

# Hypertension and Lifestyle Determinants in Public Transport Drivers: A Sector-specific Study in Coimbatore, Tamil Nadu

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## Abstract

**Introduction:** Cardiovascular diseases are a leading cause of death worldwide, prompting this investigation into hypertension – a key risk factor – among a vulnerable group, bus drivers, who may be affected by job-related stress and health behaviors. **Materials and Methods:** This cross-sectional analysis evaluated 800 male TNSTC bus drivers from Coimbatore using a multistage sampling method. Interviews, physical measurements, and blood pressure assessments provided the data, which were subjected to comprehensive statistical analysis. **Results:** A concerning 49.9% of drivers were hypertensive, and 27.75% did not have their condition under control. Increased risk was linked with advancing age (those above 51 were 3.28 times more at risk than those under 30), lower educational attainment, familial hypertension history, and lifestyle choices, including sedentary habits, excessive salt consumption, and substance use. A striking correlation was observed between obesity and hypertension (odds ratio: 1.36; 95% confidence interval: 1.09–1.69). **Conclusion:** This research highlights an alarming rate of hypertension within the bus driver cohort, influenced by both modifiable and non modifiable risk factors. It underscores the urgent need for targeted health programs, proactive screenings, and educational initiatives. Expanding the study to other centers will provide a broader context for these findings.

**Keywords:** Bus drivers, cardiovascular diseases, hypertension, lifestyle factors, occupational health

## INTRODUCTION

Noncommunicable diseases (NCDs) pose a formidable threat to global health, distinguished by their chronicity, progressive nature, and delayed onset. At the helm, cardiovascular diseases (CVDs) claim nearly 71% of mortalities, contributing to almost half the global disease burden.<sup>[1-3]</sup> Among the myriad of risk factors for NCDs, hypertension is pivotal, with some risks modifiable by lifestyle interventions and others not.<sup>[4]</sup> Modernization and economic advances have led to more sedentary lifestyles and a spike in substance use, factors that fuel the rise of hypertension.<sup>[5]</sup>

Occupational health risks, especially within the driving profession, stem from the stress of stringent schedules and lengthy hours.<sup>[6]</sup> Surveillance by the National Institute of Occupational Safety and Health in the USA indicates an elevated incidence of hypertension in certain work

demographics.<sup>[7]</sup> Lifestyle choices among drivers, including decreased physical activity and increased tobacco usage, lead to a greater frequency of CVD risk factors relative to the broader population.<sup>[6-8]</sup> Moreover, stressors such as traffic congestion and customer service obligations compound the strain on drivers.<sup>[9]</sup> Bus drivers, in particular, demonstrate a significant correlation between hypertension and associated lifestyle comorbidities like obesity.<sup>[10]</sup>

Prompted by a scarcity of data, this investigation seeks to ascertain the prevalence and influencing factors of hypertension among bus drivers at Tamil Nadu State Transport Corporation (TNSTC in Coimbatore). The study aims to quantify hypertension rates and scrutinize its correlated risk elements among this group of professionals.

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## MATERIALS AND METHODS

This community-based cross-sectional investigation surveyed TNSTC bus drivers in Coimbatore from January to December 2019. Drawing from Rao *et al.*'s findings, which reported a hypertension prevalence of 36% among Andhra Pradesh State Road Transport Corporation (APSRTC) bus drivers in Visakhapatnam,<sup>[1]</sup> our sample size was determined. Considering a 95% confidence interval (CI), a relative precision of 10%, and accounting for a 15% nonresponse rate, we rounded our target sample size to 800. Eligible participants were those with at least 1 year of service at TNSTC, which operates across six regions in Tamil Nadu, including the Coimbatore region with four districts and 11 bus depots. Out of the total 2618 drivers, multistage sampling led to the selection of five depots through simple random sampling. The final sample adhered to the probability proportionate to size sampling method from these depots, totaling 1681 drivers.

