Original Article

Cardiovascular wellness in low-resource settings: A mobile app-based risk prediction study among fuel filling station employees in Puducherry district

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Abstract

Background: India is witnessing a significant increase in the prevalence of non-communicable diseases (NCDs), and addressing this requires a comprehensive and multi-faceted approach. The burden of NCDs puts a strain on the healthcare system, requiring an increased focus on preventive measures, early detection, and management of chronic conditions. Adopting a risk-based approach to cardiovascular diseases (CVDs) in resource-poor settings offers several economic and social advantages. **Aims and Objectives:** The aim of the study was to assess the prevalence of CVD risk factors among fuel filling station employees in the Puducherry district and the 10-year CVD risk prediction score among the study participants with the World Health Organisation package of essential non-communicable (WHO PEN) app and package for resource-poor settings. **Methods:** A community-based cross-sectional study was conducted among the fuel filling station employees in Puducherry. A universal sampling method was employed. The data were collected using a pilot-tested, predesigned, structured questionnaire and the WHO PEN app was used to estimate the CVD risk score. The data were collected from February 2021 to January 2022 and analysed using Statistical Package for Social Sciences (SPSS) version 20. Frequency distribution along with the Chi-square test was employed to test statistical significance. **Results:** Out of 212 subjects, 170 (80.2%) were males, out of which 116 (54.7%) were between 40 and 50 years old. Nearly half the participants (48%) had CVD risk scores ranging from 5 to 20%, with an increased prevalence of CVD risk factors, namely, obesity/overweight (65.5%), physical inactivity (58.5%), hypertension (52%), alcohol consumption (51%) and tobacco consumption in any form (25.5%). **Conclusions:** This study sheds light on the sedentary nature of the occupation and the increased prevalence of CVD risk factors among the study participants. It is also evident that the participants had higher CVD risk scores for developing CVDs in the future. **Recommendations:** The use of mobile-based apps can be used as a feasible strategy to save scarce resources in delivering primary health care. We also propose that the nature of occupation be taken into account as one of the parameters for risk prediction. Risk prediction assessment should be made mandatory during the annual examination of employees.

Keywords: CVD risk, fuel filling station employees, mhealth, World Health Organisation package of essential non-communicable

Introduction

India is witnessing a significant increase in the prevalence of non-communicable diseases (NCDs), and addressing this requires a comprehensive and multi-faceted approach.[1] The burden of NCDs puts a strain on the healthcare system, requiring an increased focus on preventive measures, early

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detection, and management of chronic conditions.[2] Adopting a risk-based approach to cardiovascular diseases (CVDs) in resource-poor settings offers several advantages.[3] Such an approach is essential for optimising limited resources and addressing the unique challenges faced by populations with constrained access to healthcare. A risk-based approach allows for the identification and prioritisation of individuals at higher risk for CVDs.[4] Implementing screening programmes using risk assessment tools that take into account the unique risk profile of the local population and workplace wellness programmes are effective, low-cost strategies in low-resource settings. This targeting helps optimise the allocation of limited resources towards those who need preventive and therapeutic interventions the most.[5] A review of the existing literature has revealed that despite routine workplace wellness programmes for fuel-filling stations, there are a lot of occupational hazards they face in their line of work. Many studies in India and abroad have revealed respiratory problems, abnormalities in haematological parameters, genotoxic effects, etc., as the most common health issues prevalent among fuel-filling station employees, but there is a paucity of information concerning their cardiovascular risk.[6–10] Keeping this knowledge gap in mind, this study was designed to assess the CVD risk of fuel filling station employees using the World Health Organisation package of essential non-communicable (WHO PEN) disease interventions ideal for use in resource-poor settings.

Objectives

1. To measure the prevalence of CVD risk factors among fuel filling station employees in the Puducherry district and
2. To measure the 10-year CVD risk prediction score among the study participants with the WHO PEN app and package for resource-poor settings.

Methodology

Study design and setting

This community-based cross-sectional study was carried out among fuel-filling station employees in the Puducherry district for a period of one year, from February 2021 to January 2022.

