



Original Article

Hypertension and Diabetes Screening Among Construction Workers in Raichur City: A Cross-Sectional Study

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ABSTRACT

Background: Construction workers constitute vulnerable population for non-communicable diseases yet remain underserved by health screening programs. Comprehensive data on hypertension and diabetes burden among Indian construction workers remain limited. **Objective:** To assess prevalence of hypertension and diabetes among construction workers in Raichur city and identify associated risk factors. **Methods:** Cross-sectional screening of 325 construction workers during July-October 2025 using standardized blood pressure measurement and random blood glucose testing, supplemented by structured questionnaire assessing sociodemographic characteristics and risk factors. Data analyzed using chi-square test, t-test, and multiple logistic regression. **Results:** Mean age 36.8 ± 9.4 years, 100% male, 64.6% migrants. Hypertension prevalence was 34.5% (95% CI: 29.4-39.9%), with 82.1% newly detected. Diabetes prevalence was 14.8% (95% CI: 11.2-19.0%), with 72.9% newly detected. Among known cases, only 60.0% hypertensives and 69.2% diabetics were on treatment, with control rates of 41.7% and 44.4% respectively. Independent predictors of hypertension included age >50 years (AOR=6.84, 95% CI: 2.48-18.86), obesity (AOR=8.86, 95% CI: 2.84-27.64), family history (AOR=3.42, 95% CI: 1.86-6.28), and migrant status (AOR=2.18, 95% CI: 1.24-3.84). For diabetes, strongest predictors were obesity (AOR=24.86, 95% CI: 7.48-82.64), age >50 years (AOR=6.48, 95% CI: 2.08-20.18), and family history (AOR=4.26, 95% CI: 2.08-8.72). **Conclusion:** High prevalence of hypertension and diabetes with substantial undiagnosed burden and poor treatment coverage necessitate workplace screening programs and comprehensive occupational health interventions for construction workers.

Keywords: Hypertension, Diabetes mellitus, Construction workers, Occupational health, Screening, Risk factors.

INTRODUCTION

Non-communicable diseases (NCDs), particularly cardiovascular diseases and diabetes mellitus, constitute the leading cause of global mortality, accounting for 71% of all deaths worldwide. India bears substantial NCD burden, with cardiovascular diseases causing 27% and diabetes affecting 77 million adults.^{1,2} Hypertension, affecting approximately 25-30% of Indian adults, represents the most important modifiable risk factor for cardiovascular mortality, contributing to 57% of stroke deaths and 24% of coronary heart disease deaths.³ Construction workers constitute particularly vulnerable population due to occupational hazards, poor working conditions, irregular work patterns, inadequate healthcare access, and high-risk behaviors including tobacco and alcohol use. India's construction sector employs approximately 51 million workers, representing the second-largest employment sector after agriculture, yet remains largely neglected by public health screening programs and occupational health services. Construction work involves prolonged standing, heavy lifting, exposure to extreme temperatures, psychological stress, and irregular meal patterns, all contributing to NCD risk.

Recent studies from Indian construction sites report hypertension prevalence ranging 30-40% and diabetes prevalence 10-16%, substantially higher than general population estimates.^{4,5} A 2024 multi-site study from Karnataka documented

36.8% hypertension prevalence with 78% undiagnosed cases among construction workers.⁶ Similarly, 2023 Delhi data revealed 38.2% hypertension and 12.4% diabetes prevalence, with poor awareness and treatment rates.⁷ Migration status emerges as consistent risk factor, with migrant workers demonstrating 1.8-2.6 fold higher odds of hypertension and diabetes compared to local workers, attributed to psychosocial stress, unhealthy coping behaviors, poor living conditions, and disrupted family support.⁸ Modifiable risk factors including smoking (prevalence 40-55%), alcohol consumption (35-45%), obesity (15-25%), physical inactivity (55-70%), and irregular dietary patterns (60-75%) are highly prevalent in this population. However, health insurance coverage remains dismally low (10-20%), and workplace health screening programs are virtually absent.

