South East Asia Journal of Public Health

Vol. 16, No. 1 (2026)
pISSN: 2220-9476 · eISSN: 2313-531X

ORIGINAL RESEARCH

Occupational Health Burden of Chronic Low Back Pain among Female Nurses in Bangladesh: Socioeconomic and Clinical Determinants

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ABSTRACT

Chronic low back pain (CLBP) is a major occupational health problem affecting healthcare workers globally, with female nurses being particularly vulnerable. In Bangladesh, where nursing workforce shortages compromise healthcare delivery, the burden of CLBP among nurses remains poorly documented. This study examined socioeconomic, demographic, and clinical determinants of CLBP severity among female nurses in a tertiary hospital in northern Bangladesh. A hospital-based cross-sectional study was conducted among 104 female nurses with clinically diagnosed CLBP at Rangpur Medical College Hospital from September 14–23, 2023. Bivariate analysis using eta correlation and multivariate linear regression was performed to identify predictors of CLBP severity. Mean participant age was 35.8±7.2 years; 91.3% were married. Pain severity distribution showed 45.2% mild, 41.3% moderate, and 13.5% severe CLBP. BMI showed the strongest association with pain severity (eta=0.807, $p<0.001$). Multivariate regression identified four independent predictors explaining 70.2% of variance: BMI ($\beta=0.925$, $p<0.001$), number of children ($\beta=0.070$, $p<0.05$), monthly family income ($\beta=0.044$, $p<0.05$), and age ($\beta=-0.094$, $p<0.05$). CLBP is a significant occupational health burden among Bangladeshi female nurses, strongly influenced by modifiable factors, particularly obesity, and compounded by childcare responsibilities. Urgent implementation of workplace health promotion, weight management, ergonomic improvements, and family-friendly policies is needed.

Keywords: Occupational health; low back pain; female nurses; body mass index; Bangladesh; health workforce; musculoskeletal disorders; workplace health

Introduction

Low back pain (LBP) is the leading cause of years lived with disability globally, affecting an estimated 619 million people and imposing enormous economic and social costs on individuals, healthcare systems, and societies (1). Among occupational groups, healthcare workers, particularly nurses, experience disproportionately high prevalence rates of chronic low back pain (CLBP), ranging from 40% to 80% across different countries (2,3). This occupational vulnerability stems from physically demanding work conditions, including prolonged standing, repetitive patient lifting and transfers, awkward postures, shift work, and psychosocial stressors inherent to healthcare delivery (4).

In low- and middle-income countries (LMICs) of South and Southeast Asia, where healthcare infrastructure is already strained, the occupational health burden on nursing staff is compounded by inadequate staffing ratios, limited mechanical patient handling equipment, and poor workplace ergonomics (5). The nursing workforce crisis in these regions, characterized by shortages, high turnover, and inadequate working conditions, threatens healthcare system sustainability and universal health coverage goals (6).

Bangladesh, a densely populated South Asian nation of 170 million people, faces critical healthcare workforce challenges. With a nurse-to-population ratio of approximately 3 per 10,000 population, far below the WHO minimum recommendation of 25.4 per 10,000 (7) Bangladesh's nursing workforce operates under enormous strain. Female nurses constitute the majority of this workforce and serve as the backbone of healthcare delivery in both public and private sectors (8).

Despite their essential role, Bangladeshi nurses work in challenging conditions characterized by heavy patient loads, extended duty hours, limited resources, and insufficient occupational health protections (9). The occupational health needs of this workforce remain under-researched and under-addressed in health system planning. Existing evidence from Bangladesh indicates a high prevalence of musculoskeletal disorders among nurses (10), yet comprehensive investigations of factors determining CLBP severity are lacking.

CLBP among nurses carries significant public health implications beyond individual suffering. At the micro level, CLBP reduces work productivity, increases absenteeism, drives workforce attrition, and diminishes the quality of patient care (11). At the meso level, it increases healthcare costs through medical treatment, rehabilitation services, and workforce replacement (12). At the macro level, it undermines health system capacity and threatens progress toward Sustainable Development Goal 3 (ensuring healthy lives and well-being for all) (13).