Study participants, sampling technique and sample size

There are three main petroleum companies in operation in Pondicherry, namely, Indian Oil, Bharath Petroleum and Hindustan Petroleum. The lottery method was used to select one company randomly, which was approached for permission to conduct the study. All employees of the selected company, namely, Indian Oil Corporation, who were aged between 40 and 75 years were included. Those employees unwilling to be included in the study, those with prior diagnoses of CVDs and stroke, and those unable to be contacted even after two visits to the outlets were excluded. The final sample size was reached as per the flowchart below [Figure 1].

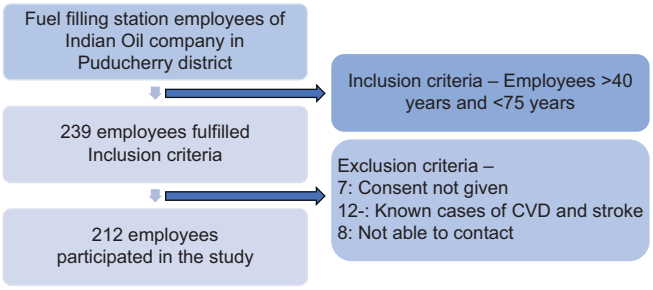

Figure 1: Flow Chart of data collection procedure

Data collection tools and techniques

A questionnaire was developed to collect the sociodemographic details, work profile and other relevant CVD risk factors. For calculating the CVD risk score, the WHO PEN[11] disease intervention for primary healthcare app was used. The WHO PEN app was developed as a tool to facilitate the implementation of essential NCD interventions for primary health care. It is intended to be used by primary healthcare providers and peripheral health workers in resource-poor settings for both CVD risk assessments and interventions. The app is available in the Google Play Store and is free to download and use. The CVD risk calculator has both lab- and non-lab-based risk assessments. The non-lab-based assessments include age, gender, smoking status, systolic blood pressure, and body mass index. The lab-based assessments include total cholesterol levels in addition. We have used the non-lab-based assessment for the current study. The data were collected by the principal investigator and the coinvestigators.

Weight

A calibrated digital weighing scale was used to measure weight in kilograms with participants wearing light clothing and no footwear.

Height

A calibrated stadiometer or a vertical wall-mounted stadiometer was used to measure height in centimetres with participants standing barefoot and with a straight posture.

Blood pressure

Blood pressure (BP) was assessed using an Omron BP monitor following the American Heart Association (AHA) recommendations. Two consecutive measurements were taken with a minimum of five minutes between readings, and the average was recorded.[12]

Body mass index

Body mass index (BMI) is a person's weight in kilograms divided by the square of their height in metres. BMI is an inexpensive and easy screening method for weight categories like underweight, healthy weight, overweight, and obesity.[13] In our study, we used WHO-revised guidelines for the South Asian population, which includes India.[14]

Smoking and alcohol consumption

The definition for various forms of smoking and alcohol consumption was taken from the report of the non-communicable risk factors survey conducted by the Integrated Disease Surveillance Project.[15]

Smoker

A smoker was defined as someone who smoked any tobacco product at the time of the survey/who had smoked previously.

Nontobacco users: Individuals who never smoked/used smokeless tobacco in their lifetime.

Alcoholic: A person who had consumed alcohol in any drinks with different alcohol content in the past or during the last 12 months before the survey.

Non-alcoholic: Individuals who have never consumed one or more drinks of any type of alcohol in their lifetime.

Physical activity[16]

Vigorous physical activity

Activities on at least three days a week achieving a minimum total physical activity of at least 1500 metabolic equivalent (MET) minutes a week or seven or more days of any combination of walking, moderate intensity or vigorous intensity activities achieving a minimum total physical activity of at least 3000 MET minutes a week.

Moderate physical activity

Activity is more than likely equivalent to half an hour of at least moderate-intensity physical activity on most days or three or more days of vigorous-intensity activity and/or walking of at least 30 minutes per day or five or more days of moderate-intensity activity and/or walking of at least 30 minutes per day, achieving a minimum total physical activity of at least 600 MET minutes a week.