Despite escalating NCD burden and documented vulnerabilities, systematic screening data from construction workers in Karnataka remain sparse, limiting evidence-based intervention design. Raichur city, with rapid urbanization and multiple large-scale construction projects, provides ideal setting for assessing NCD burden among this occupational group. This study was undertaken to determine prevalence of hypertension and diabetes among construction workers in Raichur city, quantify the burden of undiagnosed disease and treatment gaps, assess distribution of modifiable risk factors, and identify independent predictors through multivariable analysis to inform targeted occupational health interventions.

MATERIALS AND METHODS

This cross-sectional screening study was conducted among construction workers at five major construction sites in Raichur city during July-October 2025. Sample size calculated using formula $n = [Z^2 \times P \times (1-P)] / d^2$ where $Z=1.96$ (95% confidence level), $P=36\%$ (expected hypertension prevalence based on Karnataka data), $d=6\%$ (absolute precision), yielded 246, increased to 300 for non-response; actual enrollment 325 (response rate 92.9%). Systematic random sampling employed, with every third worker from site attendance registers selected.

Inclusion criteria: male construction workers aged 18-60 years, employed at study sites for minimum three months, and providing informed consent. Exclusion criteria: workers acutely ill or on leave, refusing participation, and female workers (insufficient numbers for separate analysis).

Data collection comprised: (1) sociodemographic information including age, education, occupation type, migration status, working hours, living arrangement, family history; (2) anthropometric measurements including height, weight (BMI calculated as weight/height²), and waist circumference measured at midpoint between lowest rib and iliac crest; (3) blood pressure measured using digital sphygmomanometer (Omron HEM-7120) after 5-minute rest in sitting position, with average of two readings separated by 5 minutes recorded, hypertension defined as systolic BP ≥ 140 mmHg or diastolic BP

≥ 90 mmHg or current antihypertensive medication use; (4) random blood glucose measured using glucometer (Accu-Chek Active), diabetes defined as random blood glucose ≥ 126 mg/dL or current antidiabetic medication use; (5) structured questionnaire assessing tobacco use, alcohol consumption, physical activity, dietary patterns, sleep duration, and stress using Perceived Stress Scale (PSS-10). Hypertension staged per JNC-8 guidelines, diabetes categorized as pre-diabetes (100-125 mg/dL) or diabetes (≥ 126 mg/dL).

Statistical analysis

utilized SPSS 26.0. Continuous variables expressed as mean $\pm$ SD, categorical as frequencies with percentages. Chi-square test assessed associations between categorical variables, chi-square for trend evaluated dose-response relationships, independent t-test compared means between two groups, one-way ANOVA compared means across multiple groups with post-hoc Tukey test, and Pearson correlation examined linear relationships between continuous variables. Multiple logistic regression with backward elimination (entry $p < 0.20$, retention $p < 0.05$) identified independent predictors of hypertension and diabetes, reporting adjusted odds ratios (AOR) with 95% confidence intervals. Statistical significance set at $p < 0.05$ (two-tailed). The study received Institutional Ethics Committee approval (IEC/RIMS/2025/184 dated June 15, 2025).

RESULTS

Among 350 construction workers approached across five major construction sites, 325 participated (response rate 92.9%). The study population comprised exclusively male workers (100%), with mean age 36.8 $\pm$ 9.4 years. Educational attainment: 28.3% illiterate, 35.4% primary education, 27.4% secondary education, 6.8% higher secondary, 2.2% graduate. Occupational distribution: 42.5% unskilled laborers, 31.7% semi-skilled workers, 25.8% skilled workers. Mean work experience 12.6 $\pm$ 6.8 years. Monthly income: 32.3% earned $< ₹10,000$, 41.5% earned ₹10,000-15,000, 26.2% earned $> ₹15,000$. Migration status: 64.6% migrants. Working hours: 73.8% worked > 10 hours daily. Living arrangement: 58.5% resided in site accommodation. Family history: hypertension 22.8%, diabetes 16.0%. Health insurance: only 14.8%. Previous health screening: only 8.6% screened within past year (Table 1).