With approval from the institutional human ethical committee and after securing informed consent, participants engaged in a semistructured interview using a validated questionnaire. The data encompassed sociodemographic and occupational details, sleep patterns, diet, physical activity, medical history including hypertension, diabetes, cerebrovascular events, behavioral history, perceived stress levels (Perceived Stress Scale-4 [PSS-4]), and anthropometric measurements with blood pressure recordings. Institutional ethics committee approval number and date: Ref. No.: IHEC/160/ Community Medicine/ 12/2018 dated 12.12.2018.

## RESULTS

In our investigation of bus drivers in Coimbatore district, we engaged 800 male participants from local depots to gauge the prevalence of hypertension. The results have been carefully cataloged according to key metrics:

Figure 1 shows that a high level of stress was perceived by 20.9% of the participants and the moderate stress level was 63.5% among the participants. Stress was low in 15.6% of the participants. The prevalence of newly diagnosed hypertension was 19.4% and 30.5% of the study participants were already known hypertensives. The overall prevalence of hypertension in this study was 49.9%. Among those hypertensives, 222 (27.75%) participants did not have blood pressure under control, putting them at risk of developing complications.

Table 1 shows that the relationship between sociodemographic characteristics and hypertension cases among bus drivers, the study participants belong to 51–60 years had 3.28 times (95% CI: 1.99–5.39) higher risk of having hypertension when compared to the participants belonging to the age group <30 years, and it is statistically significant. Hypertension was found to be significantly more among those who had a lower education qualification when compared to those who graduated (odds ratio [OR] [95% CI]: 1.74 [1.02–2.94];  $P = 0.015$ ).

The study, involving 800 bus drivers, found a notable association between hypertension and several lifestyle factors. Individuals with a family history of hypertension had a 16% increased likelihood of having the condition themselves (OR: 1.16;  $P = 0.038$ ). Those with diabetes had an even higher risk, at 55% (OR: 1.55;  $P < 0.001$ ). Elevated blood cholesterol levels were also linked to a significant risk increase (OR: 1.41;  $P = 0.002$ ).

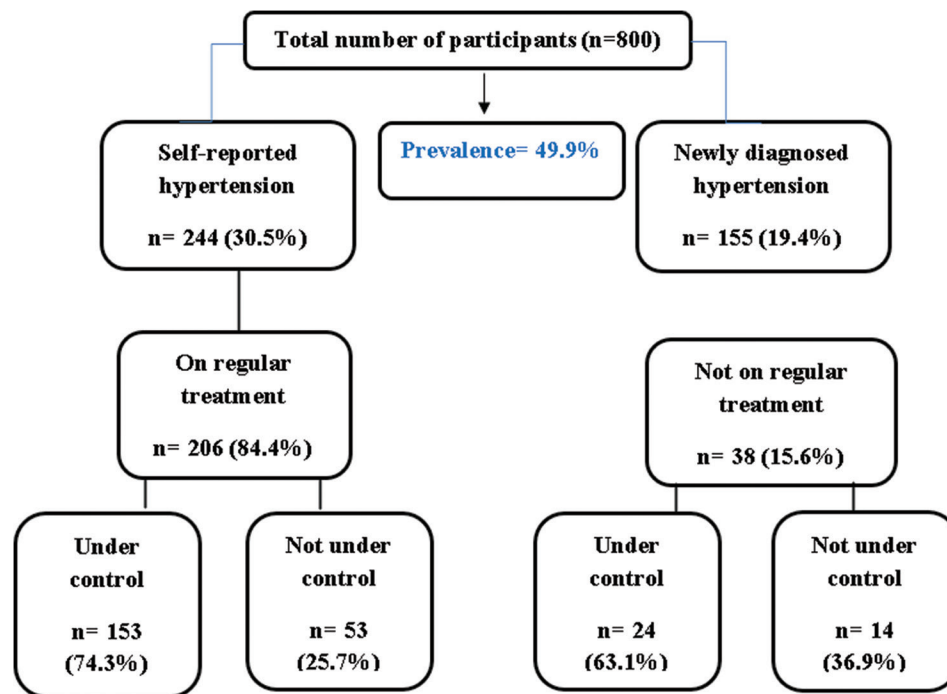
However, the history of myocardial infarction did not show a significant correlation with hypertension (OR: 1.18;  $P = 0.194$ ). Diet type emerged as a determinant; those on a mixed diet faced a higher risk than vegetarians (OR: 1.43;  $P = 0.022$ ). Excessive salt intake was associated with a 25% higher risk of developing hypertension (OR: 1.25;  $P = 0.014$ ). Physical inactivity and substance use were also risk factors, with inactive individuals facing a 20% increased risk (OR: 1.20;  $P = 0.028$ ), smokers an 18% increased risk (OR: 1.18;  $P = 0.020$ ), and smokeless tobacco users a 23% increased risk (OR: 1.23;  $P = 0.016$ ). Alcohol consumers had a 23% increased risk compared to nondrinkers (OR: 1.23;  $P = 0.002$ ). Finally, obesity was significantly correlated with hypertension, with obese individuals having a 36% increased risk (OR: 1.36;  $P = 0.033$ ).

