REVIEW ARTICLE
pISSN09763325 | eISSN22296816
Open Access Article (CC BY-SA)
www.njcmindia.com
DOI: 10.55489/njcm.130620222034

A Review of Risk Factors for Non-Communicable Diseases Among Bus Drivers

Arun R[1], Meriton Stanly A[2]

[1]Sree Balaji Medical College and hospital, Chromepet, Chennai
[2]Sri Ramachandra Medical College and Research institute, Chennai

ABSTRACT

A significant threat among the developing countries towards health and development in the current era is attributed by non-communicable diseases. These diseases contribute to major portion of morbidity and mortality globally. It has been predicted that with such an alarming rise in these cases, NCDs will exceed communicable, maternal, perinatal, and nutritional disease as the common causes of death by 2030. Without any action towards this menace the burden of these diseases will continue to escalate overwhelming our capacity to address them. Metropolitan drivers are a group of people who spend their majority of time in a polluted, noisy and a dangerous workplace. With the very few data on the predisposing risk factors among this population, this review helps us identifying such factors among the drivers which can help in formulating new policies and improve their health.

Key words: Bus drivers, non-communicable diseases, risk factors

INTRODUCTION

World has undergone phenomenon of epidemiological transition towards the later part of 20th century. Due to urbanization, there is increased consumption of food and tobacco with decreased physical activity. This has led to change of disease pattern of change from communicable to non-communicable diseases.[1] Chronic diseases are becoming a major issue when evaluated in terms of disablement, poverty, loss of life and economic loss to the country. With 57 million deaths occurred globally during 2016, 41 million deaths were attributed to NCDs, the leading causes being cardiovascular diseases (17.9 million), cancers (9 million), chronic respiratory diseases (3.8 million) and diabetes (1.6 million). Approximately 42% of deaths were before 70 years. India contributes to more than two thirds towards the total deaths due to NCD.[2] The prevalence of risk factors among the people is essential for planning of intervention programme.[3]

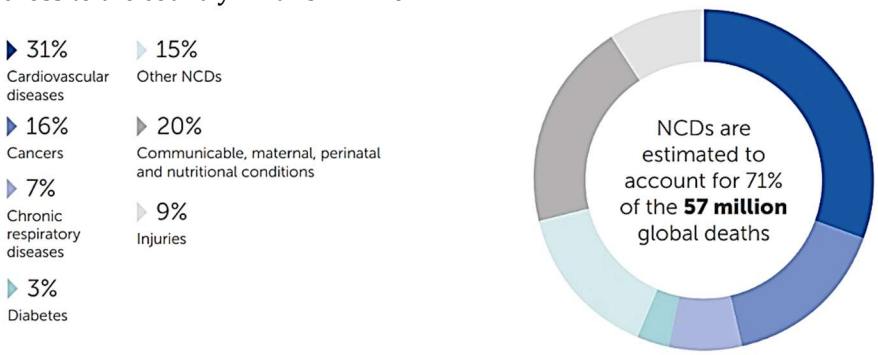

Figure 1: Global Mortality for all ages and both sexes 2016.

How to cite this article: Arun R, Stanly AM. A Review of Risk Factors for Non-Communicable Diseases Among Bus Drivers. Natl J Community Med 2022;13(6):404-410. DOI: 10.55489/njcm.130620222034

Financial Support: None declared | **Conflict of Interest:** None declared | **Date of Submission**: 28-04-2022 **Date of Acceptance**: 16-05-2022 **Date of Publication**: 30-06-2022

Correspondence: Dr. Arun R (Email: arunraja271993@gmail.com)

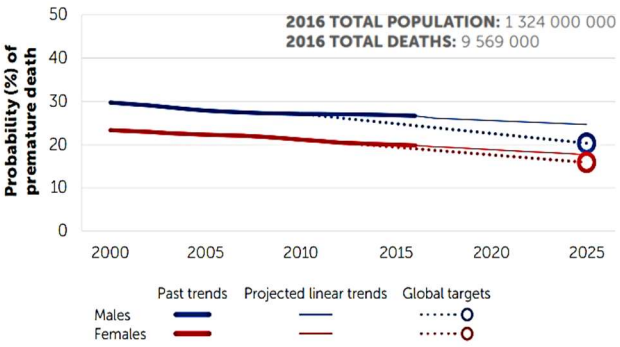

Figure 2a: Risk of premature death due to NCDs (%) in India

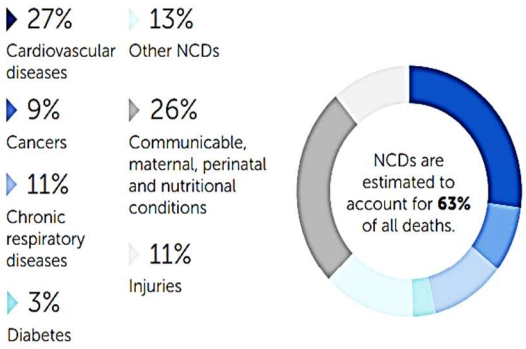

Figure 2b: Proportional Mortality of NCDs in India

IMPACT OF NCDs IN INDIA

Health Impact: NCDs accounts for 53% of disease burden. Over 20% of Indian population has at least one chronic disease. Probability of NCD related death during the most productive years is 26%.2 Almost 62% of total burden of foregone DALYs and 53% of total deaths are contributed by NCDs.[4]