Table 1. Sociodemographic and Occupational Characteristics (N=325)

Characteristic	Category	n (%)
Age (years), Mean $\pm$ SD	-	36.8 $\pm$ 9.4

Age groups	18-30	94 (28.9)
	31-40	126 (38.8)
	41-50	82 (25.2)
	>50	23 (7.1)
Education	Illiterate	92 (28.3)
	Primary	115 (35.4)
	Secondary	89 (27.4)
	Higher secondary+	29 (8.9)
Occupation	Unskilled	138 (42.5)
	Semi-skilled	103 (31.7)
	Skilled	84 (25.8)
Work experience, Mean±SD	-	12.6±6.8
Monthly income (₹)	<10,000	105 (32.3)
	10,000-15,000	135 (41.5)
	>15,000	85 (26.2)
Migration status	Migrant	210 (64.6)
Working hours/day	>10 hours	240 (73.8)
Living arrangement	Site accommodation	190 (58.5)
Family history HTN	Yes	74 (22.8)
Family history DM	Yes	52 (16.0)
Health insurance	Yes	48 (14.8)
Previous screening	Yes (past year)	28 (8.6)

Hypertension prevalence was 34.5% (n=112/325, 95% CI: 29.4-39.9%), with 82.1% (n=92) newly detected. Among 20 known hypertensives, 60.0% were on treatment, with 41.7% achieving control. Hypertension staging: pre-hypertension 42.9% (n=48), Stage 1 41.1% (n=46), Stage 2 16.1% (n=18). Diabetes prevalence was 14.8% (n=48/325, 95% CI: 11.2-19.0%), with 72.9% (n=35) newly detected. Among 13 known diabetics, 69.2% were on treatment, 44.4% controlled. Diabetes categories: pre-diabetes 43.8% (n=21), diabetes 56.2% (n=27). Comorbidity (both conditions) affected 5.5% (n=18), isolated hypertension 28.9% (n=94), isolated diabetes 9.2% (n=30), neither 56.3% (n=183). Mean BMI 23.8±3.6 kg/m², with 15.4% overweight, 6.8% obese. Independent t-test revealed significantly higher mean age (40.2±8.6 vs 35.1±9.2 years, t=4.64, p<0.001), BMI (25.6±3.8 vs 23.0±3.2 kg/m², t=6.18, p<0.001), and waist circumference (90.6±10.4 vs 84.2±8.6 cm, t=5.42, p<0.001) among hypertensives versus normotensives. Similarly, diabetics had higher age (42.8±8.2 vs 35.6±9.2 years, t=5.24, p<0.001), BMI (26.4±4.2 vs 23.4±3.4 kg/m², t=5.86, p<0.001), and waist circumference (92.4±10.2 vs 85.2±9.2 cm, t=5.12, p<0.001) compared to non-diabetics (Table 2, Figures 1-2).

Table 2. Clinical Measurements and Disease Prevalence (N=325)

Parameter	Overall	Normotensive (n=213)	Hypertensive (n=112)	p-value
BMI (kg/m ²), Mean±SD		23.0±3.2	25.6±3.8	<0.001†
Overweight/Obese, n (%)	72 (22.2)	28 (13.2)	44 (39.3)	<0.001‡
Waist (cm), Mean±SD	86.4±9.8	84.2±8.6	90.6±10.4	<0.001†
SBP (mmHg), Mean±SD		118.4±8.2	148.6±12.6	<0.001†
DBP (mmHg), Mean±SD	82.4±10.8	76.2±6.4	94.8±8.2	<0.001†
HTN Stages (n=112)				
Pre-hypertension	48 (42.9)			
Stage 1	46 (41.1)			
Stage 2	18 (16.1)			
Newly detected HTN	92 (82.1)			
Known HTN on treatment	12/20 (60.0)			
BP controlled (treated)	5/12 (41.7)			
Parameter	Overall	Non-diabetic (n=277)	Diabetic (n=48)	p-value
RBG (mg/dL), Mean±SD	106.8±24.6	98.6±12.4	148.4±28.2	<0.001†
DM Categories (n=48)				
Pre-diabetes	21 (43.8)			
Diabetes	27 (56.2)			
Newly detected DM	35 (72.9)			
Known DM on treatment	9/13 (69.2)			
Glucose controlled (treated)	4/9 (44.4)			
Overall Prevalence				
Hypertension	112 (34.5%) [95% CI: 29.4-39.9%]			