In assessing the impact of driving patterns on hypertension among 800 bus drivers, a distinct trend was observed. Those with 11–20 years of driving experience exhibited a 50% increased risk of hypertension (OR: 1.50;  $P < 0.001$ ), which escalated to a 56% risk for those with 21–30 years of experience (OR: 1.56;  $P < 0.001$ ). Drivers in the most experienced bracket, with over 30 years on the job, were more than twice as likely to have hypertension (OR: 2.18;  $P < 0.001$ ). Daily driving hours also influenced hypertension risk; those driving 8 h or less had a higher risk (OR: 1.27;  $P < 0.001$ ) compared to those driving more. Night shifts, however, did not show a significant effect on hypertension rates, with those doing <10 night shifts per month having an OR of 1.40 ( $P = 0.286$ ). This analysis underscores the clear association between the length and patterns of driving with the risk of developing hypertension.

In our study involving 800 participants, we explored the relationship between perceived stress levels, as measured by the PSS-4, and the prevalence of hypertension. Among those reporting high stress, 55.1% were found to have hypertension, yielding an OR of 1.21; however, this association did not reach statistical significance ( $P = 0.108$ ). Participants with moderate stress levels showed a slightly lower hypertension prevalence of 49.2%, with an OR of 1.08, which also lacked statistical significance ( $P = 0.469$ ). The group reporting low-stress levels served as the reference category. Despite a substantial proportion, approximately 42.75%, of hypertensive individuals reporting moderate-to-high-stress levels, the study did not establish a statistically significant link between stress levels and hypertension.

## DISCUSSION

The study participants belonging to the age group more than



**Figure 1:** Prevalence of hypertension among the bus driver ( $n = 800$ )

**Table 1: Relationship between sociodemographic characteristics and hypertension cases among bus drivers**

Sociodemographic details	Participants number	Hypertension		OR (95% CI)	P
		Yes ( $n=399$ ), $n$ (%)	No ( $n=401$ ), $n$ (%)		
Age (years)					
21–30	63	13 (20.6)	50 (79.4)	Reference	
31–40	279	114 (40.9)	165 (59.1)	1.98 (1.20–3.28)	0.002
41–50	316	176 (55.7)	140 (44.3)	2.70 (1.65–4.42)	<0.001
51–60	142	96 (67.6)	46 (32.4)	3.28 (1.99–5.39)	<0.001
Level of education					
Up to high school	429	219 (51.0)	210 (49.0)	1.74 (1.02–2.94)	0.015
Higher secondary	279	146 (52.3)	133 (47.7)	1.78 (1.04–3.03)	0.011
Diploma	58	24 (41.4)	34 (58.6)	1.41 (0.77–2.57)	0.251
Graduate and above	34	10 (29.4)	24 (70.6)	Reference	
Socioeconomic status					
Class-1	393	209 (53.2)	184 (46.8)	Reference	
Class-2	366	170 (46.4)	196 (53.6)	0.87 (0.76–1.01)	0.063
Class-3	40	20 (50.0)	20 (50.0)	0.94 (0.68–1.23)	0.701
Class-4	1	0	1 (100.0)	–	0.288
Place of residence					
Urban	382	201 (52.6)	181 (47.4)	1.23 (0.93–1.63)	0.138
Rural	418	198 (47.4)	220 (52.67)	Reference	