Economic Impact: Numerous researches have established a positive correlation between economic growth and health.[5] The effects of NCDs are reported in terms of avoidable deaths, disability and economic impact.[6] Records from 2004 indicate that NCDs accounted for 40% of all hospital stays and 35% of outpatient visits.[7] WHO estimated that India has lost $237 billion in 2006-2015 from premature deaths.

Societal Impact: Overall decreased wellbeing of population. Premature mortality leads to problematic families and societies. Increased care burden on family members leading to loss of other opportunities for development.

The driving occupation is associated with increased risk of developing NCD. Contributing factors for increased risk of NCD in drivers are prolonged hours of sitting, physical inactivity, altered circadian rhythm, job stress and tension. Drivers are at increased risk of obesity, hypertension, hypercholesterolemia, hyperglycaemia.[8] Studies have shown that physical inactivity and unhealthy dietary habits of the bus drivers which caused high mortality and morbidity. The CVD risk factors were high among drivers more than 50 years of age. Age act as an independent risk factor for CVD with prevalence of hypertension higher among drivers older than 35years.[9]

RISK FACTORS

Risk factors of NCD's are categorized as modifiable and metabolic risk factors as per WHO.2 World Health Report has prioritized the following four as the behavioural (modifiable) risk factors: Tobacco use, harmful consumption of alcohol, unhealthy diet such as increased fat and sodium and low fruit/vegetable intake and physical inactivity.

The major biological (metabolic) risk factors identified are: Overweight and obesity, raised blood pressure, raised blood glucose and abnormal blood lipids and its subset raised total cholesterol.

BEHAVIORAL (MODIFIABLE) RISK FACTORS:

Tobacco: Tobacco usage could be in a smokeless and smoking form. Smokeless tobacco consumed in unburnt forms as chewing or sniffing and more several carcinogenic while smoking tobacco, being the most used form globally. Tobacco consumption leads to different forms of cancers, respiratory diseases, cardiovascular, periodontitis, etc. according to CDC 2004. Tobacco exposure contribution towards health risk could be from either direct consumption of tobacco or to second hand smoke.[10]

World Health organization stated tobacco as a major cause of preventable death. Each year 6million deaths are reported which leads to economic damage. It is more prevalent in low and middle countries.[11] India contributes to a significant portion of this global tobacco burden.

According to Bhan et al.2012, smoking tobacco is more prevalent among men (47%).[12] Prevalence of Smokeless form of tobacco is more among women.[13] The proportion of smokers in rural areas is higher than those in urban areas.14 According to surveillance of risk factors of NCDs from Chennai reported the prevalence of smoking was 55.8% among men.[14]

Smoking is more prevalent among drivers because they use tobacco while driving to eliminate boredom, occupation stress relief and sleepiness.[15] The prevalence of tobacco use among drivers is twice as compared to non-drivers.[16] Chewable tobacco is the most used form.[17] According to Hammond et al., 2006 the knowledge of the participants regarding the constituents of tobacco smoke was found to be very low. The bus drivers who smoke always keep their daily income aside for smoking. Tobacco use was more among long distance drivers rather than short distance drivers.[18] Majority of the drivers does not know about the harmful effects of tobacco consumption.[19]

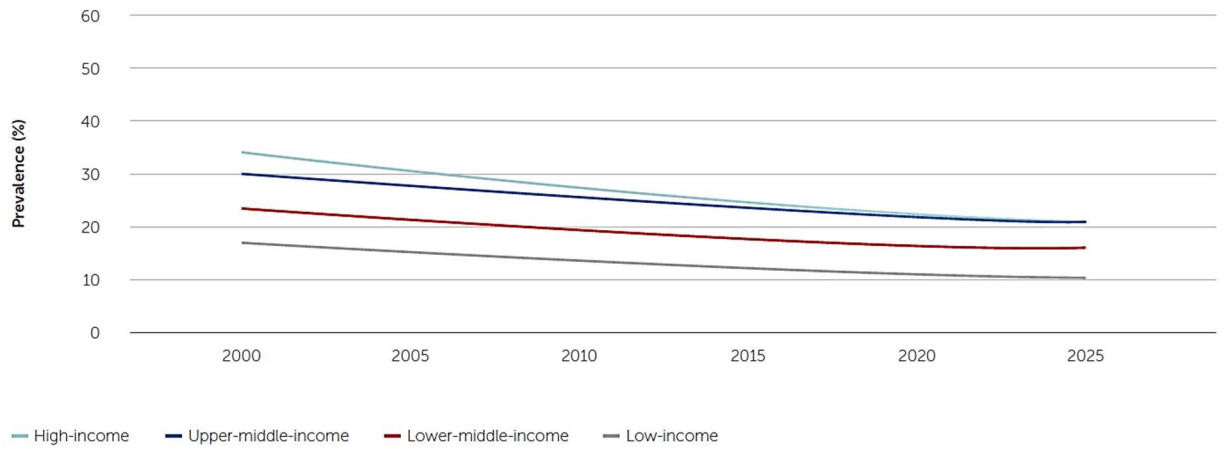

Figure 3: WHO global report on trends in prevalence of tobacco smoking 2000-2025.[2]

