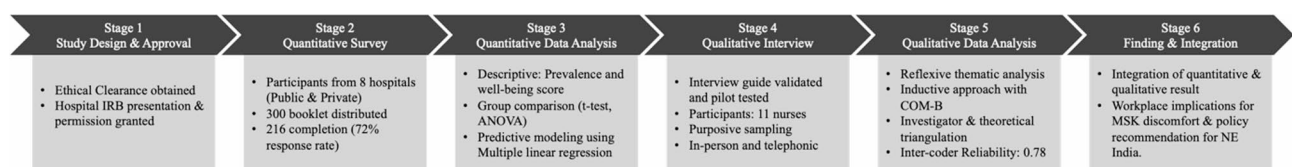
debriefing sessions were held between the researchers to refine coding decisions and resolve discrepancies [48]. Additionally, findings were presented to a panel of researchers at the lead author’s university for external validation. Reflexivity was maintained throughout the analysis by critically examining personal biases and decision-making processes. Discrepancies in coding were resolved through discussion and consensus [48]. Potential biases during data collection were mitigated using structured prompts, non-leading questions, and interviewer reflexivity practices [48, 49]. These measures collectively strengthened the credibility, dependability, and confirmability of the qualitative findings [50].

**Triangulation**

We employed a convergent mixed-methods triangulation approach (see Fig. 2) to integrate quantitative and qualitative data [52]. Quantitative data were obtained from survey responses, including analyses of prevalence rates, group comparisons, and regression outcomes. Qualitative data were gathered through one-on-one interviews that explored personal narratives and lived experiences related to workplace strain, coping strategies, and institutional support. Triangulation was achieved by comparing thematic patterns identified in the qualitative interviews with statistical findings from the survey. A joint display table (see Table 6) was used to juxtapose and synthesize the key results.

**Ethics**

The study adhered to the ethical guidelines of the American Psychological Association and the Declaration of Helsinki, as mandated by the Research Conduct and Ethics Committee (RCEC) at Christ University, India. Ethical approval was granted following a full review process under clearance number CU: RCEC/00510/09/23. Informed consent was obtained from all participants prior to data collection to ensure voluntary participation, anonymity, and confidentiality. Participants were fully briefed on the study’s objectives, their right to withdraw at any time without penalty, and the measures in place to safeguard their data. No identifying information was collected, and all responses were securely stored. Throughout the study, we adhered to the principles of beneficence, justice, and respect for persons.



**Fig. 2** Sequential flow of the study

**Table 2** Demographic characteristics of participants (N=216)

Variables	n(%) or Mean (SD)
Age (years)	
21–35	103(47.68)
36–45	82(37.96)
46–60	30(13.88)
Gender	
Female	182(84.25)
Male	34(15.74)
Experience Level	
Junior Nurses	101(46.75)
Middle-level Nurses	85(39.35)
Senior Nurses	30(13.88)
Type of Hospital	
Public	91(42.12)
Private	125(57.87)
Years of Experience	11.5(4.3)
Average shift Length (Hours)	9.5(1.8)
Well-being (%)	58.2 (12.4)
MSK Discomfort (Number of sites)	2.8(1.6)

Note. n = number of participants, % = percentage, SD = Standard Deviation

WHO-5 scores range from 0 to 100

**Finding**

**Quantitative findings**

**Sample characteristics**

We received responses from 216 nurses (see Table 2), the majority of whom were female (n=182, 84.25%), with a smaller proportion identifying as male (n=34, 15.74%). Participants were distributed across three age groups: 21–35 years (47.68%), 36–45 years (37.96%), and 46–60 years (13.88%). The sample comprises 101 junior nurses (46.75%), 85 mid-level nurses (39.35%), and 30 senior nurses (13.88%). Respondents were employed in both public (42.12%) and private (57.87%) hospitals. On average, nurses had 11.5 years of professional experience (SD=4.3) and worked 9.5-hour shifts (SD=1.8). The mean WHO-5 mental well-being score was 58.2 (SD=12.4), indicating moderate well-being. Additionally,

nurses reported MSK discomfort in an average of 2.8 body sites (SD = 1.6).

**Prevalence of MSK discomfort**

Lower back pain was the most frequently reported musculoskeletal (MSK) issue over the past 12 months (47.22%), followed by knee pain (27.31%) and upper back pain (25.00%). In the past seven days, lower back pain remained the most prevalent (20.83%), with knee pain (12.04%) and upper back pain (11.11%) also commonly reported. Despite experiencing discomfort, only a small proportion of participants sought medical care, with the highest rates observed for lower back pain (3.70%) and knee pain (1.85%) (see Table 3).

**Group difference**

Nurses working in public hospitals reported significantly greater MSK discomfort than those in private hospitals across multiple body regions, including the shoulders (p=0.045, d=0.277), elbows (p=0.001, d=0.536), wrists/hands (p=0.001, d=0.642), knees (p=0.001, d=0.479), and ankles/feet (p=0.044, d=0.279) (see Table 4a). Additionally, older nurses (45–60 years) reported significantly more knee pain (p=0.005, η² = 0.051) and elbow pain (p=0.006, η² = 0.048) than their younger counterparts (see Table 4b). Regression analysis revealed that 32.6% of the variance in MSK discomfort was explained (R² = 0.326, p<0.001) (see Table 5). Well-being emerged as a significant negative predictor (β = -0.436, p<0.001), indicating that lower levels of well-being were associated with greater MSK discomfort.

**Qualitative findings**

The thematic analysis identified key challenges faced by nurses, emphasizing the physical, emotional, and institutional stressors embedded within their work environments (see Fig. 3). The qualitative sample consisted of 11 participants (9 females and 2 males), including nurses from both public (n=3) and private (n=7) hospitals,

**Table 3** MSK profile of nursing practitioners (N=216)

Body Region	12 month prevalence n(%)	7 day prevalence n(%)	Mean (SD)	Range	Mild n(%)	Moderate n(%)	Severe n(%)	Sought Medical Care n(%)
Neck	44(20.37)	15(6.94)	0.59(1.49)	0–9	29 (13.43)	12(5.56)	3(1.39)	6(2.78)
Shoulder	46(21.30)	18(8.33)	0.62(1.45)	0–8	28(12.96)	16(7.41)	2(0.93)	5(2.31)
Upper Back	54(25.00)	24(11.11)	0.72(1.47)	0–8	30(13.89)	23(10.65)	1(0.46)	2(0.93)
Elbow	24(11.11)	10(4.63)	0.32(1.04)	0–5	14(6.48)	10(4.63)	0	2(0.93)
Wrist/hand	41(18.98)	14(6.48)	0.51(1.26)	0–7	27(12.50)	13(6.02)	1(0.46)	1(0.46)
Low back	102(47.22)	45(20.83)	1.53(1.96)	0–7	57(26.39)	42(19.44)	3(1.39)	8(3.70)
Hips/Thighs	44 (20.37)	18(8.33)	0.60(1.38)	0–6	26(12.04)	18(8.83)	0	2(0.93)
Knees	59(27.31)	26(12.04)	0.83(1.61)	0–7	33(15.28)	25(11.57)	1(0.46)	4(1.85)
Ankle/Feet	37(17.13)	16(7.41)	0.56(1.47)	0–8	21(9.72)	14(6.48)	2(0.93)	3(1.39)