OR: Odds ratio, CI: Confidence interval

51 years had 3.28 times (95% CI: 1.99–5.39,  $P < 0.001$ ) higher risk of having hypertension when compared to the participants belonging to the age group <30 years. The studies conducted by Sangaleti *et al.* among drivers in Brazil and Odeyinka and Ajayi among drivers in Nigeria showed an association of advancing age with hypertension which is comparable to the current study findings as in Table 1.<sup>[12,13]</sup>

The study done by Chankaramangalam *et al.* among drivers in Coimbatore showed that increasing age (OR = 3.160  $P < 0.001$ ) is significantly associated with hypertension. Another study in Kozhikode, Kerala by Lakshman *et al.* showed that drivers aged more than 35 years have significantly higher risk of hypertension.<sup>[14,15]</sup> The current study shows the association of age with hypertension among drivers and these observations are consistent with other studies across the world. Hypertension

**Table 2: Hypertension prevalence and its association with lifestyle variables in bus drivers (n=800)**

Lifestyle variables	Participants number	Hypertension		OR (95% CI)	P
		Yes (n=399), n (%)	No (n=401), n (%)		
Family history of hypertension					
Yes	271	149 (55.0)	122 (45.0)	1.16 (1.01–1.34)	0.038
No	529	250 (47.3)	279 (52.7)	Reference	
History of diabetes mellitus					
Yes	131	93 (71.0)	38 (29.0)	1.55 (1.35–1.78)	<0.001
No	669	306 (45.7)	363 (54.3)	Reference	
History of elevated blood cholesterol					
Yes	66	45 (68.2)	21 (31.8)	1.41 (1.18–1.69)	0.002
No	734	354 (48.2)	380 (41.8)	Reference	
History of myocardial infarction					
Yes	53	31 (58.5)	22 (41.5)	1.18 (0.93–1.51)	0.194
No	747	368 (49.2)	379 (50.8)	Reference	
Type of diet					
Mixed diet	741	378 (51.0)	363 (49.0)	1.43 (1.02–2.03)	0.022
Vegetarian	59	21 (35.6)	38 (64.4)	Reference	
Salt consumption					
Excess	127	76 (59.8)	51 (40.2)	1.25 (1.06–1.47)	0.014
Normal	673	323 (48.0)	350 (52.0)	Reference	
Consumption of junk foods					
Yes (at least once weekly)	322	160 (49.7)	162 (50.3)	0.99 (0.86–1.14)	0.931
No	478	239 (50.0)	239 (50.0)	Reference	
Consumption of oily foods					
Yes (at least once weekly)	465	236 (50.7)	229 (49.3)	1.04 (0.90–1.20)	0.558
No	335	163 (48.7)	172 (51.3)	Reference	
Physical activity					
No	586	306 (52.2)	280 (47.8)	1.20 (1.01–1.43)	0.028
Yes	214	93 (43.5)	121 (56.5)	Reference	
History of smoking					
Yes	268	149 (55.6)	119 (44.4)	1.18 (1.03–1.36)	0.020
No	532	250 (47.0)	282 (53.0)	Reference	
History of smokeless tobacco usage					
Yes	148	87 (58.8)	61 (41.2)	1.23 (1.05–1.44)	0.016
No	652	312 (47.9)	340 (52.1)	Reference	
Alcohol use					
Yes	392	218 (55.6)	174 (44.4)	1.23 (1.07–1.42)	0.002
No	408	181 (44.4)	227 (55.6)	Reference	
BMI category					
Underweight	4	2 (50.0)	2 (50.0)	1.23 (0.45–3.35)	0.706
Normal	133	54 (40.6)	79 (59.4)	Reference	
Overweight	186	80 (43.0)	106 (57.0)	1.06 (0.81–1.38)	0.667
Obese	477	263 (55.1)	214 (44.9)	1.36 (1.09–1.69)	

