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Original Research Article

Health camps for truck drivers: a community-based approach to wellness

Sahil Jagnani[1], Ankit Chowdhury[1]*, Snigdha Saikia[2]

[1]Primary Healthtech Private Limited, Building E-12, Block E, Sector 6 Noida, Uttar Pradesh, India
[2]Department of Chemistry and Biotechnology, Primary Healthtech Private Limited, Building E-12, Block E, Sector 6 Noida, Uttar Pradesh, India

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***Correspondence:**
Ankit Chowdhury,
E-mail: ankit@mobilab.in

ABSTRACT

Background: Globally, non-communicable diseases (NCDs) are a leading cause of morbidity and mortality. Occupational lifestyle, particularly in professions like truck driving, increases exposure to NCD risk factors. Early detection at the community level is vital for prevention and ensuring well-being. M/S Primary Healthtech Private Limited, in collaboration with the Indian Institute of Technology Guwahati, developed "Mobilab" a portable, battery-operated, IoT-enabled biochemistry analyzer. To support early screening, health camps targeting truck drivers key contributors to the national supply chain were conducted.
Methods: Two health camps were organized in Binola (Camp-1) and Greater Noida (Camp-2), screening 382 and 234 participants respectively over 8 days each. Screening used the Mobilab device to assess various biochemical and physiological parameters for early detection of NCDs.
Results: Parameters tested included cholesterol (CHOL), triglyceride (TGL), LDL, HDL, uric acid (UA), creatinine (CRE), glucose (GLU), hemoglobin (HB), total bilirubin (TBIL), total protein (TP), albumin (ALB), globulin (GLO), and albumin/globulin ratio (A/G). Camp-2 showed higher prevalence of kidney issues (41.1%) and anemia (39%) compared to Camp-1 (26.18% and 18%, respectively). Diabetes prevalence was low in both camps: 2.88% in Camp-1 and 2.16% in Camp-2.
Conclusions: This community-based screening among truck drivers in Binola and Greater Noida highlights the effectiveness of early NCD detection using portable diagnostic tools. The study underscores the importance of regular health check-ups, especially for kidney-related complications, and the need for sustained preventive healthcare initiatives for high-risk occupational groups.

Keywords: Health camps, Non-communicable diseases, Biochemistry parameter, Mobilab, Trucking community

INTRODUCTION

The NCDs include cardiovascular diseases, diabetes, kidney disorders, and liver diseases.[1] With regards to the burden of rising NCDs with high disease severity and case-fatality in low-income and middle-income countries compared with high-income countries, the UN recognized in 2012 that the burden of NCDs, in fact, one of the greatest threats to sustainable development in this 21st century.[2] The work culture and nature of occupation play a crucial role in shaping lifestyle and associated risk factors for NCDs.[3]

Truck driving is an occupation where drivers are more prone to get exposed to several risk factors for NCDs compared other occupations.[4-7] Truck driver's primary job is to sit and drive in public road and their health have

a significant impact on public safety. Any health issues that affect driver's health may increase the likelihood of higher risk of road accidents.[8] If NCDs are not managed on time, while driving on public road, drivers may encounter sudden NCDs related complications. If NCDs related complications, such as cerebrovascular, cardiovascular, hypertension, diabetes, anaemia, and others, are not properly managed in a timely manner, they may result in sudden, fatal health issues while driving, and potentially leading to tragic road accidents.[9,10]

Drivers working for long hours on the roads, getting disturbed shifts, inadequate healthy food availability, and no exercise in their routine activities have led them to chronic conditions such as hypertension, diabetes, and cardiovascular diseases.[3,11]

The health of truck drivers is a significant public and economic concern, as they are essential to maintaining supply chains across the country. Health camps for truck drivers are crucial for monitoring their health conditions in a timely manner, as the demands of their job are giving rise to NCDs related health issues.[12]

This study aims to evaluate the health conditions of the truck drivers in India's most commercially active regions, Binola and Greater Noida by organizing health camps. The key health parameters assessed in the Binola and Greater Noida camps were cholesterol (CHOL), triglyceride (TGL), low density lipoprotein (LDL), high lipoprotein (HDL), uric acid (UA), creatinine (CRE), glucose (GLU), haemoglobin (HB), total bilirubin (TBIL), total protein (TP), albumin (ALB), globulin (GLO), albumin/globulin Ratio (A/G). The biochemical analysis was conducted using the "Mobilab" a clinical biochemistry analyzer, which is portable, battery-operated, IoT-enabled, and clinically validated with a diagnostic accuracy level of over 90%.