Alcoholism: Alcohol consumption is one among a risk factor for early death and disability worldwide. 2.3 million Deaths were reported in 2004 due to harmful and hazardous drinking of alcohol which accounts for 3.8% of all death worldwide. Majority of the death due to alcoholism are due to alcohol induced cirrhosis, atherosclerosis and hepatocellular carcinoma. Around 4.5% of estimated DALYs are contributed by alcoholism. Alcohol consumption level varies widely around the world.[20] Global adult per capita estimates 6 litres of pure alcohol consumption during 2008, with highest among European region and lowest in Eastern Mediterranean regions.

In India, Andhra Pradesh, Goa, Punjab and north-eastern states have highest alcohol consumption. About 80% of alcohol consumption is in the form of hard liquor with high alcohol content. Country liquor accounts for 60%.[21] Truck drivers predominantly consume alcohol at rest which is associated with accidents and death on roads. Factors driving alcohol consumption in drivers are stress, exhaustion, long distance driving, living far away from family.[22] Alcohol usage was significantly associated with cardiovascular health especially hypertension and is more prevalent in heavy consumption.[23]

A person who belongs to lower socioeconomic groups tends to consume alcohol more than high socio-economic groups.[24] Studies done in Russia showed that working men with low educational qualification are prone for alcohol usage.[25] Though higher socioeconomic groups consume higher levels of alcohol than low socioeconomic groups, the deleterious effect of alcohol is more in socioeconomically disadvantaged groups. This is because of clustering of risk behaviour such as poor diet, smoking etc. in this groups.[26]

Physical Inactivity: Physical inactivity is defined as inability to achieve the recommended levels of physical activity for health.[27] Physical inactivity is one among the leading modifiable risk factor. Nearly 32.1 million DALYs every year and around 3.2 million deaths are attributable towards physical inactivity. Physically inactive persons are at 20 to 30 percent increased risk of mortality. It lowers the risk of ischemic heart diseases, stroke, hypertension and depression. The prevalence of physical inactivity in women is almost 50% in American and Eastern Mediterranean region, while the prevalence among men is 40% and 36% respectively. In south East Asia the prevalence is 19% for women and 15% for men.[28]

Reduced Physical activity was predominantly seen among urban residence as compared to rural residence. Rural people are engaged in agricultural and labour work. Only10 to 15% among them is reported to have less physical activity. A threefold increase in prevalence is noted among urban men and women in comparison to rural area in overweight/obesity.

ICMR-INDIAB Studied physical inactivity patterns among Indians. Results of phase 1 study were published in the year 2014. In India, it was done in Tamil Nadu, Jharkhand, Maharashtra and Chandigarh regions with a combined population of 213 million people. Reports of this study showed that 54.4% were inactive and 13.7% were highly active. More physical inactivity was found in urban compared to rural areas. Males are more active than females. Subjects spent more active minutes at work than in recreation and commuting activities.[29]

Worksite physical environment influences individual's physical activity behaviour. Long work hours and shift work on the transportation route make physical activity behaviours difficult for drivers.[30] Physical inactivity is a health risk in drivers with only 20 to 40% of the drivers meet physical activity guidelines.[31] Prolonged sitting time is associated with higher risk of cardiovascular diseases, diabetes and all-cause mortality. Studies done on office workers showed estimated around 65% to 82% working sedentary by sitting during working hours.[32]

Insufficient Fruits and Vegetables Intake: According to the world cancer research fund around 27 – 39% of the cancers could be prevented by improvis-

ing diet and physical activity. Nearly 1.7 million deaths and 16 million DALYs around the world are attributed to reduced green leafy vegetable and fruits intake, which could decrease the risk for cardiovascular diseases and gastrointestinal cancers. Increased consumption of high energy foods including packaged and processed foods that are rich in fats and sugars, promotes towards obesity.[33]

A major determinant of blood pressure levels and overall cardiovascular risk is determined by dietary salt intake. WHO recommends salt intake of less than 5g/day towards prevention of cardiovascular disease. Consuming increased fruits and vegetables increases the nutritive value thereby reducing the risk of cardiovascular diseases, stroke and cancers. Persons who are engaged in minimal to moderate physical activity daily should consume double the equivalents of vegetables and fruits.[34]