OR: Odds ratio, CI: Confidence interval

was found to be significantly higher among those drivers, who had a lower education qualification when compared to those who graduated (OR [95% CI]: 1.74 [1.02–2.94];  $P = 0.015$ ). A study done by Borle and Jadhao among bus drivers in Nagpur also published a similar observation of lower educational status associated with increased prevalence of hypertension when compared to higher educational status [Table 2].<sup>[16]</sup>

About 49.1% belonged to upper socioeconomic status and 45.8% belonged to upper middle socioeconomic status in our study. A study conducted by Borle and Jadhao in

Nagpur showed that lower socioeconomic status people had more risk of hypertension when compared to upper socioeconomic status drivers.<sup>[16]</sup> A study done by Lakshman *et al.* in Kozhikode, Kerala, found that there was no association between socioeconomic status and hypertension in drivers.<sup>[15]</sup> The present study shows no significant association between socioeconomic status and hypertension.

Family history of hypertension was present in 33.8% of the participants and it is significant with  $P = 0.038$  (OR [95% CI]: 1.16 [1.01–1.34]) in the present study, which was higher

**Table 3: Association between pattern of driving and prevalence of hypertension among the study participants (n=800)**

	n=800	Hypertension		OR (95% CI)	P
		Yes (n=399), n (%)	No (n=401), n (%)		
Experience in years					
10 or less	331	125 (37.8)	206 (62.2)	Reference	
11–20	293	166 (56.7)	127 (43.3)	1.50 (1.26–1.78)	<0.001
21–30	159	94 (59.1)	65 (40.9)	1.56 (1.30–1.89)	<0.001
<30	17	14 (82.4)	3 (17.6)	2.18 (1.68–2.83)	<0.001
Driving duration per day (hours)					
≤8	334	190 (56.9)	144 (43.1)	1.27 (1.11–1.45)	<0.001
>8	466	209 (44.8)	257 (55.2)	Reference	
Night shifts per month					
<10	786	394 (50.1)	392 (49.9)	1.40 (0.69–2.84)	0.286
10–20	14	5 (35.7)	9 (64.3)	Reference	

OR: Odds ratio, CI: Confidence interval

**Table 4: Association between perceived stress levels using Perceived Stress Scale-4) and hypertension among the study participants (n=800)**

Perceived stress levels	n=800	Hypertension		OR (95% CI)	P
		Yes (n=399), n (%)	No (n=401), n (%)		
High	167	92 (55.1)	75 (44.9)	1.21 (0.95–1.53)	0.108
Moderate	508	250 (49.2)	258 (50.8)	1.08 (0.87–1.33)	0.469
Low	125	57 (45.6)	68 (54.4)	Reference	

OR: Odds ratio, CI: Confidence interval

compared to studies by Anto *et al.* (18.4%) and Lakshman *et al.* (22.5%), respectively,<sup>[15,17]</sup> whereas in Borle and Jadhao study majority 81.3% were having a family history of hypertension.<sup>[16]</sup>

In this study, self-reported diabetes mellitus was present in 16.4% and hypercholesterolemia in 8.3%, myocardial infarction and transient ischemic attack were present in 6.6% and 4.9% of the participants, respectively. About 15.6%, 7.3%, and 11.1% of the drivers were diabetic in studies by Adedokun *et al.*, Lakshman *et al.*, and Rao *et al.*, respectively.<sup>[11,15,18]</sup> In Priya and Sathiya study, 14% of the drivers had diabetes mellitus.<sup>[19]</sup>