This study offers insights into the risk factors among truck drivers, aiming to serve as a preventive measure to avoid accidents or sudden fatal episodes. Such programs are very important, as truck drivers play a very important role in the logistics and transport industries, and their health and well-being should be promoted.

METHODS

A convenience sampling method was used, wherein all available and consenting truck drivers attending the health camps were screened. No formal sample size calculation was performed, as the study aimed to provide exploratory insights into the prevalence of NCD risk factors in this specific occupational population.

This is a community-based cross-sectional study conducted through health camps at Binola and Greater Noida in truck drivers. The study included 616 participants, comprising truck drivers with 382 from Camp-1 (Binola site) and 234 from Camp-2 (Greater Noida sites). The health camps spanned eight days each and followed a structured schedule from 9 am to 5 pm, divided into two sessions (9 am - 12 pm and 2 pm - 5 pm) to accommodate the maximum number of participants effectively. The schematic representation of the study is shown in Figure 1.

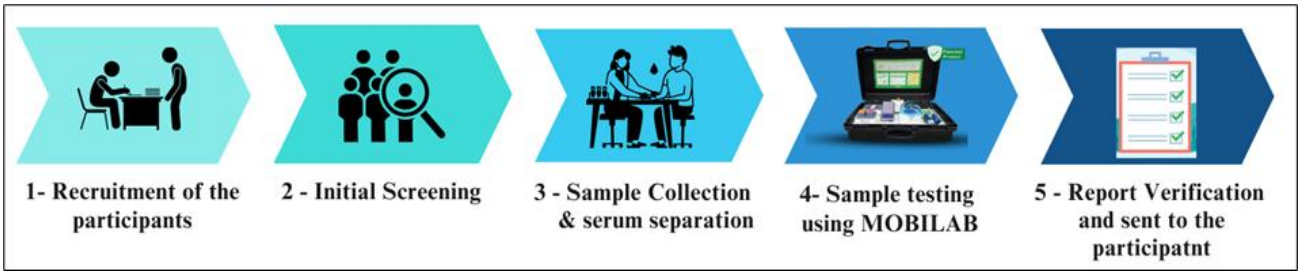

Figure 1: Schematic presentation of the steps involved in the study.

Step-1: Patient registration is done and immediately Sample ID is allotted. Step-2: Initial Screening included the measurements of blood pressure, height, weight and BMI, Step-3: Sample collection was done in EDTA (for hemoglobin) and clot vial (for rest of the tests). Step-4: The blood sample in clot vial was centrifuged using Mobifuge to separate the serum. Step-5: The digitized report is generated, verified, and delivered to the concerned individual.

Selection and recruitment of the participants

Participants were selected based on the following inclusion and exclusion criteria prior to recruitment into the study:

Inclusion criteria

Adult truck drivers (aged 18 years and above) who were present at the health camp site during the study period and provided informed verbal consent to participate in the screening were included.

Exclusion criteria

Individuals who were visibly under the influence of alcohol or drugs, unable to provide consent, or had acute medical emergencies requiring immediate referral were excluded from the screening.

Prior to the test performance in Mobilab, a portable clinical biochemistry analyzer, participants were thoroughly informed about the study objectives and consent was taken from each participant. The confidentiality of their personal health information was strictly maintained in line with ethical standards.

Camp 1 – Binola

Duration: 8 days (5th August 2024 to 12th August 2024).

Participants: 382 patients were participated and screened.

Camp 2 – Greater Noida

Duration: 8 days (9th September 2024 to 13th September 2024).

Participants: 234 patients were participated and screened.

Parameters Tested: Identical to Camp 1.

Initial screening

During the initial screening, blood pressure, height, weight, and BMI were recorded for the participants.