Understanding determinants of CLBP severity in Bangladesh's nursing workforce is essential for developing evidence-based occupational health interventions and informing health workforce policies. This study aimed to: (1) assess the burden and severity distribution of CLBP among female nurses in a tertiary hospital in northern Bangladesh; (2) identify socioeconomic, demographic, and clinical factors associated with CLBP severity; and (3) determine independent predictors of pain severity to inform targeted public health interventions.

Methods

Study design, setting, and period

This hospital-based cross-sectional study was conducted at Rangpur Medical College Hospital (RMCH), a 750-bed tertiary care teaching hospital in Rangpur city, northern Bangladesh. RMCH serves as the primary referral center for the entire Rangpur Division (population approximately 16 million) and employs approximately 600 nurses. Data collection occurred during September 14–23, 2023.

Study population and eligibility criteria

The study included female nurses working at RMCH with clinically confirmed CLBP. Eligible participants were those diagnosed by a specialist, willing to give informed consent, and able to complete interviews in Bengali. Nurses with acute back pain, current pregnancy, recent back surgery, or severe cognitive impairment were excluded.

Sample size and sampling method

In the absence of epidemiological data on CLBP prevalence among Bangladeshi nurses, convenience sampling was employed. A total of 104 female nurses with diagnosed CLBP were recruited through simple random sampling from hospital employment lists. This sample size exceeded the minimum requirement for multivariate regression analysis (minimum 10–15 subjects per predictor variable) (14). With four primary predictors in the final model, the sample of 104 participants provided adequate statistical power and yielded strong effect sizes (adjusted R^2=0.702).

Data collection methods

A structured questionnaire in Bengali and English was developed through literature review, expert consultation, and pre-testing with seven nurses. Pain severity was assessed using a 10-item scale (score range 0–30) and categorized as mild (≤10), moderate (11–19), or severe (≥20). Height and weight were measured using standard procedures to calculate BMI, classified according to WHO Asian-Pacific guidelines (15).

Data collection procedure

Two trained female nursing students and the principal investigator conducted face-to-face interviews following two days of intensive training. Each interview lasted 20–30 minutes, conducted privately during break periods under direct supervision.

Data quality assurance

Data quality was ensured through daily checking of completed questionnaires and immediate correction of errors. Data were entered twice into SPSS to reduce errors and cleaned by checking for out-of-range values and logical inconsistencies.

Data analysis

Data was analyzed using IBM SPSS Statistics (version 22). Descriptive analyses, bivariate analyses (eta correlation, F-tests, t-tests, $\alpha=0.05$), and multivariate linear regression were performed. Stepwise regression developed the final parsimonious model. Model assumptions were verified; variance inflation factors (VIF<10) confirmed the absence of multicollinearity.

Ethical considerations

The study was conducted in accordance with the Declaration of Helsinki and received ethical approval from the Director of Rangpur Medical College and Hospital. Written informed consent was obtained from all participants. Participation was voluntary, and confidentiality was ensured through data anonymization and secure storage.

Results

Sociodemographic profile

Table 1 presents sociodemographic characteristics. Mean age was 35.8±7.2 years, with the majority (53.8%, n=56) aged 30–40 years. Nearly all participants (99.0%, n=103) had graduate-level education. Most (91.3%, n=95) were married. Approximately 40% (n=41) had two children; 17.3% (n=18) had no children. Monthly family income: 68.3% (n=71) reported >40,000 BDT.

Clinical characteristics and pain burden

Table 2 summarizes clinical characteristics. BMI distribution showed 51.9% (n=54) normal BMI, 41.3% (n=43) overweight, and 6.7% (n=7) obese class I. Disc prolapse was present in 16.3% (n=17). The lumbo-sacral region was the most common pain location (60.6%, n=63), with pain radiation in 68.3% (n=71). Pain severity: mild 45.2% (n=47), moderate 41.3% (n=43), severe 13.5% (n=14); thus, 54.8% experienced moderate-to-severe CLBP.

Bivariate associations with pain severity

Table 3 presents bivariate analyses. Four variables showed significant associations with pain severity: age (eta=0.262, p=0.01), monthly family income (eta=0.247, p=0.05), number of children (eta=0.269, p=0.05), and BMI (eta=0.807, p<0.001). Education level, family history of arthritis, disc prolapse status, and postural pattern were not significantly associated.