In our study, we found that individuals with diabetes had a higher occurrence of hypertension, with the association being statistically significant (OR [95% CI]: 1.55 [1.35–1.78];  $P < 0.001$ ). There was also a significant link between high cholesterol levels and hypertension ( $P = 0.002$ ). This is in contrast to Lakshman *et al.*'s research, where out of the drivers who reported having diabetes, a smaller fraction, 7.26%, were also dealing with hypertension. In that subset, 61.54% reported high blood pressure.<sup>[15]</sup> Moreover, diabetics in our study presented with higher average systolic and diastolic blood pressures than those without diabetes. Our findings, however, did not show a statistically significant relationship between hypertension and diabetes mellitus, highlighting potential variations in the interplay between these conditions.

Unhealthy dietary habit (79.5%) was the most common risk factor for hypertension reported in the current study. Nearly, half of the participants 54.9% were taking adequate vegetables

per week. Studies done among drivers in Minneapolis and Hong Kong reported the prevalence of unhealthy dietary habits to be around 60%–80%.<sup>[20,21]</sup>

In this study, excess salt consumption was observed in 15.6% of the participants and the association between salt intake and hypertension was significant ( $P = 0.014$ ). Robinson *et al.* demonstrated that higher dietary salt intake was a precipitating factor for developing hypertension and CVD.<sup>[22]</sup>

Obesity according to Asia Pacific guidelines was about more than half (59.6%) of the study participants. In India, the prevalence of obesity among males was found in the general population to be 34% as per the recent National Nutrition Monitoring Bureau (NNMB) survey. However, in Tamil Nadu, the prevalence of obesity among the general population was higher (42%) when compared to the national burden. The prevalence of obesity in the current study is still higher which shows that it is more prevalent among drivers when compared to the general population. However, studies done by Udayar *et al.* among drivers in Andhra Pradesh have reported that the prevalence of obesity based on the WHO was around 35%.<sup>[23]</sup>

The association between obesity and hypertension in drivers was examined in this study and the association was significant (OR: 1.36; 95% CI: [1.09–1.69]) in drivers. The studies done around the world showed a significant association between obesity and hypertension. A study done in Nigeria by Odeyinka and Ajayi (2017) showed that the drivers who were obese (adjusted OR 6.23; 95% CI: 1.88–20.71) were 6.2 times more



likely to develop hypertension which was similar to the current study findings.<sup>[13]</sup>

Studies conducted around India also showed a significant association between obesity and hypertension. A study done on Nagpur bus drivers by Borle and Jadhao showed that the obese drivers had 5.45 times more risk of having hypertension when compared to nonobese drivers. Another study done in Coimbatore, South India, by Chankaramangalam *et al.* showed that the overweight drivers had more than two times (OR = 2.210  $P < 0.05$ ) risk of developing hypertension when compared to drivers with normal body mass index.<sup>[14,16]</sup>

The prevalence of physical inactivity among the bus drivers in the current study was 91.1%. This proportion was similar when compared to the prevalence of physical inactivity among the general population as per the recent (2018) National Nutrition Monitoring Bureau report.

Previous studies in India had reported the physical inactivity level among the bus drivers to be ranging from 64% to 87%. Studies conducted among bus drivers in Andhra Pradesh showed a prevalence of physical inactivity to be 87% which was similar to the current study.<sup>[23]</sup>

Globally, tobacco consumption among bus drivers varies widely, reported to be between 17% and 93% in different studies.<sup>[16,24,25]</sup> Our current research indicates a 33.5% tobacco usage among participants, exceeding India's general population usage of 21.4% as identified by the authors.<sup>[14]</sup> Notably, Indian bus drivers exhibit a higher prevalence, with figures ranging from 29% to 78%.