Sample collection and serum separation

Approximately 2 mL of blood was collected by a trained phlebotomist and immediately transferred into a clot vial. It was left to stand at room temperature for 10 min before being centrifuged at 3,500 rpm for 5 minutes. The separated serum was then transferred to a microfuge tube, ready for testing in the Mobilab. Figure 2 outlines the steps involved in sample collection and serum separation.

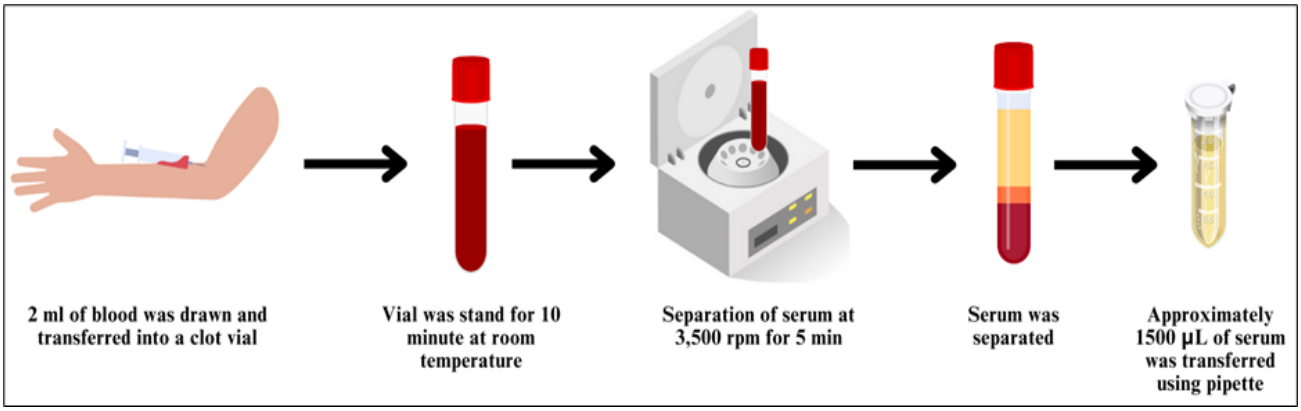

Figure 2: Workflow for serum preparation from blood samples.

A total of 2 ml of blood was drawn and transferred into a clot vial. The vial was allowed to stand for 10 min at room temperature to facilitate clot formation. The sample was then centrifuged at 3,500 rpm for 5 minutes to separate the serum. The serum was collected and approximately 1500 µl was transferred to a new microfuge tube using a micropipette for further analysis.

The separated serum sample was used for each parameter by following the manufacture's protocol of the reagent. The reagent kits for all parameters were purchased from Agappe (Kerala, India). A CHOL reagent kit (CHOD-PAP method13) with Ref no.: 51403002, A TGL reagent kit (GPO-PAP method14) with Ref no.: 51410002, An LDL-C Direct with Calibration Reagent kit (Selective solubilization Method15) with Ref no.: 51415003, A UA kit (Uricase PAP method16) with Ref no.: 51412002, A CRE reagent kit (Enzymatic method17) with Ref no.: 51420003, A GLU reagent kit (GOD-PAP method18) with Ref No.: 51406001, A HB reagent kit (Cyanmethemoglobin method 19,20) with Ref No.: 51011001, A TBIL reagent kit (Modified DMSO/Diazo method21) with Ref no.: 51003003, A TP reagent kit (Direct Biuret method22) with Ref no.: 51013002, An ALB reagent kit (Bromocresol Green Method23) with Ref no.: 51415003. High Lipoprotein (HDL), Globulin (GLO), Albumin/Globulin Ratio (A/G) were calculated by using following formulas:

HDL

HDL was if the Triglycerides value is <400 mg/dL, using the following Equation24:

HDL = Total Cholesterol - LDL - TG/5

Globulin

Globulin was calculated from Total Protein and Albumin, using the following equation:[25]

Globulin = Total Protein - Albumin

Albumin/Globulin Ratio

Albumin/Globulin ratio was calculated from Globulin and Albumin, using the following equation:[26]

A/G= Albumin/Globulin

Sample testing in Mobilab

4 ml polystyrene cuvettes were purchased from Axibio (France), a device Mobilab (M/S Primary Healthtech Private Limited, India), Mobimix -a mixer device (M/S Primary Healthtech Private Limited, India), an Android smartphone (Redmi 9A, Xiaomi), micro-USB OTG cable, a centrifuge, two, micropipettes (Figure 3).