Table 1. Sociodemographic characteristics of study participants (n=104)

Characteristic	Category	n	%
Age (years)	20–30	17	16.3
	30–40	56	53.8
	40–50	29	27.9
	50–60	2	1.9
	Mean ± SD: 35.8 ± 7.2		
Education level	Higher secondary	1	1.0
	Graduate	103	99.0
Marital status	Married	95	91.3
	Unmarried	9	8.7
Number of children	0	18	17.3
	1	24	23.1
	2	41	39.4
	3	18	17.3
	4	2	1.9
	5	1	1.0
Monthly family income (BDT)	3,000–5,000	6	5.8
	5,000–10,000	2	1.9
	20,000–40,000	25	24.0
	>40,000	71	68.3

BDT=Bangladeshi Taka; SD=standard deviation

Table 2. Clinical characteristics and pain profile of study participants (n=104)

Characteristic	Category	n	%
Body Mass Index (kg/m²)	Normal (18.5–22.9)	54	51.9
	Overweight (23.0–27.4)	43	41.3
	Obese Class I (≥27.5)	7	6.7
Disc prolapse	Yes	17	16.3
	No	87	83.7
Family history of arthritis	Yes	53	51.0
	No	51	49.0
Postural status	Mal-posture	30	28.8
	Good posture	74	71.2
Pain location	Lumbar	25	24.0
	Lumbo-sacral	63	60.6
	Sacral/coccygeal	16	15.4
Pain radiation	Yes	71	68.3
	No	33	31.7
Pain severity level	Mild (≤10 points)	47	45.2
	Moderate (11–19 points)	43	41.3
	Severe (≥20 points)	14	13.5

Table 3. Bivariate associations between selected variables and chronic low back pain severity (n=104)

Variable	Category	n	Eta	F-value	df	p-value
Age (years)	20–30	17	0.262	7.65	3, 100	0.01*
	30–40	56				
	40–50	29				
	50–60	2				
Monthly family income (BDT)	3,000–5,000	6	0.247	4.28	3, 100	0.05*
	5,000–10,000	2				
	20,000–40,000	25				
	>40,000	71				
Number of children	0	18	0.269	3.89	5, 98	0.05*
	1	24				
	2	41				
	3	18				
	≥4	3				
Body Mass Index	Normal	54	0.807	98.45	2, 101	<0.001***
	Overweight	43				
	Obese Class I	7				

*p<0.05; **p<0.01; ***p<0.001; BDT=Bangladeshi Taka; df=degrees of freedom

Independent predictors of pain severity

Multiple linear regression analysis (Table 4) identified four independent predictors explaining 70.2% of variance (adjusted R^2=0.702, F=50.944, p<0.001): BMI (B=0.925, p<0.001; R^2 change=0.702), monthly family income (B=0.044, p<0.05; R^2 change=0.076), number of children (B=0.070, p<0.05; R^2 change=0.050), and age (B=−0.094, p<0.05; R^2 change=0.043). All VIF values were <2.0.

Table 4. Multiple linear regression analysis of factors associated with chronic low back pain severity (n=104)

Variable	B	SE	β	R^2 change	p-value
Constant	8.456	1.234	–	0.002	<0.001
Age (years)	−0.094	0.042	−0.128	0.043	0.028*
Monthly family income (BDT)	0.044	0.019	0.156	0.076	0.022*
Number of children	0.070	0.031	0.142	0.050	0.026*
Body Mass Index (category)	0.925	0.089	0.743	0.702	<0.001***

Model summary: Multiple R=0.846; R^2=0.716; Adjusted R^2=0.702; SE=0.386; F=50.944 (df=4, 99); p<0.001

*p<0.05; ***p<0.001; B=unstandardized coefficient; β=standardized coefficient; BDT=Bangladeshi Taka. All VIF<2.0.

Discussion

This study provides novel evidence that CLBP represents a substantial occupational health burden among Bangladeshi female nurses, with severity strongly influenced by modifiable risk factors, particularly obesity, alongside family caregiving responsibilities. The key findings have important public health implications for health workforce sustainability in resource-limited settings.