In India, the intake of fruits and vegetables which acts as a protection against NCDs is very low. Comparing to countries with lower NCD prevalence urban areas showed higher consumption of fruits and vegetables (27%). Less than five servings of fruits per day were common among poorer income groups compared to the rich.[35] The rise in the price of fruits and vegetables has resulted in a negative impact on the consumption pattern among the poor.[36]

METABOLIC/PHYSIOLOGICAL RISK FACTORS

Hypertension: Worldwide, 7.5 million deaths and 57 million DALYs are reported due to raised blood pressure which accounts to 12.8% of annual mortality and 3.7% of total DALYs. Increased blood pressure is a crucial risk factor for CHD and stroke. The risk of cardiovascular disease doubles for each incremental increase of 20/10 mmHg of blood pressure, starting as low as 110/70 mmHg with age. Other complications of hypertension are congestive cardiac failure, visual impairment, peripheral vascular disease, retinal haemorrhage and chronic kidney disease. Cardiovascular disease risk decreases by reducing the blood pressure of below 140/90 mmHg.[37]

The prevalence of hypertension in adults aged 25 years and over, about 40% were found to have hypertension in 2008. Because of ageing and increase in growth of population the number of people with hypertension rose from 600 million in 1980 to 1 billion in 2008.[38] In India, with a marginal rural urban difference the prevalence ranges from 17 to 21% among all states.

In developed countries hypertension is largely contributed to cardiovascular mortality. Due to industrialization and globalization the diseases which are prevalent in high income countries are becoming more prevalent now in low-income countries. This transition led to the emergence of NCDs including hypertension, obesity, diabetes, cancer and other conditions.[39] The prevalence and severity of hypertension increases with age according to NHANES-III.[40] There is a strong correlation between hypertension and age more than 35 years.[41] The sensitivity increases when selected occupational groups are screened. Drivers are one such group due to their nature of profession.[42]

Drivers spend most of their time in pollutant, noisy and dangerous environment which predisposes them to hypertension. Unhealthy diet pattern, sedentary lifestyle and stressful jobs further increase the risk of hypertension.[43] Prevalence of hypertension is more among drivers in comparison with general population.[44] The drivers who are found to have hypertension did not regularly use their prescribed medication. The factors contributing to this are lack of long travel times, lack of information and lack of adequate health services.[45]

Hypertension in drivers not only affects them but community at large. Professional driving encourages in consumption of high energy dense food and physical inactivity which leads to higher BMI which further causes increased incidence of hypertension.[46] According to WHO 2003 criteria 36.7% of the drivers were hypertensive.[47] Professional driving creates pressure due to repetitive routine, time constraints, distractions such as radio broadcast, environment and passenger conversation. Job stress is a risk factor for raised blood pressure.[48]

Drivers who carry passengers tend to be at greater risk than those who carry goods. Study done in Bangkok bus drivers showed that the prevalence of hypertension was 23% as compared to 15.85% in normal population. Ambulatory blood pressure was high in drivers before, during and after driving shifts.[49]

Diabetes Mellitus: Diabetes is the most common cause of CKD in both developed and developing countries. Impaired fasting glucose act as an initiating factor for diabetes mellitus and cardiovascular diseases. In developed countries, Diabetes Mellitus is one among the causes towards visual impairment and blindness. In adults aged more than 25 years of age, the estimated prevalence was 10% globally. In Asia the reported prevalence is around 1.2-14.6%, 4.6-40% in the Middle East and 1.3-14.5% in Iran, with the highest in the Eastern Mediterranean regions and Region of Americas and lowest in the WHO European and western pacific regions.[50,51]

The prevalence of Diabetes Mellitus is predicted to double by 2030 to 366 million from 171 million in 2000. By 2030, India is predicted to have 79.4million individuals, while other Asian countries (42.3million) and the United States (30.3million).[52] Studies done by ICMR (Indian Council of Medical Research) showed a reduced proportion of the population affected in states of Northern India (Chandigarh 0.12 million, Jharkhand 0.96 million) as compared to Maharashtra (9.2 million) and Tamil Nadu (4.8 million). Professional drivers are at increased risk of diabetes mellitus as their profession involves exposure to stress, shift work, prolonged sitting which all leads

to obesity and hypertension and thus indirectly affects carbohydrate metabolism. Hypertension and diabetes mellitus often go hand in hand as a part of metabolic syndrome.[53] Diabetic complications and medication side effects can affect driving skills. Because of specific working conditions, drivers are more likely to be involved with metabolic syndrome and its related complications.[54]

Overweight and Obesity: Globally, Obesity (including overweight) accounts for 2.8 million deaths yearly and 35.8 million DALYs. They contribute towards development of adverse metabolic effects such as hypertension, hypercholesterolemia, insulin resistance and triglycerides. As body mass index (BMI) increases, the risk of coronary heart disease, type 2 Diabetes Mellitus and ischemic stroke increases accordingly, thereby contributing to increased mortality. Goal for individual is to maintain an ideal BMI in the range of 18.5 to 24.9 Kg/m^2.[55]