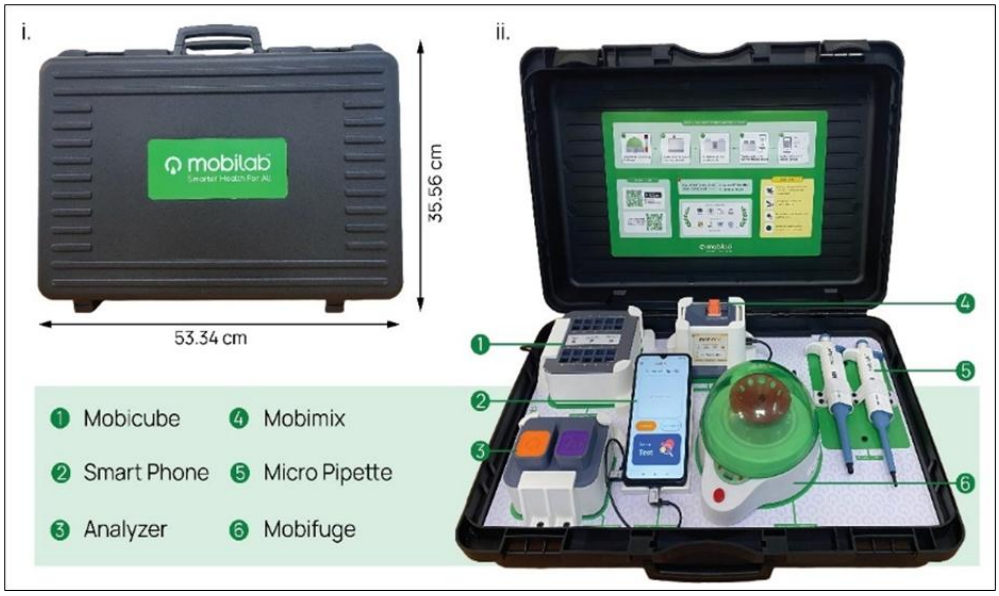

Figure 3: Mobilab.