Light physical activity/sedentary

A low level of physical activity means that the participant does not meet any of the criteria for either moderate or high levels of physical activity.

Data analysis

The collected data were entered in Microsoft Excel 2010 and analysed using Statistical Package for Social Sciences (SPSS version 20. The data have been presented in the form of numbers and percentages for qualitative variables, and mean, standard deviation/median, and interquartile range for quantitative variables. Chi-square test was applied to find out the association between ten years of CVD risk and other risk factors. Statistical significance was set at P value < 0.05.

Ethical considerations

Written informed consent was sought from all participants who were enrolled in the study. The scientific and ethical committee approval was obtained from the Institute Research Committee and the Institute Human Ethics Committee (MGMCRI/Res/01/2019/14/IHEC/015), respectively. Data safety and confidentiality were maintained at every step of the study.

Results

A total of 212 participants participated in the study, and the results were described under the following headings:

- Sociodemographic and work profile
- Prevalence of risk factors
- 10 years of CVD risk assessment.

Sociodemographic details

Among the study participants, the majority (80.2%) were males and nearly half (54.7%) of the study participants were aged between 40 and 50 years. Other sociodemographic and work profile details of the study participants are given in Table 1.

Prevalence of risk factors

A pretested questionnaire was used to assess the various risk factors for CVDs. Among the participants, 110 (51.9%) had a history of alcohol consumption, and more than half were overweight or obese. Physical inactivity was more common among the study participants [Table 2].

Table 1: Sociodemographic and work profiles of the study participants (*n*=212)

Sociodemographic details	Frequency (%)
Gender	
Male	170 (80.2%)
Female	42 (19.8%)
Age in years	
40–50	116 (54.7%)
51–60	77 (36.3%)
>60	19 (9.0%)
Socioeconomic status (based on the modified BG Prasad classification)[17]	
Upper	6 (2.8%)
Upper middle	43 (20.3%)
Middle	107 (50.5%)
Lower middle	55 (25.9%)
Lower	1 (0.5%)
Education	
Illiterate	17 (8.0%)
Primary	29 (13.7%)
Secondary	83 (39.2%)
Higher secondary	41 (19.3%)
Diploma/graduate	42 (19.8%)
Type of shift	
Day alone	81 (38.2%)
Both day and night	131 (61.8%)
Type of work	
Permanent	123 (58%)
Temporary	89 (42%)

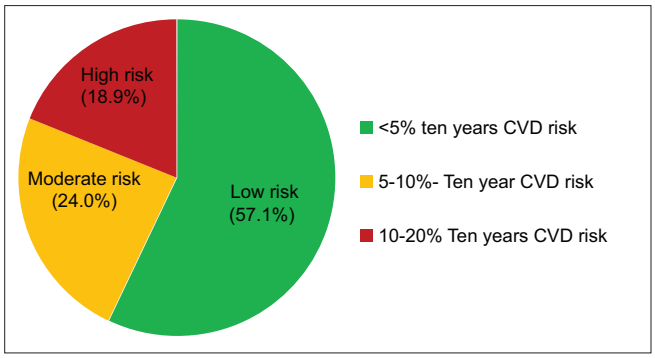

Figure 2: Ten-year CVD risk prediction score (N = 212)

Ten-year CVD risk assessment

Figure 2 depicts the ten-year CVD risk assessment among the study participants. Half of the study participants had less than a 5% risk of developing CVD in 10 years. However, 24% and 18.9% of the participants had a 5–10% and 10–20%, respectively, risk of developing CVD in 10 years.

Apart from the risk factors utilised to evaluate CVD risk score, there was a statistically significant increase in CVD risk among those with physical inactivity (22.7%) and those doing both duties (24.4%) [Table 3].