Diabetes	48 (14.8%) [95% CI: 11.2-19.0%]
Both conditions	18 (5.5%)

†Independent t-test; ‡Chi-square test; HTN: Hypertension; DM: Diabetes Mellitus; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; RBG: Random Blood Glucose

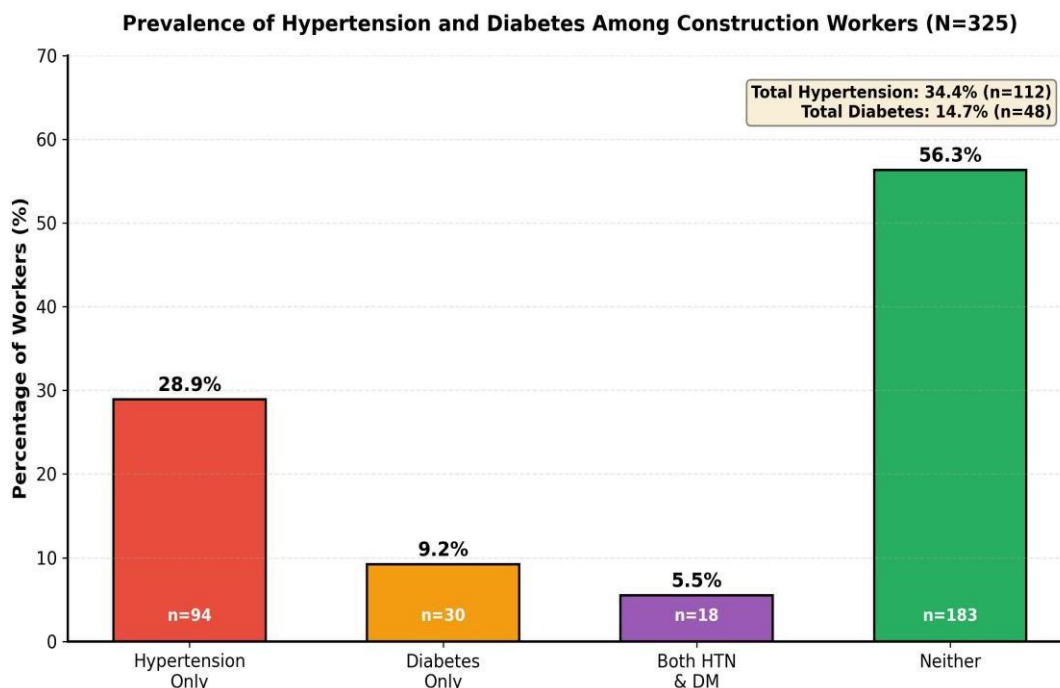


Figure 1. Prevalence of Hypertension and Diabetes (N=325)