In India, the prevalence is found to be slightly increased in urban and high socioeconomic status groups.[56] On comparing with National Family Health Survey-3 (NFHS 3) and National Family Health Survey-4 report (NFHS-4), the prevalence of overweight/obesity in males increased from 9.3% to 19%.[57] The National Nutrition Monitoring Bureau (NNMB) report showed an increasing trend of overweight and obesity in adults from rural population.[58]

Studies done on rural and urban areas of Tamil Nadu showed an increased prevalence of overweight/obesity, reflecting lifestyle changes and economic situation. It is alarming that 40% of rural participants and 70% of urban participants were centrally obese, which by itself is an act high risk factor for diabetes and CHD.[59] Studies have showed that the overall prevalence of obesity is expected to rise from 4% to 5% by 2030. Similarly overweight will also rise from 12.9% in 2005 to 28% by 2030.

Transportation workers showed higher rates of obesity than other occupational groups.[59] Lack of healthful food, long working hours and lack of scheduled break or meals, physical inactivity on the transportation routes makes healthful food choices and physical activity behaviours difficult for transportation workers. As obesity increases the frequency of metabolic syndrome prevalence also increases.[60]

Drivers tends to consume high carbohydrate meal leading to hyperinsulinemia, hypertriglyceridemia, hyperglycaemia which are well known to cause increase in body fat.[61] Most of the drivers consume meals served in intercity restaurants wherein the meals are poor in fibre, rich in animal proteins, high glycaemic index foods that tend to raise the BMI in drivers.[62] Long work hours acts as a significant factor for increased BMI.[63] In those with excess weight there is an increased prevalence of carbohydrate metabolism disorders, a twofold risk in comparison with normal individuals. Obesity is also a contributing factor for hypertension in drivers.[64]

Hypercholesterolemia: Deranged cholesterol levels increase risk for CHD and stroke. Globally, 2.6 million deaths and 29.7 million DALYs are contributed by hypercholesterolemia. In developed as well as developing countries raised total cholesterol act as an important cause of disease burden. By a minimal 10% reduction in serum cholesterol among men aged 40 years showed significant reduction in cardiac diseases in duration of five years; whereas in men aged 70 years could result in a 20% reduction in cardiac disease occurrence.[65]

The prevalence of hypercholesterolemia was found to be 39% globally, highest among Europeans (54%) followed by Americans (48%). The lowest prevalence was found in African (23%) and South East Asian regions (30%) respectively.[66] In developed countries majority of adults had deranged lipid profile which is twice the level in developing and underdeveloped countries.[67]

Drivers who are having irregular eating habits and low physical activity due to prolonged sitting develops obesity/overweight which increases the abdominal adipose tissue further leads to increase in fasting glucose and triglyceride levels. These factors lead to higher risk of developing cardiovascular events among professional drivers.[68]

Daytime Sleepiness: Disturbances in sleep and sleep deprivation are highly prevalent in both developed and developing countries with its round the clock work schedules. Studies showed that daytime sleepiness act as a crucial factor in the occurrence of road traffic accidents. Many studies revealed that drivers have a high prevalence of excessive day time sleepiness, sleep debt and obstructive sleep apnea. Each of these three conditions is independently associated with road traffic accidents.[68]

Shift work is an integral part of driving profession. The term shift worker describes a person who works outside the normal day light hours. Shift working causes disruption in sleep pattern and Circadian rhythm which leads to shift work sleep disorder. Sleepiness is the largest identifiable and preventable cause of accidents rather than alcohol or drug related accidents. Prolonged working hours contributes towards development of irritability, physical and mental fatigue, insomnia, hypersomnia and gastric ulcer. It could also result in inattention, frequent accidents in work place.[68] Studies done on interstate bus driver's revealed high rate of sleep complaints due to life style habits of these individuals, irregular shift work which does not provide good physical and mental restoration during sleep.[69]

CONCLUSION

The non-communicable diseases among bus drivers are a rising threat and this review elaborates the risk factors to be looked among them. Unless such population are screened, there will be a substantial load on healthcare system and services. Therefore, a sus-

tained effort is necessary to develop strategies for screening and managing NCDs among bus drivers.