Note. n = number of participants, % = percentage

MSK = Musculoskeletal

**Table 4** Comparison of MSK discomfort across (a) gender, type of hospital, (b) age group and experience level among nurses

Body Region	Gender		Type of Hospital				Mean Difference	p	d
	Female M(SD)	Male M(SD)	Public M(SD)	Private M(SD)	Public M(SD)	Private M(SD)			
Neck	0.57 (1.49)	0.64 (1.50)	0.61 (1.64)	0.56 (1.38)	0.61 (1.64)	0.56 (1.38)	0.047	0.818	0.031
Shoulder	0.53 (1.34)	1.11 (1.90)	0.85 (1.75)	0.45 (1.17)	0.85 (1.75)	0.45 (1.17)	0.401	0.045*	0.277
Upper Back	0.63 (1.41)	1.17 (1.70)	0.89 (1.50)	0.60 (1.44)	0.89 (1.50)	0.60 (1.44)	0.290	0.154	0.197
Elbow	0.28 (0.97)	0.52 (1.33)	0.63 (1.36)	0.09 (0.64)	0.63 (1.36)	0.09 (0.64)	0.541	0.001*	0.536
Wrist/hand	0.47 (1.20)	0.70 (1.53)	0.95 (1.64)	0.18 (0.73)	0.95 (1.64)	0.18 (0.73)	0.772	0.001*	0.642
Low back	1.52 (1.94)	1.58 (2.06)	1.76 (1.97)	1.36 (1.94)	1.76 (1.97)	1.36 (1.94)	0.409	0.130	0.209
Hips/Thighs	0.42 (1.09)	0.41 (1.05)	0.64 (1.29)	0.25 (0.87)	0.64 (1.29)	0.25 (0.87)	0.392	0.009*	0.365
Knees	0.85 (1.61)	0.70 (1.59)	1.26 (1.91)	0.51 (1.26)	1.26 (1.91)	0.51 (1.26)	0.751	0.001*	0.479
Ankle/Feet	0.58 (1.47)	0.38 (1.41)	0.79 (1.66)	0.38 (1.28)	0.79 (1.66)	0.38 (1.28)	0.407	0.044*	0.279

Body Region	Age Group			Experience Level			F	p	η <sup>2</sup>
	21–35 M(SD)	35–45 M(SD)	45–60 M(SD)	Junior M(SD)	Middle M(SD)	Senior M(SD)			
Neck	0.74 (1.58)	0.34 (1.24)	0.50 (1.25)	0.83 (1.79)	0.24 (0.80)	0.73 (1.72)	4.956	0.010*	0.035
Shoulder	0.44 (1.11)	0.69 (1.56)	0.80 (1.54)	0.52 (1.30)	0.57 (1.28)	1.10 (2.00)	1.089	0.342	0.018
Upper Back	0.67 (1.48)	0.80 (1.48)	0.56 (1.40)	0.70 (1.49)	0.80 (1.48)	0.56 (1.40)	0.305	0.738	0.003
Elbow	0.08 (0.50)	0.56 (1.35)	0.50 (1.28)	0.08 (0.51)	0.57 (1.35)	0.40 (1.19)	5.511	0.006*	0.048
Wrist/hand	0.31 (0.92)	0.70 (1.41)	0.43 (1.19)	0.31 (0.93)	0.74 (1.44)	0.50 (1.54)	2.723	0.072	0.024
Low back	1.37 (1.94)	1.80 (2.05)	1.30 (1.74)	1.38 (1.98)	1.72 (2.02)	1.46 (1.73)	0.695	0.502	0.007
Hips/Thighs	0.24 (0.88)	0.53 (1.20)	0.66 (1.29)	0.30 (1.05)	0.41 (0.99)	0.83 (1.36)	1.889	0.158	0.025
Knees	0.46 (1.36)	1.03 (1.76)	1.43 (1.69)	0.47 (1.37)	1.01 (1.71)	1.50 (1.77)	5.630	0.005*	0.052
Ankle/Feet	0.41 (1.35)	0.43 (1.27)	1.13 (1.75)	0.42 (1.36)	0.35 (1.09)	1.56 (2.19)	4.195	0.019*	0.077

Note. Gender (Female= 182, Male= 34), Type of hospital (Public= 91, Private = 125), Age (21–35 = 103, 35–45 = 82, 45–60 = 30) and Experience level (Junior= 101, middle = 85, senior = 30)

d = effect size

η<sup>2</sup> = eta-square indicating effect size

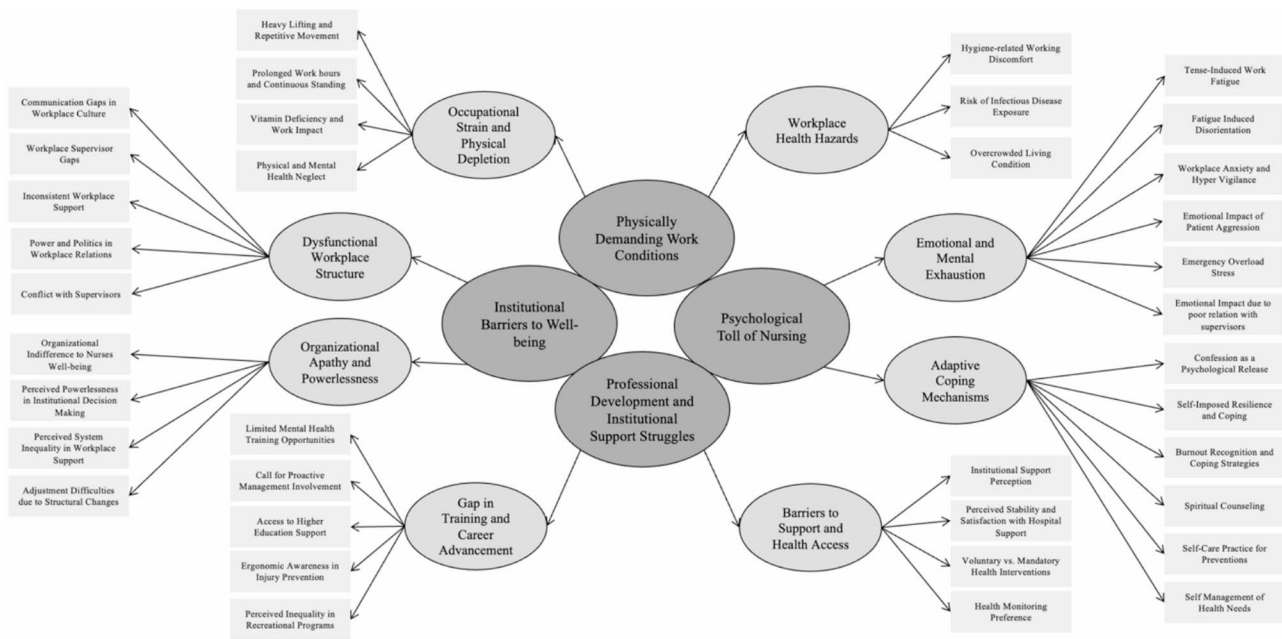
\*A p-value < 0.05 indicates statistical significance