Within this context, Karnataka State Road Transport Corporation (KSRTC) reported a 29% tobacco use rate among drivers,<sup>[19]</sup> closely aligning with our results. Conversely, Maharashtra State Road Transport Corporation (MSRTC) drivers in Nagpur city presented a much higher usage rate at 78%.<sup>[16]</sup> Alcohol consumption patterns among bus drivers also exhibit variation, with reported rates between 23% and 67% internationally.<sup>[23,25]</sup> In our study, we observed a 49% alcohol use rate, which is substantially higher than the 22.9% rate reported among the general Indian populace in fourth National Family Health Survey (NFHS-4).<sup>[26]</sup> Despite this, the prevalence among Indian bus drivers typically ranges from 24% to 62%, with several studies reporting findings similar to ours. Specific to KSRTC and a Bangalore study, the prevalence was reported at lower rates of 24% and 32%, respectively.<sup>[19,27]</sup> This evidence suggests a need for targeted health interventions in this occupational group.

Studies conducted among bus drivers in Andhra Pradesh by Udayar *et al.* showed a prevalence similar to the present study (42%).<sup>[23]</sup> However, the study done in Maharashtra by Borle and Jadhao showed a higher prevalence of alcohol use (64%) when compared to the current study.<sup>[16]</sup>

The present study showed that alcohol use (OR - 1.23 95% CI: 1.07–1.42) was significantly associated with hypertension among the bus drivers. Similarly, the study done on Hong

Kong professional drivers by Siu *et al.* showed that alcohol use is significantly associated with the risk of hypertension.<sup>[21]</sup>

In contrast to our findings, Borle and Jadhao reported no link between alcohol consumption and hypertension among Nagpur's driving population.<sup>[16]</sup> Our analysis from Table 3 revealed that drivers with over three decades of experience exhibited more than twice the risk of hypertension (OR: 2.18; 95% CI: 1.68–2.83), and those with 20–30 years of driving had a 56% increased risk (OR: 1.56; 95% CI: 1.30–1.89) compared to their counterparts with 10 years or less on the road. This aligns with Siu *et al.*'s study from Hong Kong, which also identified a heightened hypertension risk correlating with the duration of driving experience.<sup>[21]</sup>

Our study did not show a significant correlation between stress levels and hypertension among drivers illustrated in Table 4. However, research by Taklikar in Mumbai indicated a significant relationship between job tenure and stress.<sup>[28]</sup> The absence of multivariate analysis in that study limits any definitive conclusions regarding job experience as a stress predictor. This suggests an area for further research to elucidate the potential link between job experience and stress levels among drivers.

The study demonstrates that in the sample data, the prevalence of hypertension were at a high percentage. It also becomes alarming as the number of bus drivers affected by the condition has increased by two to three times of expected values. Hence, there is a need for developing an occupational health strategy to effectively screen all the bus drivers for the various cardiovascular risk factors during the periodic health examination. There is a need for health education and awareness campaigns at regular intervals. The individuals screened and diagnosed for hypertension during periodic examination need to be referred to the appropriate health facility for further management without any delay.

The study was done in five bus depots with a sample size of 800, so the study outcomes cannot be generalized to all the bus drivers. Multicentric study with a larger sample size is needed to extrapolate the results. In this study, biochemical estimations (blood sugar and lipid profile) were not done due to logistic constraints. Being a cross-sectional study, causal association and risk estimation could not be done. Hence, a future analytical study (case-control study or cohort study) in the study population can overcome this limitation.

## CONCLUSION

Our study on TNSTC bus drivers in Coimbatore District found hypertension rates at 49.9%. Age, driving tenure, family history, diabetes, and high cholesterol were linked to higher hypertension risk. Sedentary work, irregular hours, and traffic stress may increase tobacco and alcohol use, contributing to this risk. We also noted substantial prehypertension and undiagnosed cases, along with treatment noncompliance among diagnosed individuals.

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## Conflicts of interest

There are no conflicts of interest.

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