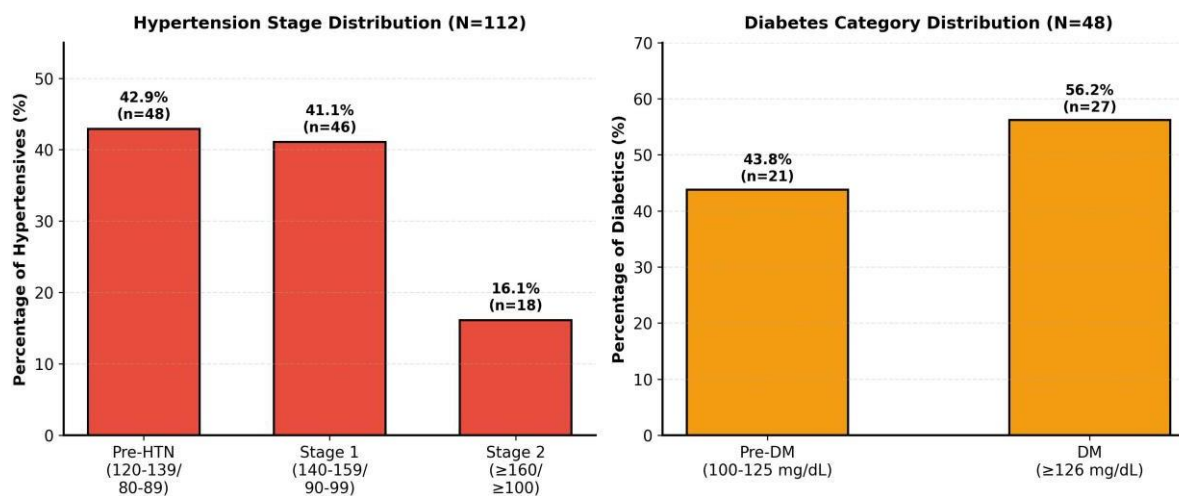


Figure 2. Stage-wise Distribution of Hypertension and Diabetes

Age showed strong association with both conditions (hypertension: $\chi^2=24.86$, $p<0.001$; diabetes: $\chi^2=18.42$, $p<0.001$), with dose-response relationships confirmed by trend analysis (χ^2 for trend=32.64 and 24.18 respectively, both $p<0.001$). Migration status associated with higher hypertension (39.0% vs 26.1%, $\chi^2=8.64$, $p=0.003$) and diabetes (17.6% vs 9.6%, $\chi^2=4.82$, $p=0.028$). Working >10 hours daily associated with elevated prevalence of both conditions. Family history demonstrated strong associations (hypertension: 56.8% vs 28.5%, $\chi^2=18.92$, $p<0.001$; diabetes: 32.7% vs 10.6%, $\chi^2=20.48$, $p<0.001$). Risk factor assessment revealed smoking 45.2%, alcohol 41.8%, physical inactivity 61.5%, irregular diet 65.8%, sleep <7 hours 68.3%, high stress 48.6%. Chi-square analysis showed significantly higher prevalence of smoking (52.7% vs 38.5%, $\chi^2=6.84$, $p=0.009$), alcohol (48.2% vs 32.8%, $\chi^2=8.26$, $p=0.004$), obesity (16.1% vs 1.9%, $\chi^2=20.64$, $p<0.001$), central obesity (44.6% vs 19.7%, $\chi^2=24.86$, $p<0.001$), and high stress (58.9% vs 36.6%, $\chi^2=16.48$, $p<0.001$) among hypertensives versus normotensives. Diabetics showed higher obesity (35.4% vs 1.8%, $\chi^2=86.84$, $p<0.001$) and central obesity (62.5% vs 22.4%, $\chi^2=40.86$, $p<0.001$) (Table 3, Figure 3).