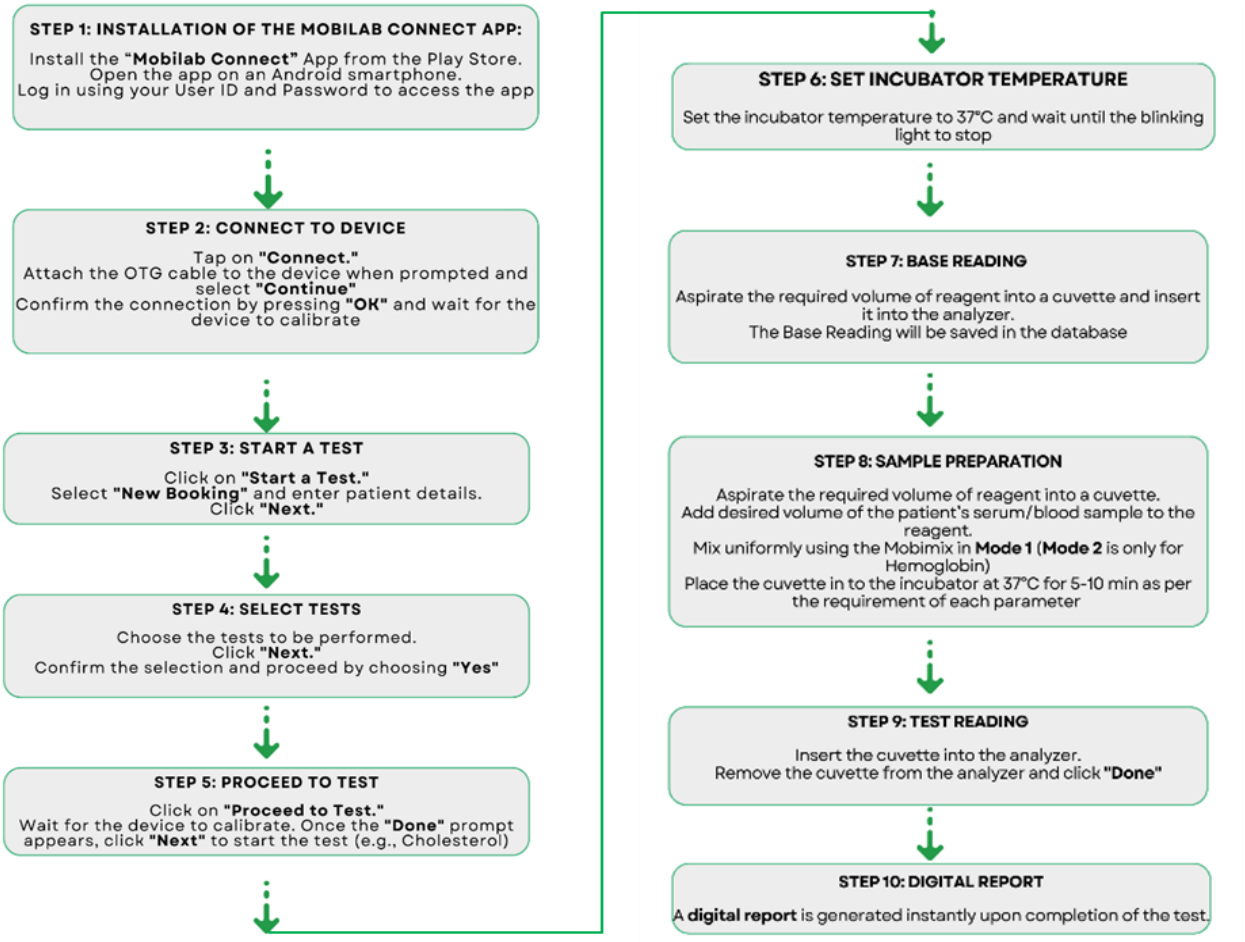

Figure 4: Flow chart for operating "Mobilab Connect" App to perform Test.

Figure 3: (i) Closed view of Mobilab with a length of 53.34 cm and height of 35.56 cm. ii) Opened view of Mobilab consisting of (1) Mobicube, a portable battery-operated external incubator that regulates temperature to incubate multiple samples simultaneously during the test (2) An Android Smartphone which is installed with the "Mobilab Connect" application (3) Analyzer, a device that measures all biochemical parameters. It is portable, battery operated and digitally connected through an OTG cable (4) Mobimix, a portable and battery-operated device used for automated uniform mixing of sample and reagent (5) Micropipette used for aspirating the required volume of the reagent and sample (6) Mobifuge, a portable and battery-operated centrifuge that separates serum from blood.

The sample is prepared and run in the Mobilab device by installing a software Mobilab Connect and following the steps mentioned below:

Flow chart for operating "Mobilab Connect" App to perform Test.

RESULTS

The health camps reported a large number of screenings at both locations. 5,730 and 3,510 tests were performed while screening 382 truck drivers at Camp -1 (Binola site), and at Camp -2 (Greater Noida site). A maximum of 80 participants were screened per day in Camp-1 with 16-71 yrs of age group (average age = 32 yrs) and 65 in Camp-2 with 15-75 yrs age group (average age = 31yrs). The outcomes are listed in Table 1 uncovered several notable health trends within the truck drivers.

Table 1: Clinical Screening data for trucking communities: Camp-1 (Binola Site) and Camp-2 (Greater Noida Site).

Tested Profile	Camp 1 (Binola Site)		Camp-2 (Noida Site)	
No. of patients	382		234	
Testing period (Hrs.)	64		40	
Number of screenings	5730		3510	
	Health status of screened Truck drivers (%)			
	Unhealthy	Healthy	Unhealthy	Healthy
Heart	18.06	81.94	26.3	73.7
Kidney	26.18	73.82	41.1	58.9
Liver	25	75	30	70
Anaemia	30	70	18	82
Diabetes	2.88	97.12	2.16	97.84

The health screening conducted at Camp-1 and - 2 focused on identifying the health status of participants concerning key organ functions, including the liver, heart, kidneys, and anaemia risk.