The finding that 54.8% of participants experienced moderate-to-severe CLBP indicates a major occupational health crisis. This prevalence aligns with Sanjoy et al.'s (10) report of 73.3% CLBP among Bangladeshi nurses and falls within

international ranges (40–80%) (2,3). In Bangladesh's context of severe nursing shortages (nurse-to-population ratio 3:10,000 vs. WHO recommendation 25.4:10,000) (7), CLBP-related absenteeism, reduced productivity, and workforce attrition compound existing healthcare access barriers (11).

BMI emerged as by far the strongest predictor of CLBP severity, accounting for 70% of explained variance. Overweight and obese individuals experienced increased spinal loading, altered biomechanics, chronic low-grade inflammation, and reduced physical capacity, all amplifying pain in occupationally stressed spines (16,17). Heuch et al. (18) demonstrated in a large longitudinal study that overweight and obesity significantly increase the risk of chronic LBP effects that are likely amplified in occupational nursing cohorts due to cumulative biomechanical exposures. Concerningly, 48.1% of our sample were overweight or obese, substantially higher than Bangladesh's national adult overweight/obesity prevalence (19), suggesting occupational factors compound Bangladesh's ongoing nutrition transition (20).

The significant independent association between number of children and CLBP severity reveals how family caregiving responsibilities compound occupational health risks for female nurses. This "double burden" phenomenon, simultaneous paid work and unpaid domestic labor, carries important gender equity implications (21). In Bangladesh's cultural context, where traditional gender norms assign primary domestic responsibilities to women regardless of employment (22), this double burden is particularly pronounced. Family-friendly policies, including flexible scheduling, on-site childcare, adequate parental leave, and workload adjustments for caregivers, are not merely social benefits but occupational health necessities (23).

The counterintuitive positive association between family income and CLBP severity may reflect multiple overlapping mechanisms: nutrition transition effects (higher income promoting sedentary lifestyles and obesity (20]), detection bias (better healthcare access increasing diagnostic rates), and income as a proxy for occupational seniority and cumulative biomechanical exposure. These mechanisms are not mutually exclusive, and longitudinal studies are needed to clarify causality.

Our findings call for practical, multi-level action to protect and support healthcare workers. At the individual and workplace level, hospitals should strengthen occupational health programs, improve ergonomics, ensure safe staffing, and adopt family-friendly policies. At the health system level, occupational health should be integrated into nursing education, standards, workforce planning, and surveillance systems. At the population level, healthcare worker health should be included in national obesity prevention strategies (24).

Limitations

This cross-sectional design precludes causal inference. Single-center convenience sampling limits generalizability. The pain assessment tool lacks formal validation against established instruments (Oswestry Disability Index, Visual Analog Scale). Self-reported income and clinical variables may introduce bias. Unmeasured occupational exposures (shift patterns, patient handling frequency, workplace ergonomics) may confound associations. Small subgroup numbers limited statistical power for some analyses. Future prospective cohort studies, multi-center designs, and intervention trials are warranted.

Conclusion

This study highlights that chronic low back pain is a serious occupational health challenge among female nurses in Bangladesh, with severity strongly linked to modifiable factors, especially obesity, and intensified by family caregiving responsibilities. Workplace health programs focused on weight management, ergonomic improvements, adequate staffing, and family-friendly policies can significantly reduce this preventable burden. As Bangladesh advances toward universal health coverage and Sustainable Development Goal 3, safeguarding the health of nurses, who are the backbone of the healthcare system, must be a national priority.

Acknowledgements

The authors gratefully acknowledge the nursing staff at Rangpur Medical College Hospital for their participation. We thank the hospital administration for facilitating this research and Md Ashrafuzzaman for data collection support.

Funding

This research did not receive any funding. Authors' Contributions

Authors' Contributions

MTI conceptualized and designed the study, supervised data collection, performed data analysis, and drafted the manuscript. MKBS contributed to the study design, critically revised the manuscript, and approved the final version. MAA assisted with data analysis and manuscript preparation. MMH supervised the study and critically reviewed the manuscript. All authors read and approved the final manuscript.

Conflicts of Interest

The authors declare no competing interests.

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