REFERENCES

1. Mohan V, Deepa R. Risk factors for coronary artery disease in Indians. J Assoc Physicians India. 2004 Feb;52:95-7. PMID: 15656040
2. World Health Organization. (2018). Noncommunicable diseases country profiles 2018. World Health Organization.
3. Leowski J, Krishnan A. Capacity to control noncommunicable diseases in the countries of South-East Asia. Health Policy. 2009 Sep;92(1):43-8. doi: 10.1016/j.healthpol.2009.02.003. PMID: 19304337.
4. Thakur J, Prinja S, Garg CC, Mendis S, Menabde N. Social and Economic Implications of Noncommunicable diseases in India. Indian J Community Med. 2011 Dec;36(Suppl 1):S13-22. doi: 10.4103/0970-0218.94704. PMID: 22628905; PMCID: PMC3354895.
5. Chen S, Kuhn M, Prettner K, Bloom DE. The macroeconomic burden of noncommunicable diseases in the United States: Estimates and projections. *PLoS One*. 2018;13(11):e0206702. Published 2018 Nov 1. doi:10.1371/journal.pone.0206702
6. Kankeu HT, Saksena P, Xu K, Evans DB. The financial burden from non-communicable diseases in low- and middle-income countries: a literature review. Health Res Policy Syst. 2013 Aug 16;11:31. doi: 10.1186/1478-4505-11-31. PMID: 23947294; PMCID: PMC3751656.
7. Engelgau, M., Karan, A., & Mahal, A. S. (2012). The economic impact of non-communicable diseases on households in India. *Globalization and Health*, *8*(Art. ID: 9), 1 - 10. https://doi.org/10.1186/1744-8603-8-9
8. Frost P, Kolstad HA, Bonde JP. Shift work and the risk of ischemic heart disease - a systematic review of the epidemiologic evidence. Scand J Work Environ Health. 2009 May;35(3):163–79
9. Borle AL, Jadhao A. Prevalence and Associated Factors of Hypertension among Occupational Bus Drivers in Nagpur City, Central India- A Cross Sectional Study. Ntl J of Com- munity Med 2015; 6(3):423-428.
10. Oberg M, Jaakkola MS, Woodward A, Peruga A, Prüss-Ustün A. Worldwide burden of disease from exposure to second-hand smoke: a retrospective analysis of data from 192 countries. Lancet. 2011 Jan 8;377(9760):139-46. doi: 10.1016/S0140-6736(10)61388-8. PMID: 21112082.
11. Mallikarjun S, Rao A, Rajesh G, Shenoy R, Bh MP. Role of tobacco warning labels in informing smokers about risks of smoking among bus drivers in Mangalore, India. Asian Pac J Cancer Prev. 2014;15(19):8265-70. doi: 10.7314/apjcp.2014.15.19.8265. PMID: 25339016.
12. Bhagyalaxmi A, Atul T, Shikha J. Prevalence of risk factors of non-communicable diseases in a District of Gujarat, India. J Health Popul Nutr. 2013 Mar;31(1):78–85. doi: 10.3329/jhpn.v31i1.14752. PMID: 23617208; PMCID: PMC3702362.
13. https://icmr.nic.in/sites/default/files/reports/Phase-1_States_of_India.pdf [Internet].
14. Jain S, Jain V, Jain S, Jain S. Prevalence of modifiable risk factors for non-communicable diseases in urban slum: a cross sectional study using WHO STEPS approach. *International Journal Of Community Medicine And Public Health, 6*(4), 1565-1572.
15. Krishnaswamy U, Chhabria M, Rao A. Excessive sleepiness, sleep hygiene, and coping strategies among night bus drivers: A cross-sectional study. Indian J Occup Environ Med. 2016 May-Aug;20(2):84-87. doi: 10.4103/0019-5278.197526. PMID: 28194081; PMCID: PMC5299817.
16. Bathija, G. V., Bant, D. D., Itagimath, S. R., Lokare, L., Godbole, M., Nekar, M. S., Shidaraddi, K., & Kurigodiavar, M. D. (2014). A study on stress among government city bus drivers in Hubli. *International Journal of Biomedical Research*, *5*(2), 102–104. https://doi.org/10.7439/ijbr.v5i2.503