**Table 5** Multiple linear regression predicting musculoskeletal (MSK) discomfort among nurses

Predictors	Unstandardized Coefficient		Standardized Coefficient		95% CI for B			R	R <sup>2</sup>	Adj R <sup>2</sup>
	B	Std. Error	β	t	p	Lower Bound	Upper Bound			
Intercept	17.86	1.61	-	11.090	0.001*	-	-	0.571	0.326	0.304
Well-being	-0.576	0.081	-0.436	-7.093	0.001*	-0.5575	-0.315			
Age (35–45 vs. 45–60)	1.794	2.825	0.311	0.635	0.526	-0.654	1.277			
Age (21–35 vs. 45–60)	-5.093	3.692	-0.883	-1.379	0.169	-2.145	0.379			
Sector (Private vs. Public)	-2.250	0.789	-0.390	-2.851	0.005*	-0.660	-0.120			
Seniority (Mid-level vs. Senior)	-3.351	2.849	-0.581	-1.176	0.241	-1.550	0.393			
Seniority (Junior vs. Senior)	3.988	3.761	0.692	1.060	0.290	-0.594	1.977			
Gender (Male vs. Female)	1.411	0.911	0.245	1.549	0.123	-0.066	0.556			

Note. N = 216. B = Unstandardized coefficient. SE = Standard Error. β = Standardized coefficient. t = t-test statistic. p = p-value. 95% CI = Confidence Interval for B

\*A p-value < 0.05 indicates statistical significance



**Fig. 3** Thematic mapping of study codes using inductive approach

working across various wards such as emergency, intensive care, high-dependency, psychiatry, and maternity units. Participants reported several institutional shortcomings, including hierarchical barriers, inadequate support systems, and limited opportunities for career advancement. To manage their well-being, nurses employed adaptive coping strategies such as peer support, spiritual counseling, and self-care practices.

The analysis followed an inductive approach, progressing from open coding to the development of subthemes and final theme consolidation. Themes were defined based on recurring patterns of meaning across participants’ narratives and refined to ensure internal coherence and clear thematic boundaries. While each theme reflects a distinct aspect of the nurses’ experiences, collectively they offer a comprehensive understanding of how

physical, emotional, and institutional factors intersect to shape well-being.

**Theme 1: enduring physical strain**

This theme underscores how the physically demanding nature of nursing—particularly prolonged standing, patient handling, and inadequate infrastructure—directly contributes to MSK strain. The subthemes capture both the physical exhaustion associated with routine care tasks and the heightened health risks posed by hazardous work environments.

**Subtheme 1. Occupational strain and physical depletion** Nurses consistently described their physically demanding roles, citing long working hours, continuous standing, and strenuous patient-handling tasks as key

contributors to MSK discomfort. Extended shifts often left them with minimal opportunities for rest, meals, or even basic needs. One nurse expressed this sentiment, stating,

*“Our shift is 12 hours, and sometimes we don’t get time to sit, eat, or even go to the washroom” (P8 – personal interview, 2023).*

Patient handling was frequently described as a physically exhausting task, particularly when caring for restless or immobile patients who required frequent repositioning. Nurses reported having to lift patients multiple times during a single shift, often without access to proper assistive equipment or adequate staff support. One nurse shared,

*“Therefore, we have to change the position, and most of the patients are very restless also most of the time, so they will be changing their position. However, like they are restless, so we have to bring to the right position again. So it is like, in one hour, we have to lift the patient once like that, if it is very restless patient and if the patient is not resting less than two hours, once put in two hours” (P5 – personal interview, 2023).*

Maintaining proper posture while lifting or transferring patients was considered essential, yet often difficult due to the high workload and urgency of tasks. One nurse emphasized,

*“We have to maintain our posture. First thing like if we don’t maintain, during sitting, lifting and all, we’ll get pain” (P3 – personal interview, 2023).*

**Subtheme 2. Workplace health hazards** Nurses described multiple occupational health risks encountered in their daily work environments. In high-risk areas such as emergency departments, they reported persistent anxiety about potential exposure to infectious diseases. Despite adhering to standard investigative procedures, a lingering fear of contracting illnesses remained due to the unpredictable nature of patient cases. One nurse shared,

*“In emergency settings, we are exposed to various risks. We conduct investigations, but there is always a sense of uncertainty. Our anxiety only eases once all necessary tests are completed and the results are clear. For example, we face potential exposure to infectious diseases such as tuberculosis, HIV, hepatitis B, and C” (P6 – personal interview, 2023).*

Environmental factors such as inadequate sanitation and poor ventilation were also identified as significant workplace health concerns. Nurses explained that unclean and poorly maintained restroom facilities discouraged them from using them during shifts, leading to discomfort and potential health consequences. One nurse described,

*“The restroom is far from our ward, and most times, it is not even clean. We hold it in because we don’t want to go. It feels unhygienic, and after long shifts, it makes everything worse...skin rashes from constant sweating, irritation from dust, and even coughing because of poor ventilation. It just adds to the exhaustion” (P9 – personal interview, 2023).*

### **Theme 2: emotional exhaustion and coping**

This theme captures the emotional and cognitive toll of sustained occupational stress experienced by nurses. The subthemes reflect both the depth of emotional exhaustion, and the coping strategies nurses employ to safeguard their psychological well-being.

**Subtheme 1. Emotional and mental exhaustion** Nurses described experiencing mental and emotional fatigue due to the demands of their profession. Many reported feeling physically drained to the point of disorientation, with some struggling to distinguish between work hours and personal time. One nurse shared an instance of confusion caused by extreme exhaustion, stating,

*“I was so tired one day, I just came after duty after preparing lunch. In addition, just because I slept, it was approximately 4:30. I just looked out and thought it was morning 5:30. I started shouting that I had duty at six when it was actually the evening” (P11 – personal interview, 2023).*

Additionally, some nurses expressed a desire to take breaks to recover from emotional and mental strain but found it difficult due to demanding workloads and the expectation to perform continuously. As one nurse explained,

*“Sometimes we feel like we need to take a gap [break], but we don’t know if we can. We just keep pushing through, but it is tiring” (P7 – personal interview, 2023).*

**Subtheme 2. Adaptive coping mechanism** Despite the mental and emotional demands of their work, nurses have developed various coping strategies to manage stress and maintain psychological well-being. Several participants emphasized the importance of prioritizing self-care, including engaging in physical activities, maintaining

proper nutrition, and fostering social connections, to prevent work-related stress from spilling into their personal lives. As one nurse shared,

*“We should be mindful about our own health as well. Like one needs to practice yoga, get enough water to drink, sleep adequately, and focus on diet. Moreover, we, as nurses, see various scenarios in the hospital that traumatize us or worry us even when we are not at work... we need to engage ourselves socially and be involved in community activities. So that this stress will not impact us or our personal life” (P9 – personal interview, 2023).*

In addition to self-care, institutional resources such as psychological counseling and spiritual programs were reported as valuable support systems for nurses experiencing emotional distress. One nurse noted,

*“Psychologically, when we are broken, we can approach them [counsellor]. They provide counseling and even spiritual programs” (P4 – personal interview, 2023).*

### **Theme 3: workplace structure and powerlessness**

This theme explores how organizational hierarchy, lack of responsiveness, and weak support systems undermine nurses' autonomy and contribute to emotional strain. The subthemes illustrate how institutional dysfunction and perceived powerlessness intensify the physical and psychological challenges nurses face in their daily work environments.