Table 2: Prevalence of risk factors among the study participants (*n*=212)

Risk factor		Frequency (%)
Tobacco use (ever user)	Yes	54 (25.5%)
	No	158 (74.5%)
Alcohol consumption (ever user)	Yes	110 (51.9%)
	No	102 (48.1%)
BMI	Underweight	10 (4.7%)
	Normal	63 (29.7%)
	Overweight	69 (32.5%)
	Obese	70 (33.0%)
Hypertension	Optimal	53 (25.0%)
	Normal	22 (10.4%)
	High normal	26 (12.3%)
	Hypertension	111 (52.4%)
Physical activity	Inactive (low and sedentary)	124 (58.5%)
	Active (moderate and vigorous)	88 (41.5%)

Table 3: Association of risk factors with CVD risk score (*n*=212)

Risk factor	Ten-year CVD risk			*P*
Physical activity	<5%	5–10%	10–20%	
In active	40 (45.5%)	28 (31.8%)	20 (22.7%)	0.014*
active	81 (65.3%)	23 (18.5%)	20 (16.1%)	
Type of work	<5%	5–10%	10–20%	
Permanent	70 (59.9%)	30 (24.4%)	23 (18.7%)	0.990
Temporary	51 (57.3%)	21 (23.6%)	17 (19.1%)	
Type of shift	<5%	5–10%	10–20%	
Both	75 (57.3%)	24 (18.3%)	32 (24.4%)	0.006*
Day only	46 (56.8%)	27 (33.3%)	8 (9.9%)	

*Chi-square test applied, $P<0.05$ statistical significance

Discussion

The present cross-sectional study was conducted among the automobile fuel filling station employees in the Puducherry district over a period of one year, from February 2021 to January 2022. The study was aimed at assessing the prevalence of cardiovascular risk factors and the 10-year CVD risk prediction score of automobile fuel filling station employees aged between 40 and 75 years employed by the Indian Oil Corporation in Puducherry. In the current study, the majority of the participants (80.2%) were males, aged between 40 and 60 years (91%). Around 39.2% were educated up to the secondary level. A study on risk perception among gas station workers in Brazil also reported that the majority of the participants were male (90.5%) and nearly half of the participants (50.2%) completed secondary education, which was similar to the current study.[18] Around 75% of the participants belonged to the middle and lower middle classes, according to the modified BG Prasad scale.[17,19] A similar study in Goa among fuel-filling station employees reported that half of the participants belonged to the middle class.[20] Tobacco use was reported by 25.5% of participants in this study, and alcohol consumption was reported by 51.9% of participants. Likewise, in a study by Rehkadevi *et al.*,[21] among fuel-filling station attendants, around 53.5% of the fuel-filling station employees were smokers and 35.5% were alcoholics. In contrast, a study on tobacco use among petrol fillers in Pune found that 59.02% used tobacco in all forms. Among the tobacco users, the majority of the participants (77.6%) used smokeless forms of tobacco compared to the smoking form (8.26%).[20] Around 65.5% of participants were overweight or obese in the current study, similar to findings reported by Jaiswal *et al.* where the BMI of petrol pump workers in Puducherry was reported to be 26.85 ± 0.80.[22] In the current study, around half (52.4%) of the participants were hypertensive and also physically inactive (58.5%). Similar findings were reported in a study on occupational hazards among the petrol pump attendants in Goa that prehypertension status (45.3%) was more prevalent among the fuel-filling employees.[20] A study was carried out in Iran to estimate the 10-year risk of CVDs using a modified programme (PEN) called Ira-PEN, which was integrated into the primary care programme in health centres. The prevalence of CVD risk factors in that study was as follows: history of diabetes (7.9%), history of high blood pressure (15.7%) and history of prediabetics (12.8%). The probability of suffering from a lipid disorder was 26.4% and BMI >30 was 32.4%.[23] The difference in findings may be explained by the fact that this was conducted among a different population with different characteristics, and also that this was a study conducted among the general population rather than a particular occupational cohort, which was done in our study. A secondary analysis of the National Family Health Survey (NFHS) (2015–16) data was carried out by Jaiswal *et al.*[24] to predict cardiovascular risk using the WHO CVD risk prediction chart with respect to hypertension status among the Indian population. The results