17. Bathija G, Bant D, Itagimath S, Lokare L, Godbole M, Nekar M, et al. A study on stress among government city bus drivers in Hubli. Int J Biomed Res. 2014 Jan 2;5.
18. Jadhav AV. Non-Communicable Diseases Risk Profile of Bus Drivers in Rural Maharashtra: An Exploratory Comparative Study. 2017;8(12):4.
19. Chaudhary SS, MMNagargoje SS, Kubde SC, Gupta SK. Mishra. Prevalence of cardiovascular diseases risk factors among auto-rickshaw drivers. Indian J Community Health. 2011;22(2):23.
20. Saroj G. Tobacco Use Among Long Route Bus Drivers and Staffs of Dharan Eastern Nepal a KAP Study. Sci J Public Health. 2017;5(4):301.
21. Bagnardi V, Zatonski W, Scotti L, Vecchia CL, Corrao G. Does drinking pattern modify the effect of alcohol on the risk of coronary heart disease? Evidence from a meta-analysis. J Epidemiol Community Health. 2008 Jul 1;62(7):615–9.
22. World Health Organization, Management of Substance Abuse Team, World Health Organization. Global status report on alcohol and health 2018.
23. Crouch DJ, Birky MM, Gust SW, Rollins DE, Walsh JM, Moulden JV, et al. The Prevalence of Drugs and Alcohol in Fatally Injured Truck Drivers. J Forensic Sci. 1993 Nov 1;38(6):1342–53.
24. Pisa P, Kruger A, Vorster H, Margetts B, Loots Du T. Alcohol consumption and cardiovascular disease risk in an African population in transition: the Prospective Urban and Rural Epidemiology (PURE) study. South Afr J Clin Nutr. 2010 Jan 1;23(sup2):29–37.
25. Allen L, Williams J, Townsend N, Mikkelsen B, Roberts N, Foster C, et al. Socioeconomic status and non-communicable disease behavioural risk factors in low-income and lower-middle-income countries: a systematic review. Lancet Glob Health. 2017;5(3):e277–89.
26. Murphy M, Bobak M, Nicholson A, Rose R, Marmot M. The widening gap in mortality by educational level in the Russian Federation, 1980-2001. Am J Public Health. 2006 Jul;96(7):1293–9.
27. Alcohol Research UK. Understanding the alcohol harm paradox in order to focus the development of interventions. 2015.
28. Physical Inactivity: The Major Risk Factor for Non-Communicable Diseases. [Internet]. PubFacts.
29. Global Recommendations on Physical Activity for Health. Geneva: World Health Organization; 2010. (WHO Guidelines Approved by the Guidelines Review Committee).
30. Anjana RM, Pradeepa R, Das AK, Deepa M, Bhansali A, Joshi SR, et al. Physical activity and inactivity patterns in India – results from the ICMR-INDIAB study (Phase-1) [ICMR-INDIAB-5]. Int J Behav Nutr Phys Act. 2014 Feb 26;11(1):26.
31. Ragland DR, Krause N, Greiner BA, Fisher JM. Studies of health outcomes in transit operators: policy implications of the current scientific database. J Occup Health Psychol. 1998 Apr;3(2).
32. Statistics c=AU; o=Commonwealth of A ou=Australian B of. Analysis of 2007/08 National Health Survey for the Working Population. Canberra (AUST): Commonealth of Australia; 2010.
33. Varela-Mato V, Yates T, Stensel DJ, Biddle SJH, Clemes SA. Time spent sitting during and outside working hours in bus drivers: A pilot study. Prev Med Rep. 2016 Jun 1 3:36–9.
34. Comparative Quantification of Health Risks: The Global and Regional Burden of Disease Attributable to Selected Major