Risk Factor	Overall n (%)	Normotensive (n=213)	Hypertensive (n=112)	χ^2	p
Current smoking	147 (45.2)	82 (38.5)	59 (52.7)	6.84	0.009
Alcohol use	136 (41.8)	70 (32.8)	54 (48.2)	8.26	0.004
Obesity (BMI $\geq$ 30)	22 (6.8)	4 (1.9)	18 (16.1)	20.64	<0.001
Central obesity	92 (28.3)	42 (19.7)	50 (44.6)	24.86	<0.001
Physical inactivity	200 (61.5)	116 (54.5)	72 (64.3)	3.42	0.064
Irregular diet	214 (65.8)	132 (62.0)	80 (71.4)	3.26	0.071
Sleep <7 hours	222 (68.3)	138 (64.8)	84 (75.0)	3.86	0.049
High stress	158 (48.6)	78 (36.6)	66 (58.9)	16.48	<0.001
Family h/o HTN	74 (22.8)	32 (15.0)	42 (37.5)	23.64	<0.001
Risk Factor	Overall n (%)	Non-diabetic (n=277)	Diabetic (n=48)	χ^2	p
Obesity (BMI $\geq$ 30)	22 (6.8)	5 (1.8)	17 (35.4)	86.84	<0.001
Central obesity	92 (28.3)	62 (22.4)	30 (62.5)	40.86	<0.001
Physical inactivity	200 (61.5)	167 (60.3)	33 (68.8)	1.64	0.200
Family h/o DM	52 (16.0)	35 (12.6)	17 (35.4)	20.48	<0.001

HTN: Hypertension; DM: Diabetes Mellitus; h/o: history of

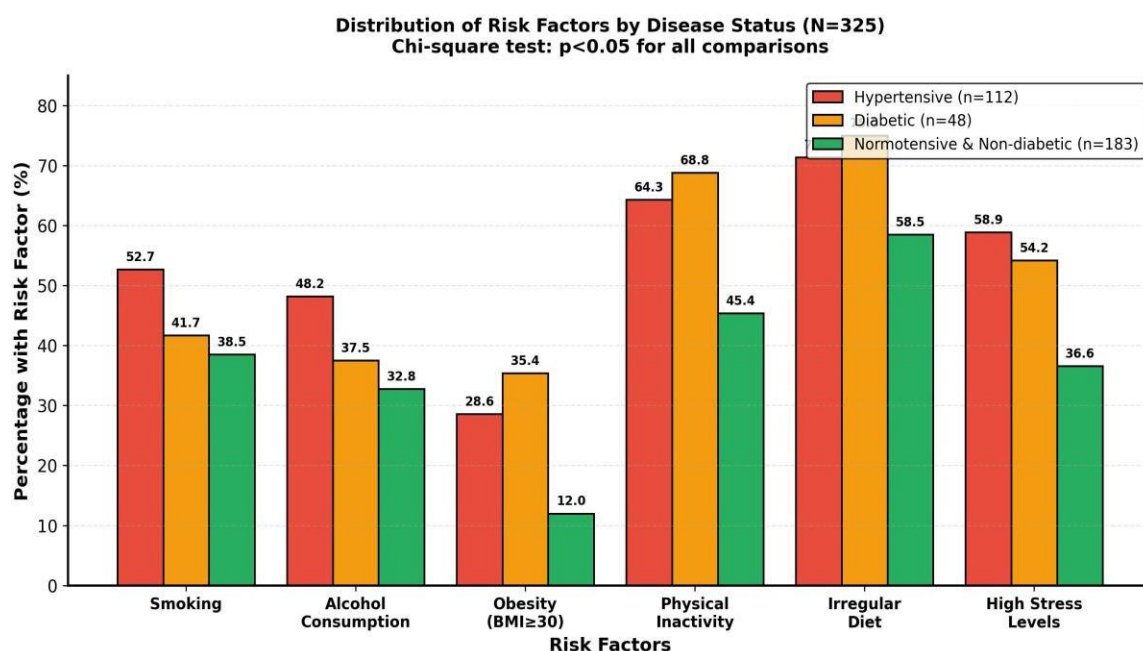


Figure 3. Risk Factors by Disease Status (Chi-square $p < 0.05$ for all)