**Subtheme 1. Dysfunctional workplace structures** Many nurses described their workplaces as hierarchical and unsupportive, with senior staff often dismissing their concerns or failing to provide necessary guidance. They highlighted the lack of open communication channels, which fostered a culture of reluctance to seek support. One nurse shared how the attitudes of senior leaders affected morale, stating,

*“Sometimes our senior leaders... sometimes nursing superintendent used to speak some words which sometimes hurt us. Therefore, it is not good to hear that kind of suggestion” (P7 – personal interview, 2023).*

Similarly, other nurses expressed reluctance to seek support from senior staff due to the perception that their struggles would not be acknowledged. One nurse noted,

*“I don't feel I should go to the senior staff seeking support or want to share that I am going through this” (P9 – personal interview 2023).*

**Subtheme 2. Organizational apathy and powerlessness** Nurses reported that their voices were not adequately considered in decision-making processes. While their concerns were occasionally acknowledged, they were rarely acted upon, leaving nurses feeling powerless within the system. One nurse described raising workplace concerns without seeing any meaningful change, stating,

*“We have voiced our concerns, but decisions are made without considering our needs” (P11 – personal interview, 2023).*

Nurses expressed feeling devalued within the medical hierarchy, noting that they often receive less respect and recognition than doctors. One nurse described how their professional contributions were sometimes undermined, stating,

*“Sometimes as a nurse, no, we see everything, we are the one who... spend more time with patients. Doctors, of course, are also important parts... putting patients while providing care, because without them, we cannot prescribe medications. However, sometimes not all are the same. However, sometimes they do not want to respect us, or they just belittle us. Like they [we] are nurses only” (P10 – personal interview, 2023).*

Another nurse expressed doubt about the effectiveness of raising concerns, acknowledging that while hospital administrators might listen, tangible actions were unlikely. The nurse shared,

*“...I can go and tell them, and they will listen to me, but I do not know whether they [the hospital administration] will act on it” (P5 – personal interview, 2023).*

### **Theme 4: support gap and career constraints**

This theme addresses how gaps in institutional support, training, and career development hinder nurses' ability to maintain their health and professional growth. The subthemes show how inconsistent access to resources and advancement opportunities contributes to sustained stress and disengagement.

**Subtheme 1. Barriers to support and healthcare access** Nurses have expressed concerns about the limited support systems available in their workplaces. The lack of institutional support - both physical and psychologi-

cal - makes it difficult for nurses to maintain their health while managing the demands of their profession. One nurse described significant shortcomings in the support provided,

*“Regarding support for the hospital, it is very less... this physical support is very less, even psychological support” (P1 – personal interview, 2023).*

Some nurses believe that hospitals should take a more proactive role in offering regular health check-ups to staff, helping to ensure their well-being without placing a financial burden on them,

*“I’d say that health setup should be done periodically, at least once a year... it should be done free of cost” (P9 – personal interview, 2023).*

Despite these concerns, a few nurses acknowledged the existence of institutional initiatives aimed at supporting mental and emotional well-being. For example, one nurse highlighted the role of counseling services and spiritual retreats in helping maintain psychological health,

*“When we are psychologically broken, we approach counseling. The hospital organizes spiritual retreats for engagement” (P4 – personal interview, 2023).*

**Subtheme 2. Gaps in training and career advancement** Another significant challenge faced by nurses was the lack of structured training programs, particularly in mental health support and stress management. Many nurses reported never having received formal training in mental health, despite the emotional burden associated with their work,

*“We haven’t received any mental health training or support in such a way” (P4 – personal interview, 2023).*

However, opportunities for professional development vary widely across hospitals. Some nurses recalled having access to regular training sessions and workplace engagement programs in previous institutions, but noted that such activities were infrequent or nonexistent in their current workplace,

*“Previously, when I was working in different hospitals... we used to have regular meetings and programs where we could attend. So, if we [are] stressed, we listen to songs on the events and dance...we used to be getting relief...but over here, we do not have many of those facilities, we have, but very rarely, like*

*maybe once in six months” (P5 – personal interview, 2023).*

While some institutions offered structured training and career advancement opportunities, this was not a universal experience. One nurse highlighted the presence of support programs within their department, including skill development initiatives and sponsorship for higher education,

*“In our department, they are giving us support, helping us improve our skills, and even sponsoring higher education” (P4 – personal interview, 2023).*

### Triangulation

The triangulation of quantitative and qualitative findings highlights the occupational burden experienced by nurses, encompassing physical strain, institutional shortcomings, and psychological distress (see Table 6). The high prevalence of musculoskeletal (MSK) discomfort with 47.72% of nurses reporting lower back pain, followed by knee pain (28.18%) and upper back pain (25.00%), suggests cumulative strain from prolonged standing, repetitive lifting, and inadequate ergonomic support. Complementing these findings, nurses described persistent back pain from lifting immobile patients, with one stating, “In the ICU, we used to lift heavy patients from the stretcher to the bed, and my back suffered. The patients weighed 70–80 kg, and I barely weighed 45 kg” (P10 – personal interview, 2023).

The quantitative data revealed a higher prevalence of musculoskeletal (MSK) discomfort among nurses in public hospitals compared to those in private institutions. Public hospitals often struggle with high patient volumes and limited staffing, whereas private facilities tend to offer better logistical support and access to healthcare benefits. However, qualitative findings suggest that neither setting fully mitigates occupational health risks. Public hospital nurses emphasized the lack of compensation and regular health check-ups, while nurses in private hospitals reported being overworked due to personnel shortages. One nurse noted, “When I was working in a private hospital ICU, we used to do everything, even the technician work. We had fewer nurses, and they wanted us to overwork” (P10 – personal interview, 2023).