of this study found that among women, the majority (95.7%) had low CVD risk (<5%), while 4.2% had 5% to <10% CVD risk, and only 0.1% had >10% risk. Among men, those with low CVD risk (<5%) were 65%, those with 5% to <10% CVD risk were 32.3%, 10% to <20% were 2.7% and a meagre 0.03% had 20 to <30% risk. These findings showed that the risk of CVD was higher among fuel-filling workers compared to the general population. Similarly, another analysis of risk factor level data for male adults aged 18 years and above from the NFHS-5 of Tamil Nadu state, India, by Sasikumar *et al.*[25] showed that out of 2289 adult males, only 1.12% of the participants had a 10-year CVD risk score greater than 30% in contrast to our study. A community-based study carried out by Sivanantham *et al.*[26] in Puducherry to assess the performance of WHO-updated CVD risk prediction charts in low-resource settings reported that the lab and non-lab charts estimated 3% (95% confidence interval: 1.7–4.2) and none of the population, respectively, to have a high risk (≥20%) for fatal or non-fatal CVD events over the next 10 years. In contrast, our study population had 19% high risk; this is because our study was conducted among high-risk populations, whereas the study in Puducherry was done among the general population.

Strengths and limitations

This was a community-based cross-sectional study that assessed the CVD risk of participants using a mobile app, thus proving that this can be replicated in other resource-poor settings. Ideally, the lab-based CVD risk assessment also should have been included, but we were unable to do so due to logistics and financial constraints. Still, this strategy of identifying individuals at higher risk with non-lab-based CVD risk assessment is an acceptable alternative.

Conclusion

This study sheds light on the sedentary nature of the occupation and the increased prevalence of CVD risk factors among the study participants. It is also evident that the participants had higher CVD risk scores for developing CVDs in the future.

Recommendations

This study highlights the importance of risk-prediction calculations to identify high-risk individuals who can subsequently be referred for more expensive lab tests. This strategy should be adopted regularly in low- and middle-income countries for early identification of NCDs, thereby saving expensive treatment costs later. The use of mobile-based apps can be used as a feasible strategy to save scarce resources when delivering primary healthcare in such settings. We also propose that the nature of occupation be taken into account as one of the parameters for risk prediction. Risk prediction assessment should be made mandatory during the annual examination of employees.

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Conflicts of interest

There are no conflicts of interest.

References

1. Nethan S, Sinha D, Mehrotra R. Non communicable disease risk factors and their trends in India. Asian Pac J Cancer Prev 2017;18:2005-10.
2. Budreviciute A, Damiati S, Sabir DK, Onder K, Schuller-Goetzburg P, Plakys G, *et al.* Management and prevention strategies for non-communicable diseases (NCDs) and their risk factors. Front Public Health 2020;8:574111.
3. Teo KK, Rafiq T. Cardiovascular risk factors and prevention: A perspective from developing countries. Can J Cardiol 2021;37:733-43.
4. Chung R, Xu Z, Arnold M, Stevens D, Keogh R, Barrett J, *et al.* Prioritising cardiovascular disease risk assessment to high risk individuals based on primary care records. PLoS One 2023;18:e0292240.
5. 9789240001367-eng.pdf. Available from: https://iris.who.int/bitstream/handle/10665/333221/9789240001367-eng.pdf?isAllowed=y&sequence=1. [Last accessed on 2024 Jan 19].
6. Srivastava A, Barkule S. Airway function and mental health status of petrol pump workers of Aurangabad (Maharashtra) city. – An analytical cross-sectional study. Clin Epidemiol Glob Health 2020;8:661-5.
7. Getu S, Shiferaw E, Melku M. Assessment of hematological parameters of petrol filling workers at petrol stations in Gondar town, Northwest Ethiopia: A comparative cross-sectional study. Environ Health Prev Med 2020;25:44.
8. Thomas JS, Mercy PJ, Joseph M, Joseph B. Awareness, prevalence and factors associated with respiratory morbidities among selected petrol pump workers in Bengaluru city. Indian J Occup Environ Med 2020;24:199-202.
9. Joshi D, Awasthi G, Mandal TK. Impact of long term exposure to petroleum products on hematological parameters in petrol pump workers of Dehradun region. Int J Pure App Biosci 2019;7:446-54.
10. Koski L, Tshoni UA, Olowoyo JO, Kobyana AS, Lion NG, Mugivhisa LL, *et al.* Occupational lead exposure in gasoline station forecourt attendants and other occupations in relation to ALS (amyotrophic lateral sclerosis) risk. medRxiv; 2023.
11. WHO. WHO package of essential noncommunicable (PEN) disease interventions for primary health care; 2020. Available from: https://www.who.int/publications-detail-redirect/9789240009226. [Last accessed on 2023 Nov 27].
12. Smith L. New AHA recommendations for blood pressure measurement. AFP 2005;72:1391-8.
13. Centers for Disease Control and Prevention. All about adult BMI. Centers for Disease Control and Prevention; 2021. Available from: https://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html. [Last accessed on