Risk Factors (Vols. 1 and 2). Institute for Health Metrics and Evaluation. 2014

35. Brown IJ, Tzoulaki I, Candeias V, Elliott P. Salt intakes around the world: implications for public health. Int J Epidemiol. 2009 Jun;38(3):791–813.
36. Meyer KA, Kushi LH, Jacobs DR, Folsom AR. Dietary fat and incidence of type 2 diabetes in older Iowa women. Diabetes Care. 2001 Sep;24(9):1528–35
37. Organization WH, Group IS of HW. 2003 World Health Organization (WHO)/International Society of Hypertension (ISH) statement on management of hypertension. J Hypertens . 2003 Nov;21(11):1983.
38. Organization WH, Group IS of HW. 2003 World Health Organization (WHO)/International Society of Hypertension (ISH) statement on management of hypertension. J Hypertens. 2003 Nov;21(11):1983.
39. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure [2019 Oct 1].
40. Olusegun SO, Ikeoluwapo OA. Prevalence of hypertension and associated risk factor among interstate commercial drivers in Jabi Park Abuja. Int J Med Med Sci. 2016 Jul 31;8(7):75–83.
41. Burt VL, Whelton P, Roccella EJ, Brown C, Cutler JA, Higgins M, et al. Prevalence of hypertension in the US adult population. Results from the Third National Health and Nutrition Examination Survey, 1988-1991. Hypertens Dallas Tex 1979. 1995 Mar;25(3):305–13.
42. Lakshman A, Manikath N, Rahim A, Anilakumari VP. Prevalence and Risk Factors of Hypertension among Male Occupational Bus Drivers in North Kerala, South India: A Cross-Sectional Study. ISRN Prev Med. 2014 ;2014:1–9.
43. Satheesh BC, Veena RM. A study of prevalence of hypertension among bus drivers in Bangalore City.International Journal of Current Research and Review. 2013 Sep 1;5(17):90.
44. WHO | Preventing chronic diseases: a vital investment. WHO. [2019 Oct 1].
45. Cipullo JP, Martin JFV, Ciorlia LA de S, Godoy MRP de, Cação JC, Loureiro AAC, et al. Hypertension prevalence and risk factors in a Brazilian urban population. Arq Bras Cardiol. 2010 Apr;94(4):519–26.
46. Tüchsen F, Hannerz H, Roepstorff C, Krause N. Stroke among male professional drivers in Denmark, 1994-2003. Occup Environ Med. 2006 Jul;63(7):456–60.
47. Erhiano E, Igbokwe V, El-Khashab M, Okolo R, Awosan K. Prevalence of Hypertension among Commercial Bus Drivers in Sokoto, Sokoto State Nigeria. Int Invent J Med Med Sci IIJMMS ISSN2408-7246. 2015 Apr 1;2:2408–7246.
48. Jayarajah U, Jayakody AJ, Jayaneth JM, Wijeratne S. Prevalence of Hypertension and Its Associated Factors among a Group of Bus Drivers in Colombo, Sri Lanka. Int J Occup Environ Med. 2017 Jan 1;8(1):58–9.
49. Rosenthal T, Alter A. Occupational stress and hypertension. Journal of the American Society of Hypertension.2012 Jan 1;6(1):2-2.
50. Occupational Stress Index (OSI) | Unhealthy Work [2019 Oct 9].
51. Alwan A, MacLean DR, Riley LM, d'Espaignet ET, Mathers CD, Stevens GA, et al. Monitoring and surveillance of chronic non-communicable diseases: progress and capacity in high-burden countries. The Lancet. 2010 Nov 27;376(9755):1861–8.
52. Organization WH. The global burden of disease : 2004 update. World Health Organization; 2008.
53. Kaveeshwar SA, Cornwall J. The current state of diabetes mellitus in India. The Australasian medical journal.2014;7(1):45.
54. Marcinkiewicz A, Szosland D. Selected risk factors of diabetes mellitus among road transport drivers.International journal of occupational medicine and environmental health. 2010 Jan 1;23(2):175-80.
55. Saberi HR, Moravveji AR, Fakharian E, Dehdashti AR. Prevalence of metabolic syndrome in bus and truck drivers in Kashan, Iran. Diabetology & metabolic syndrome. 2011 Dec;3(1):1-5..
56. Guilbert JJ. The world health report 2002–reducing risks, promoting healthy life. Education for health. 2003 May1;16(2):230-.
57. WHO | Methods for establishing a surveillance system for cardiovascular diseases in Indian industrial populations [Internet]. WHO.
58. http://rchiips.org/NFHS/factsheet_NFHS-4.shtml.
59. 1_NNMB_Third_Repeat_Rural_Survey___Technicl_Report_26.pdf .
60. Gu JK, Charles LE, Bang KM, Ma CC, Andrew ME, Violanti JM, Burchfiel CM. Prevalence of obesity by occupation among US workers: the National Health Interview Survey 2004–2011. Journal of occupational and environmental medicine/American College of Occupational and Environmental Medicine. 2014 May;56(5):516.
61. Mokdad AH, Serdula MK, Dietz WH, Bowman BA, Marks JS, Koplan JP. The spread of the obesity epidemic in the United States, 1991-1998. Jama. 1999 Oct 27;282(16):1519-22.
62. Sherwood NE, Jeffery RW, French SA, Hannan PJ, Murray DM. Predictors of weight gain in the Pound of Prevention study. International journal of obesity. 2000 Apr;24(4):395-403.
63. Yeary KH, Chi X, Lensing S, Baroni H, Ferguson A, Su J, Estabrooks PA, Tate D, Linnan L. Peer Reviewed: Overweight and Obesity Among School Bus Drivers in Rural Arkansas. Preventing Chronic Disease. 2019;16.
64. Nakamura K, Shimai S, Kikuchi S, Tominaga K, Takahashi H, Tanaka M, Nakano S, Motohashi Y, Nakadaira H, Yamamoto M. Shift work and risk factors for coronary heart disease in Japanese blue-collar workers: serum lipids and anthropometric characteristics. Occupational medicine. 1997 Apr 1;47(3):142-6.
65. Ezzati M, Lopez AD, Rodgers A, Vander Hoorn S, Murray CJ, Comparative Risk Assessment Collaborating Group. Selected major risk factors and global and regional burden of disease. The Lancet. 2002 Nov 2;360(9343):1347-60.
66. Law MR, Wald NJ, Thompson SG. By how much and how quickly does reduction in serum cholesterol concentration lower risk of ischaemic heart disease?. Bmj. 1994 Feb 5;308(6925):367-72.
67. Danaei G, Singh GM, Paciorek CJ, Lin JK, Cowan MJ, Finucane MM, Farzadfar F, Stevens GA, Riley LM, Lu Y, Rao M. The global cardiovascular risk transition: associations of four metabolic risk factors with national income, urbanization, and Western diet in 1980 and 2008. Circulation. 2013 Apr 9;127(14):1493-502.
68. Liu J, Fox CS, Hickson DA, May WD, Hairston KG, Carr JJ, Taylor HA. Impact of abdominal visceral and subcutaneous adipose tissue on cardiometabolic risk factors: the Jackson Heart Study. The Journal of Clinical Endocrinology & Metabolism. 2010 Dec 1;95(12):5419-26.
69. Mello MT, Santana MG, Souza LM, Oliveira PC, Ventura ML, Stampi C, Tufik S. Sleep patterns and sleep-related complaints of Brazilian interstate bus drivers. Brazilian Journal of Medical and Biological Research. 2000 Jan;33(1):71-7.