Additionally, nurses with more than 10 years of experience reported significantly greater MSK discomfort than their junior counterparts, challenging the assumption that experience builds resilience. Instead, qualitative findings suggest that chronic exposure to heavy workloads leads to long-term physiological consequences. One experienced nurse shared, “I am suffering now. At that time, we were so energetic. We need to do work like that, but over time, it takes a toll on us” (P11 – personal

**Table 6** Joint data comparing quantitative and qualitative analysis on MSK discomfort among nurses

Quantitative Finding	Supporting Quotes	Qualitative Themes
47.72% of nurses reported lower back pain, followed by knee (28.18%) and upper back (25.00%) pain. (Table 3)	<p><b>Lower Back Pain</b></p> <ul style="list-style-type: none"> <li>"I was having muscle pain like low back ache since 2009. Because when I started my job in the emergency department, we had to pick up the patient and drop them in the bed. That made us uncomfortable because we had to lift heavy weights. We couldn't always maintain proper posture." (P7)</li> <li>"Since six, seven months, I started having scapular, shoulder pain, and lower back ache. Leg pain is kind of continuous." (P5)</li> <li>"When I entered this profession, from that time only, I used to have back pain, back pain and back pain and calf muscle pain." (P8)</li> <li>"In ICU, we used to lift heavy patients from the stretcher to the bed, and my back suffered. The patients would weigh 70–80 kg, and I barely weigh 45 kg." (P10)</li> <li>"Standing for long hours and constantly walking from room to room, my back pain gets worse during very busy days." (P11)</li> </ul> <p><b>Knee Pain</b></p> <ul style="list-style-type: none"> <li>"With age, I feel my joints aching more, but I have no choice but to keep working." (P3)</li> <li>"I started having knee pain after years of long shifts. My legs feel heavy after prolonged standing." (P8)</li> <li>"With every shift, my knee pain increases. It wasn't there when I was younger, but now it's a daily struggle." (P9)</li> <li>"When I have to stand near patients for hours, my knees start hurting. Even at home, I feel stiffness." (P10)</li> </ul> <p><b>Upper Back Pain</b></p> <ul style="list-style-type: none"> <li>"Sometimes for long durations, due to prolonged standing, I feel leg pain and neck pain. Also, while lifting patients, I feel back pain. It's not severe, but it happens." (P4)</li> <li>"My back pain started when I worked in the ICU. Lifting patients and moving them caused continuous stress." (P3)</li> <li>"I have continuous scapular, shoulder, and upper back pain. It worsens when I have to lift patients." (P5)</li> <li>"During my BSc internship, I started developing shoulder and neck pain, which has only gotten worse with time." (P10)</li> <li>"I often get upper back pain from constant work, moving between floors, and attending to patients." (P11)</li> </ul>	Occupational strain and physical depletion
MSK discomfort was significantly higher in public hospital nurses compared to private hospital nurses ( $p < 0.05$ ). (Table 4 – Comparison by Type of Hospital)	<p><b>Complaints from Public Hospital Nurses</b></p> <ul style="list-style-type: none"> <li>"Actually, we did not get any compensation or anything from the government. So, they should be involved because in most of the central settings, they used to have this one reimbursement and all. In state government settings, we did not get it. In some cases, we get something, but in central settings, whenever they used to admit in the hospital, they used to get annual health checkups and reimbursement. We did not get that. So this should be changed, and manpower mostly." (P8)</li> <li>"When I was working in a private hospital ICU, we used to do everything, even the technician's work. We had fewer nurses, and they wanted us to overwork. If I went for a morning duty, I couldn't leave after six hours; I had to do double duty. They would offer breakfast and encourage us, but in the end, it was exhausting. In government hospitals, it's different; there are more nurses, but the workload is still high because of patient volume." (P10)</li> <li>"I started having lower back pain and calf pain after working for two years in the government hospital. I consulted a doctor, and they told me it was due to vertebral degeneration. I think the long hours, the heavy workload, and standing for long periods contribute to this." (P9)</li> </ul> <p><b>Perspective from Private Hospital Nurses</b></p> <ul style="list-style-type: none"> <li>"As a nurse, I want to tell like, mainly, my thing is like working every time like, you have to stand only not sitting to work, then you have to lift up. So, I think we also we are also looking into our physical health." (P1)</li> <li>"If we used to be very busy, like we used to forget to drink water. And for that sometimes I used to get UTI or even burning urination." (P3)</li> <li>"Logistical support, we have our staff have the skin their way our every treatment is free. So, we can go to any other doctor like surgery or medicine anywhere, physiotherapy if we have been medicines also is free." (P1)</li> <li>"If we get sick, we go for a checkup. We have this health scheme for staff to get treatment." (P3)</li> </ul>	Dysfunctional workplace structures Organizational apathy and powerlessness

**Table 6** (continued)

Quantitative Finding	Supporting Quotes	Qualitative Themes
<p>Nurses with over 10 years of experience reported higher prevalence of MSK discomfort than junior nurses (Table 4) (<math>p &lt; 0.05</math>). (Table 4) – <i>Comparison by Years of Experience</i></p>	<p><b>Nurses having more than 10 years of experience</b></p> <ul style="list-style-type: none"> <li>• “Yes, muscle, sometimes for long distance due to prolonged standing, leg pain, neck pain, also. (P4)</li> <li>• “I was having muscle pain like low back ache since 2009. Because when I started my job in [Emergency] department, we have to pick up the patient and drop him in the bed. So that made us little discomfort because we have to take a heavy weight. So with that only I had started my low back ache and this is the starting point. (P7)</li> <li>• “I am suffering now. At that time, we were so much energetic. So we need to do work like that. And that led that for that, I think we should avoid this all the limitation, which you have, at least used to be with that only.” (P7)</li> <li>• “By the time I finish my shift, my whole body aches. I don’t get enough rest, and sleep deprivation makes the pain worse. Many of my senior colleagues also complain about body pain, especially after working night shifts.” (P11)</li> <li>• “I have been working as a psychiatric nurse for 22 years. Over time, I started experiencing muscle pain due to prolonged standing and excessive walking across different rooms and floors. When the lift doesn’t work, I have to climb multiple flights of stairs, which causes leg cramps and fatigue.” (P11)</li> </ul>	<p>Emotional and mental exhaustion Organizational apathy and powerlessness Barriers to support and healthcare access</p>
<p><b>Nurses with less than 10 years of experience</b></p> <ul style="list-style-type: none"> <li>• “Actually, everything we received from here is really good the hospital provides us all the support or support you can see there is nothing.” (P2)</li> <li>• “Yes, I don’t like when we used to be very busy sometime. We have 10 bedded. So every time like sometimes we have 10 patients and they’re also five ventilator patients and during the time like so many works, we still have so that time if we run if we do if we leave the patient for sitting and all maybe like if we take to CT scan or maybe ultrasound or maybe like some patients sometimes like what happened if like if so, many patients comes then whatever like bed also used to pull here and there. So, because of that sometime I used to feel pain, like most of the time I used to feel the pain in duty time.” (P3)</li> <li>• “Yeah, when I was in theater, like we used to scrub, so there I used to have leg pain, but that was not severe after that duty and a little bit getting over. But now after like, since six, seven months, like I’m in HDU, so, we have to lift up the patients and all and most of the time we will be very busy we can see also so at that time I started having like scapular, shoulder pain part and lower back ache was big and like leg pain is like continue kind of.” (P5)</li> <li>• “I’ve been working in emergencies. So emergency room is quite very hectic. And like, we have to stand over eight hours a day. So that I think contributes to muscular pain. And plus, I think for me, I think I already had Vitamin D deficiency. So that also contribute to that...I’ve shown the doctor quite many times. And then they give me the three and calcium models. So I take painkillers when it is worsened” (P6)</li> </ul>	<p>Barriers to support and healthcare access</p>	
<p>Significant negative correlation between MSK discomfort and well-being (<math>r = -0.517, p &lt; 0.001</math>). (Table 5)</p>	<p><b>Physical Discomfort impacting Mental Wellbeing</b></p> <ul style="list-style-type: none"> <li>• “When I entered this profession, from that time only, I used to have back pain and calf muscle pain. It started affecting my daily activities, and even after taking medication, the pain returns because of long hours of standing and patient care.” (P8)</li> <li>• “I used to have muscle pain in my wrist and calf. At first, I ignored it, thinking it was due to long-term standing, but over time, it got worse. Now, even after rest, the pain continues, and it affects my ability to work efficiently.” (P9)</li> </ul> <p><b>Fatigue and Sleep Issues</b></p> <ul style="list-style-type: none"> <li>• “The workload is very high, and I hardly get time to rest. My back pain has worsened, and after continuous shifts, I don’t get enough sleep. This exhaustion affects my mood and how I interact with my family at home.” (P11)</li> <li>• “Sometimes, I feel like my whole body is in pain after a long shift. I barely get time to sit, and by the time I reach home, I have no energy left to do anything else. It’s just work, pain, and sleep—no time for anything else.” (P7)</li> </ul> <p><b>Psychological Stress</b></p> <ul style="list-style-type: none"> <li>• “I think stress makes it worse. When I feel unappreciated or when there is a misunderstanding at work, I feel mentally exhausted. That exhaustion adds to my physical pain, and some days, I just don’t feel like working at all.” (P6)</li> <li>• “I am suffering now. I was very energetic when I started this job, but over time, the stress and the constant physical work have led to pain. Now, even when I try to rest, the discomfort remains, and it feels like my body isn’t recovering properly.” (P11)</li> </ul>	<p>Emotional and mental exhaustion Organizational apathy and powerlessness</p>