2021 Oct 25].

14. Aziz N, Kallur SD, Nirmalan PK. Implications of the revised consensus body mass indices for Asian Indians on clinical obstetric practice. J Clin Diagn Res 2014;8:OC01-3.
15. National Institute of Medical Statistics, Indian Council of Medical Research (ICMR), 2009, IDSP Non-Communicable Disease Risk Factors Survey, Phase-I States of India, 2007-08. National Institute of Medical Statistics and Division of Non-Communicable Diseases, Indian Council of Medical Research, New Delhi, India.
16. Guthold R, Stevens GA, Riley LM, Bull FC. Worldwide trends in insufficient physical activity from 2001 to 2016: A pooled analysis of 358 population-based surveys with 1·9 million participants. Lancet Glob Health 2018;6:e1077-86.
17. Vasudevan J, Mishra AK, Singh Z. An update on B. G. Prasad's socioeconomic scale: May 2016. Int J Res Med Sci 2016;4:4183-6.
18. Cezar-Vaz MR, Rocha LP, Bonow CA, da Silva MRS, Vaz JC, Cardoso LS. Risk perception and occupational accidents: A study of gas station workers in southern Brazil. Int J Environ Res Public Health 2012;9:2362-77.
19. BG Prasad Scale. Prasad social classification scale update. Available from: https://prasadscaleupdate.weebly.com/. [Last accessed on 2024 Jan 22].
20. Naik AV, Ferreira AM. A cross sectional study of occupational hazards among petrol pump attendants of Panjim city in Goa. Int J Prev Curat Comm Med 2020;6:15-9.
21. Rekhadevi PV, Mahboob M, Rahman MF, Grover P. Determination of genetic damage and urinary metabolites in fuel filling station attendants. Environ Mol Mutagen 2011;52:310-8.
22. Jaiswal A. Effect of petrol fumes on an anthropometry and ventilatory function among petrol pump workers of Puducherry, India. Hum Biol 2020;9:358-69.
23. Ezzati F, Jafarzadeh M, Darabi F. Assessing and predicting the trend of cardiovascular risk factors in 40–80-year population based on the Ira-PEN program as an integrated service in primary health care. J Educ Health Promot 2023;12:374.
24. Jaswal P, Kaur P, Sarin J. Predicting 10-year cardiovascular risk using WHO/ISH risk prediction chart among rural population in Haryana, India. Indian J Forensic Med Toxicol 2021;15:497-503.
25. Sasikumar M, Marconi SD, Dharmaraj A, Mehta K, Das M, Goel S. Prevalence of risk factors and estimation of 10-year risk for cardiovascular diseases among male adult population of Tamil Nadu India-an insight from the National Family Health Survey–5. Indian Heart J 2023;75:251-7.
26. Sivanantham P, Kar SS, Lakshminarayanan S, Sahoo JP, Bobby Z, Varghese C. Performance of WHO updated cardiovascular disease risk prediction charts in a low-resource setting – Findings from a community-based survey in Puducherry, India. Nutr Metab Cardiovasc Dis 2022;32:2129-36.