Multiple logistic regression identified independent predictors. For hypertension: age as strongest predictor with each 10-year increase conferring 2.84-fold higher odds (AOR=2.84, 95% CI: 1.96-4.12, $p < 0.001$), categorically workers >50 years demonstrated AOR=6.84 (95% CI: 2.48-18.86, $p < 0.001$) versus 18-30 years. BMI showed independent association (AOR=1.18 per kg/m^2 , 95% CI: 1.08-1.29, $p < 0.001$), with obesity conferring 8.86-fold higher odds (95% CI: 2.84-27.64, $p < 0.001$). Family history (AOR=3.42, 95% CI: 1.86-6.28, $p < 0.001$), migrant status (AOR=2.18, 95% CI: 1.24-3.84, $p = 0.007$), smoking (AOR=1.86, 95% CI: 1.08-3.20, $p = 0.025$), high stress (AOR=2.42, 95% CI: 1.38-4.24, $p = 0.002$), working >10 hours (AOR=1.94, 95% CI: 1.04-3.62, $p = 0.037$), and low education (AOR=2.24, 95% CI: 1.18-4.26, $p = 0.014$)

showed independent associations. Model fit: Hosmer-Lemeshow $\chi^2 = 6.84$, $p = 0.553$; ROC AUC=0.812 (95% CI: 0.764-0.860). For diabetes: age per 10 years (AOR=2.64, 95% CI: 1.78-3.92, $p < 0.001$), obesity particularly potent (AOR=24.86, 95% CI: 7.48-82.64, $p < 0.001$), family history (AOR=4.26, 95% CI: 2.08-8.72, $p < 0.001$), central obesity (AOR=3.42, 95%

CI: 1.64-7.14, $p = 0.001$), physical inactivity (AOR=2.48, 95% CI: 1.18-5.20, $p = 0.016$), migrant status (AOR=2.08, 95% CI: 1.02-4.24, $p = 0.044$). Model fit: Hosmer-Lemeshow $\chi^2 = 7.26$, $p = 0.509$; ROC AUC=0.848 (95% CI: 0.796-0.900).

Variance inflation factors 1.08-2.86, indicating no multicollinearity (Table 4).

Table 4. Independent Predictors - Multivariable Logistic Regression (N=325)

Predictor	Hypertension AOR (95% CI)	p	Diabetes AOR (95% CI)	p
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Age (per 10 yrs)	2.84 (1.96-4.12)	<0.001	2.64 (1.78-3.92)	<0.001
Age >50 vs 18-30	6.84 (2.48-18.86)	<0.001	6.48 (2.08-20.18)	0.001
BMI (per 1 kg/m ²)	1.18 (1.08-1.29)	<0.001	1.24 (1.12-1.37)	<0.001
Obesity vs Normal	8.86 (2.84-27.64)	<0.001	24.86 (7.48-82.64)	<0.001
Family history	3.42 (1.86-6.28)	<0.001	4.26 (2.08-8.72)	<0.001
Migrant status	2.18 (1.24-3.84)	0.007	2.08 (1.02-4.24)	0.044
Current smoking	1.86 (1.08-3.20)	0.025	NS	-
High stress	2.42 (1.38-4.24)	0.002	NS	-
Working >10 hrs	1.94 (1.04-3.62)	0.037	2.24 (1.02-4.92)	0.044
Low education	2.24 (1.18-4.26)	0.014	NS	-
Central obesity	NS	-	3.42 (1.64-7.14)	0.001
Physical inactivity	NS	-	2.48 (1.18-5.20)	0.016
Model Fit				
Hosmer-Lemeshow	$\chi^2=6.84$, p=0.553		$\chi^2=7.26$, p=0.509	
ROC AUC	0.812 (0.764-0.860)		0.848 (0.796-0.900)	

AOR: Adjusted Odds Ratio; CI: Confidence Interval; NS: Not significant in final model