**Table 6** (continued)

Quantitative Finding	Supporting Quotes	Qualitative Themes
Many nurses did not seek medical care despite experiencing MSK discomfort. (Table 3)	<p><b>Self-management and Ignoring Symptoms</b></p> <ul style="list-style-type: none"> <li>• "When I developed muscle pain around my neck, I thought it was because of BP or workload. I didn't think much about it." (P10)</li> <li>• "Sometimes we just manage because we don't have time to visit a doctor. Even if there's pain, we have to continue working." (P9)</li> <li>• "Most of the time I used to feel the pain during duty time. But after some time, if I went home and took rest, it used to be okay." (P3)</li> <li>• "We are not getting enough rest. Sometimes we sleep for five hours, hardly five hours, because we have our family. So it's difficult to manage, but we just take everything positive." (P11)</li> <li>• "We have to manage ourselves. So today, I will go and check my personal health." (P8)</li> <li>• "I think an effective stress management program in any form would be good. But also, just speaking out when needed and getting help." (P6)</li> </ul> <p><b>Reliance on Temporary Relief Over Medical Consultation</b></p> <ul style="list-style-type: none"> <li>• "I was so tired one day... I just slept and woke up confused, completely disoriented. Even my brain was not working properly." (P11)</li> <li>• "At first, I took some medications, and the pain subsided, but after some time, it came back again." (P9)</li> <li>• "I think we should have regular check-ups, but right now, if we want a health check-up, we have to go by ourselves; they don't ask or arrange for it." (P1)</li> <li>• "We have no stress management programs from the hospital, but we among ourselves make friends and manage stress on our own." (P8)</li> </ul>	<p>Barriers to support and healthcare access</p> <p>Gaps in Training and Career Advancement</p>

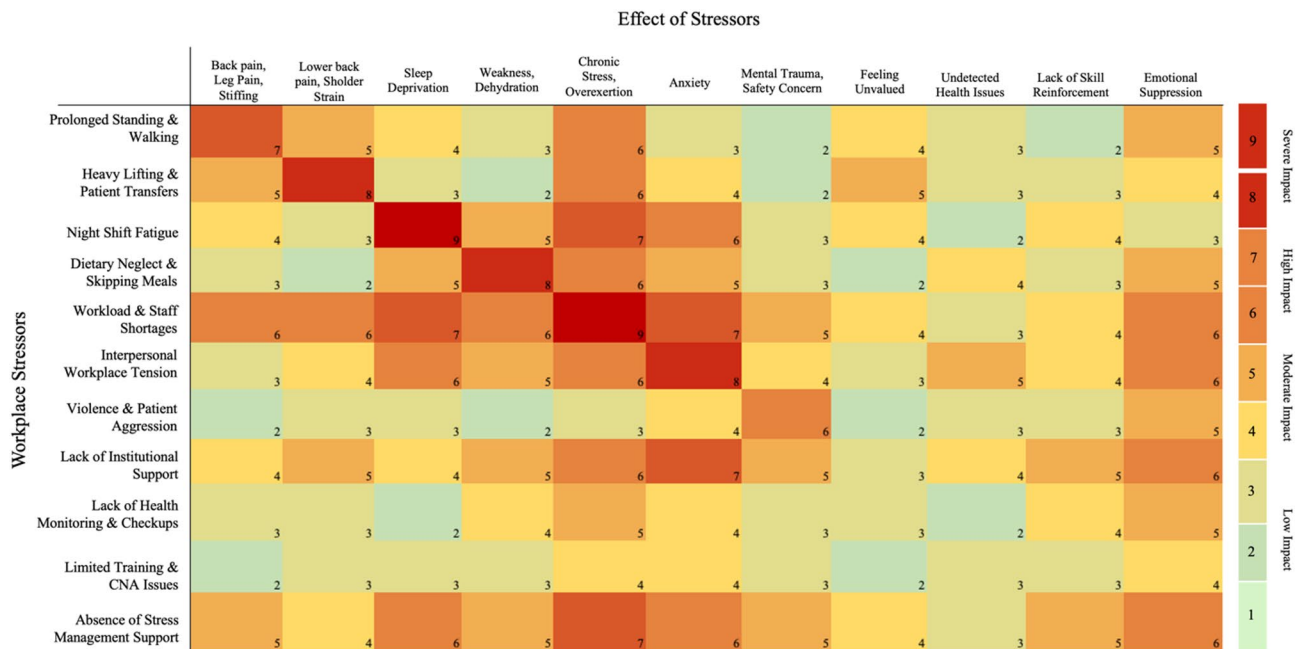
interview, 2023). Similarly, a strong negative correlation was identified between MSK discomfort and overall well-being ( $r = -0.517, p < 0.001$ ). Nurses reported experiencing severe fatigue, anxiety, and emotional exhaustion, which they attributed to unrelenting work schedules and a lack of organizational recognition and support. One nurse expressed, "I think stress makes it worse. When I feel unappreciated or when there is a misunderstanding at work, I feel mentally exhausted. That exhaustion adds to my physical pain, and some days, I just don't feel like working at all" (P6 – personal interview, 2023).

The heatmap (see Fig. 4) illustrates how workplace stressors such as prolonged physical exertion, institutional neglect, and emotional distress intersect to shape nurses' experiences. The lack of proactive health monitoring and structured stress management interventions highlights a reactive approach to nurse well-being, where interventions are only sought after significant health deterioration.

**Discussion**

We employed a sequential explanatory mixed-methods approach to examine MSK discomfort and psychological distress among nurses in northeastern India. The study revealed a high prevalence and severity of MSK discomfort, closely tied to occupational demands and institutional conditions. Physical stressors such as extended working hours and heavy lifting with limited support were strongly associated with both psychological well-being and job satisfaction. Qualitative data further highlighted disparities between public and private healthcare settings, pointing to systemic factors that exacerbate MSK-related issues. These findings directly address our three research questions: (1) Prevalence and severity of MSK discomfort, particularly in the lower back, knees, and upper back, were confirmed through survey data and regression analysis; (2) Impact on well-being and workplace experience was evident in interviews, which revealed emotional fatigue, professional dissatisfaction, and mental strain and; (3) Organizational influence emerged through the integration of both data strands, showing how high perceived workload, risk of burnout, and under-resourced systems perpetuate these health risks.

The high prevalence of lower back pain, knee discomfort, and upper back strain aligns with global epidemiological trends [13, 53, 54]. However, our findings reveal an alarming normalization of chronic pain within nursing culture. Consistent with research in under resourced settings [27, 55, 56], the disparities between public and private healthcare institutions suggest that workplace conditions, rather than individual susceptibility, are key contributors to MSK burden. Some studies report that nurses perceive mild to moderate MSK discomfort as a



**Fig. 4** Heat-map showing the thematic relationship between workplace stressors, and well-being indicators, with intuitive comparison of data frequencies

routine aspect of care work, often not viewed as a clinical concern unless it interferes with mobility or critical tasks [57, 58]. This normalization may contribute to underreporting and delay in seeking treatment. Although several group differences were statistically significant, many showed small to moderate effect sizes, suggesting practical differences may vary in magnitude and should be interpreted with clinical caution. Inadequate staffing, prolonged work hours, and the absence of assistive lifting equipment in public hospitals exacerbate physical strain, reinforcing prior evidence that institutional deficiencies amplify occupational health risks in low-resource environments [27].

Our findings also underscore that MSK discomfort is not merely an isolated physical ailment but a progressive occupational hazard with cumulative effects. Nurses with more than a decade of experience reported higher pain levels, indicating a pattern of chronic MSK deterioration consistent with longitudinal studies on ergonomic risks in nursing [59, 60]. Qualitative data added a new lens, revealing how physical pain is endured and internalized as an inevitable consequence of caregiving culture. This may foster reluctance to seek medical intervention, leaving health conditions untreated [61]. This pattern may be shaped by local cultural norms and resource constraints in northeastern India and may not reflect the experience of nurses in more resourced Indian states.

In addition to physical health conditions, our study also highlighted the psychological impact of MSK discomfort. This supports literature on the mind-body connection, linking occupational strain with burnout, emotional

exhaustion, and diminished job performance [62, 63]. Nurses frequently described a cycle of physical fatigue [64], which appeared more strongly associated with institutional neglect and the absence of psychological support mechanisms. These findings align with research showing that chronic workplace pain increases the risk of depression and anxiety among healthcare workers, reducing their capacity to deliver optimal patient care [65]. While the association between MSK discomfort and mental well-being was statistically significant, the moderate effect sizes suggest that this relationship is meaningful but likely influenced by other workplace and personal factors. This aligns with the JD-R framework, which posits that high physical and emotional demands—such as heavy lifting, long shifts, and emotional fatigue [9, 29, 30], combined with insufficient resources (e.g., ergonomic tools, mental health support, leadership engagement), lead to increased strain and reduced well-being. Our findings illustrate this dynamic clearly: elevated job demands correlate with worse MSK outcomes and psychological distress, while the lack of institutional resources limits resilience and recovery.

The hierarchical and often rigid structure of public hospitals in northeastern India emerged as a unique finding. Compared with previous studies on nursing autonomy and workplace culture [66], our findings reveal a pervasive sense of professional disempowerment, where nurses perceive their concerns, whether related to physical strain, psychological distress, or workplace policies, to be systematically disregarded. The perception that decision-making power remains concentrated among

senior administrators, with minimal input from frontline workers, aligns with research indicating that hierarchical healthcare environments contribute to higher rates of occupational dissatisfaction and burnout [67].

In addition to being exposed to various microorganisms in the workplace [68], nurses face a high level of psychological issues [69]. A critical contribution of our study is the contextualization of MSK discomfort within the sociopolitical and infrastructural conditions of north-eastern India, adding another dimension to the hazards faced by nurses. Unlike metropolitan hospitals with access to advanced ergonomic solutions and robust occupational health policies [25], hospitals in this region operate under constraints that exacerbate physical and mental health risks. Prior research has shown that northeastern India suffers from severe healthcare workforce shortages, with nurse-to-patient ratios far exceeding national and global recommendations [26, 27]. Our findings align with these systemic challenges, revealing that overburdened nurses often compensate for staffing deficiencies by taking on excessive physical workloads, which may impact their long-term health. It is important to note that MSK prevalence among nurses varies widely across India. For instance, a cross-sectional study in rural Gujarat reported a 60.5% seven-day prevalence of MSK disorders, significantly lower than the 72% seen in our sample [70]. This suggests that regional disparities in infrastructure, institutional support, and workforce density meaningfully influence MSK outcomes—emphasizing the need for localized interventions.

While studies have shown that workplace modifications, including ergonomic training and assistive lifting devices, can significantly reduce MSK injuries [71], we found that such interventions are largely absent in northeastern hospitals. The lack of institutionalized health check-ups, injury tracking, and preventive care programs reflects systemic neglect and presents significant challenges for nurses. Moreover, deficits in professional training and career development related to physical health prevention and stress management persist. Although global best practices advocate for a holistic learning framework that includes ergonomic training as a core component of nursing education [72], nurses in our study reported little to no formal instruction on injury prevention. This aligns with prior research showing that gaps in occupational health education are linked to higher injury rates and lower reporting of workplace hazards [73]. However, the effectiveness of ergonomic interventions can vary. A recent systematic review and meta-analysis found that while ergonomic adjustments significantly reduced pain in the lower back, upper back, neck, wrists, and ankles, no significant benefits were observed for shoulders, elbows, arms, thighs, or knees, and overall effect sizes were relatively small, suggesting limited

clinical impact [74, 75]. Additionally, randomized controlled trials have shown that short-term ergonomic programs can improve posture and reduce pain initially, but these benefits often diminish by the 12-month follow-up [76]. Taken together, these findings suggest that without addressing underlying factors such as workload pressure and institutional culture, even well-designed ergonomic interventions may offer only limited relief over time.