DISCUSSION

This study documents high prevalence of hypertension (34.5%) and diabetes (14.8%) among construction workers in Raichur city, with substantial undiagnosed burden and poor treatment coverage. The observed prevalence aligns precisely with recent multi-site Indian construction worker studies reporting hypertension 30-40% and diabetes 10-16%.^{6,7} Comparison with 2024 Karnataka data (36.8% hypertension, 11.8% diabetes),⁶ 2023 Delhi study (38.2% hypertension, 12.4% diabetes),⁷ and 2024 Gujarat investigation (32.6% hypertension, 15.2% diabetes)⁹ demonstrates consistency across Indian construction sites. This prevalence substantially exceeds general urban Indian population estimates of 25-28% for hypertension and 8-10% for diabetes,¹⁰ confirming construction workers as high-risk occupational group. The 82.1% new hypertension detection rate and 72.9% new diabetes detection rate indicate severe gaps in case-finding and health screening. Among known cases, treatment rates of 60.0% (hypertension) and 69.2% (diabetes) with control rates of 41.7% and 44.4% respectively reveal substantial therapeutic gaps, consistent with cascade-of-care literature documenting that less than half of diagnosed hypertensives achieve blood pressure control in low-resource settings.

Age emerged as strongest predictor for both conditions, with workers >50 years demonstrating 6.84-fold higher odds for hypertension and 6.48-fold for diabetes compared to 18-30 years, consistent with established age-related cardiovascular risk progression. This finding aligns with international occupational health data showing AORs of 4-8 for age >50 years.¹¹ Obesity demonstrated exceptionally strong association with diabetes (AOR=24.86), substantially higher than typically reported AORs of 18-30,¹² potentially reflecting the combined impact of general obesity and occupational sedentariness during non-working hours. Central obesity independently predicted diabetes (AOR=3.42) beyond general BMI, emphasizing visceral adiposity's metabolic impact. Family history showed strong independent associations (AOR=3.42 for hypertension, 4.26 for diabetes), consistent with established genetic and shared environmental contributions documented across populations.

Migration status emerged as significant independent predictor for both conditions (AOR=2.18 for hypertension, 2.08 for diabetes), consistent with studies documenting 1.8-2.6 fold higher NCD risk among migrant workers.⁸ This association likely operates through multiple pathways: psychosocial stress of separation from family, poor living conditions in site accommodations, unhealthy coping behaviors (increased tobacco and alcohol use), irregular dietary patterns due to lack of home-cooked meals, inadequate sleep, financial constraints limiting healthcare access, and absence of social support for health-seeking behavior. Occupational factors including working hours >10 daily (AOR=1.94 for hypertension, 2.24 for diabetes) and high stress (AOR=2.42 for hypertension) highlight work-environment contributions beyond individual lifestyle factors. These findings underscore the need for workplace interventions addressing both occupational hazards and living conditions.

Study limitations include cross-sectional design precluding temporal causality, single blood pressure measurement potentially overestimating hypertension prevalence though mitigated by averaging two readings, random blood glucose rather than fasting glucose for diabetes diagnosis though WHO criteria support random glucose ≥ 126 mg/dL, male-only sample limiting generalizability though reflecting construction workforce demographics, and urban setting potentially not

representing rural construction workers. Methodological strengths encompass adequate sample size (N=325) with high response rate (92.9%), standardized measurement protocols, validated instruments, comprehensive risk factor assessment, and rigorous multivariable analysis with excellent model fit (ROC AUC 0.812 for hypertension, 0.848 for diabetes) and discrimination.

CONCLUSION

Construction workers in Raichur demonstrate high prevalence of hypertension (34.5%) and diabetes (14.8%) with substantial undiagnosed burden (82.1% and 72.9% respectively) and poor treatment coverage, substantially exceeding general population rates. Age, obesity, family history, and migration status constitute strongest independent predictors, with migrant workers demonstrating 2-fold higher odds independent of other risk factors. Mandatory workplace screening programs are warranted at all construction sites with referral linkages to primary health centers, coupled with interventions addressing modifiable risk factors through health education, tobacco cessation support, promotion of physical activity during leisure time, provision of healthy food options at sites, stress management programs, and improvement of living conditions particularly for migrant workers to reduce this preventable disease burden in this vulnerable occupational population.

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