Furthermore, the lack of institutionalized mental health programs remains a major challenge for nurses' well-being, consistent with studies in similarly resourced healthcare settings [77, 78]. The reliance on self-management strategies, such as social engagement and informal peer support, may serve as short-term coping mechanisms but do not replace the need for structured workplace interventions aimed at reducing the psychological burden of caregiving.

### Strength and limitations

This study presents several key strengths. It is the first mixed-methods investigation conducted in northeastern India to examine the challenges of MSK discomfort and mental well-being among nurses. Using a sequential explanatory mixed-methods approach, we combined quantitative prevalence data with qualitative narratives to provide a comprehensive understanding of nurses' experiences. The inclusion of both public and private hospital nurses enabled cross-sector comparisons, enriching the analysis. Additionally, our findings contribute to the global nursing and occupational health literature, particularly in low-resource healthcare settings, where workplace conditions significantly affect nurses' well-being.

However, this study is not without limitations. The cross-sectional nature of quantitative data restricts our ability to establish causal relationships between MSK discomfort and workplace conditions. Moreover, the sample was geographically specific to northeastern India, which limits generalizability to other regions. That said, our 72% response rate significantly exceeds the typical averages reported in healthcare survey research. A recent meta-analysis of survey studies conducted among healthcare workers [79] found an average response rate of approximately 44%, further highlighting the robustness of our participation rate.

Furthermore, qualitative interviews were conducted with a relatively small subset of nurses, potentially over-representing participants who were more vocal about workplace challenges. The gender composition of our sample (84% female) may appear skewed, but it accurately reflects the demographics of the Indian nursing workforce, which is predominantly female. Male nurses represent a recognized minority in both national [80] and global [81] contexts. While this limits our ability to explore gender-based variations in musculoskeletal

(MSK) experiences, it does not diminish the representativeness of our findings for the majority population. Future research could consider intentionally oversampling male nurses to better understand potential gender-specific patterns. Further research should also consider longitudinal designs and larger, more diverse samples to capture variations in nursing experiences over time and evaluate the long-term impact of workplace interventions [82].

### Relevance for clinical practice and policy

From a clinical perspective, this study underscores the urgent need for workplace ergonomic improvements, including the provision of assistive lifting devices, scheduled rest breaks, and routine ergonomic training to mitigate physical strain from prolonged standing and patient handling [74, 75]. Nurses should also have access to structured physical rehabilitation programs, especially those experiencing chronic MSK discomfort, to enable early intervention and prevent long-term occupational disability [83]. The heatmap analysis revealed that prolonged standing, heavy lifting, and night shift fatigue were among the top workplace stressors, with severe impact scores on lower back pain, chronic stress, sleep deprivation, and emotional suppression. These findings support the integration of fatigue management protocols, posture correction programs, and safe patient transfer training into daily nursing routines. Institutions must not only provide ergonomic aids but also monitor their consistent use, particularly in high-risk wards such as emergency and intensive care units. Importantly, MSK discomfort is not only a physical issue but also a psychological concern. Given the relationship between physical discomfort and mental distress, it is essential to adopt occupational health frameworks that include mandatory health screenings, mental health counseling, stress reduction programs, and resilience training tailored to nursing demands. Clinical settings should promote peer-support groups and psychosocial services, as qualitative data revealed that nurses often rely on informal coping mechanisms due to the absence of institutionalized mental health interventions [84].

From a policy standpoint, healthcare administrators and policymakers must prioritize staffing reforms, addressing challenges such as unrealistic nurse–patient ratios and aligning with national and WHO recommendations [23] to reduce workforce exhaustion and physical strain. Formalized training in workplace injury prevention, ergonomic awareness, and self-care strategies should be embedded in nursing education and professional development programs [75]. Our findings indicate that institutional neglect of nurses' health concerns fosters a culture of endurance rather than proactive health management. This reinforces the need for participatory

decision-making, where nurses are actively involved in shaping hospital policies, workload distribution, and workplace health interventions to ensure sustainable change [71].

As shown in the heatmap, workload and staffing shortages had a severe or high impact across a wide range of health outcomes, including chronic stress, trauma, anxiety, and perceived lack of support. These patterns highlight the need for policy-level responses that go beyond headcount ratios and address the qualitative dimensions of nursing workload. Measures such as minimum shift recovery periods, ward-specific workload ceilings, and mandatory emotional health check-ins should be considered essential components of any nursing welfare policy [85].

In resource-constrained settings like northeastern India where healthcare workforce shortages and inadequate infrastructure exacerbate occupational risks [25, 26], targeted investments in healthcare infrastructure, occupational safety, and nursing workforce reforms are imperative. Governmental and institutional policies must shift from reactive approaches to proactive, evidence-based interventions that prioritize both physical and psychological well-being. Funding for workplace health initiatives, including physiotherapy services, occupational therapy, and subsidized healthcare for nursing professionals, should be integrated into hospital budgets to enhance workforce sustainability and reduce attrition rates.

### Conclusion

This mixed-method study addressed the critical challenges of MSK discomfort and psychological distress among nurses in northeastern India, emphasizing the role of occupational demands, inadequate institutional support, and workforce well-being. Our findings demonstrate that chronic physical strain, poor workplace ergonomics, and limited staffing contribute to persistent MSK discomfort, which in turn negatively affects mental health, job performance, and overall workplace satisfaction. The disparities between public and private healthcare settings further underscore systemic gaps in occupational health support. Therefore, it is essential for hospital administrations to respond to these challenges by implementing evidence-based workplace interventions, enacting policy-driven reforms, and establishing integrated physical and mental health support systems. These measures are crucial to promoting a sustainable nursing workforce and enhancing patient care outcomes.

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#### Author contributions

BP, and PMS contributed to the study conceptualization and design. Material preparation was done by BP. Data Collection was done by BP. Quantitative Data Analysis was performed by BP. Qualitative Data Analysis both manual and software was done by BP and manual by PMS. Data collection was done by BP. The first draft of the manuscript was written by BP. MCCL revised the manuscript extensively. The final draft was written by BP, and MCCL, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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#### Data availability

The datasets collected and analyzed during the current study are not publicly available due to institutional data protection policies and participant confidentiality agreements. However, de-identified data may be made available upon reasonable request and subject to approval from the ethics committee.

#### Declarations

##### Ethics approval and consent to participant

The study was approved by under the ID: CU: RCEC/00510/09/23 from the Research Conduct and Ethical Committee from Christ University, India in accordance with Declaration of Helsinki. Informed consent was obtained from all participants after explaining the purpose, procedures, and their rights, including the option to withdraw at any time. Participation was entirely voluntary and confidential.

##### Consent for publication

Not applicable.

##### Competing interests

The authors declare no competing interests.

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