The liver screening revealed that 75% and 70% of individuals were healthy, while 25% and 30% were categorized as at risk at Camp-1 and Camp -2 respectively.

The screening revealed that in terms of heart function, 81.94 and 73.7% of participants were healthy and 18.06% and 26.3% were at risk, at Camp 1 and 2, respectively, indicating a significant concern for cardiovascular health in a fraction of the truck drivers.

Kidney function analysis indicated that 21.47% are at early stage of kidney-related issues, and 4.71% are suffering from kidney diseases at Camp-1 and 34.2% are at the early stages of kidney diseases, 6.5% are suffering from kidney diseases, and 0.4% have experienced kidney failure at Camp-2.

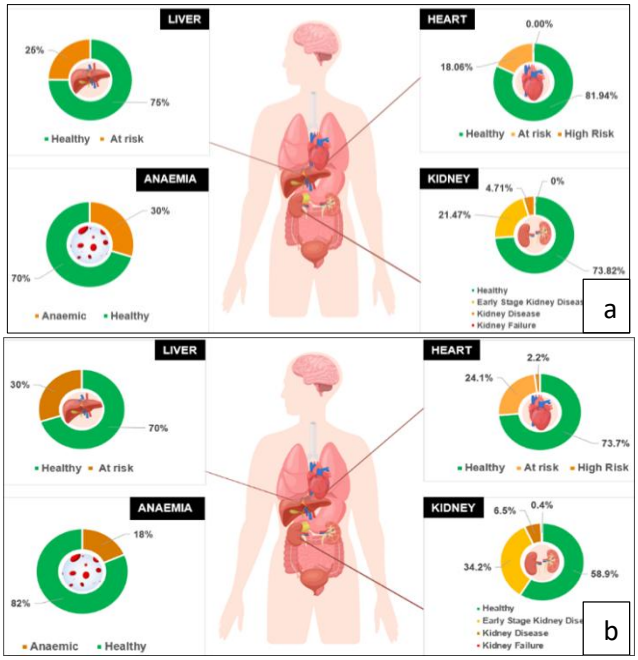

Figure 2: Organ-specific risk and health status of participants at two camp locations (a) Camp-1 (Binola Site); (b) Camp-2 (Greater Noida Site).

Random Glucose test results in participated truck drivers revealed as non-diabetic in 97.12% in Camp 1, and 97.84% in Camp-2. Whereas, a very less fraction of the tested population, 2.88% at Camp-1, and 2.16% at camp - 2 was detected as diabetic.

The anaemia assessment highlighted that 82% of participants had healthy hemoglobin levels, whereas 30%, and 18% were identified as anaemic at Camp 1 and 2, respectively, requiring intervention to prevent associated

health complications. Detailed health insights from Camps 1 and 2 (Camp 1 and Camp 2) are shown in Figure 2.

Figure 2: Organ-specific risk and health status of participants at two camp locations (a) Camp-1 (Binola Site): 25% of participants are at risk of liver diseases, 30% are anaemic, 18.06% are at risk of developing heart diseases, 21.47% are at early stage of kidney-related issues, and 4.71% are suffering from kidney diseases. (b) Camp-2 (Greater Noida Site): 30% of participants are at risk of liver diseases, 18% are anaemic, 24.1% are at risk of developing heart-related issues, 34.2% are at the early stages of kidney diseases, 6.5% are suffering from kidney diseases, and 0.4% have experienced kidney failure.

Figure 3: Comparison of organ-specific health issues among participants at Camp-1 (Binola) and Camp-2 (Greater Noida): The graph depicts the percentage of participants affected by various health conditions at two camps. At Camp-1 (Binola), 18.06% reported heart problems, 25% liver problems, 26.18% kidney problems, 30% anaemia, and 2.88% diabetes. At Camp-2 (Greater Noida), 26.3% reported heart problems, 30% liver problems, 41.1% kidney problems, 18% anaemia, and 2.16% diabetes.

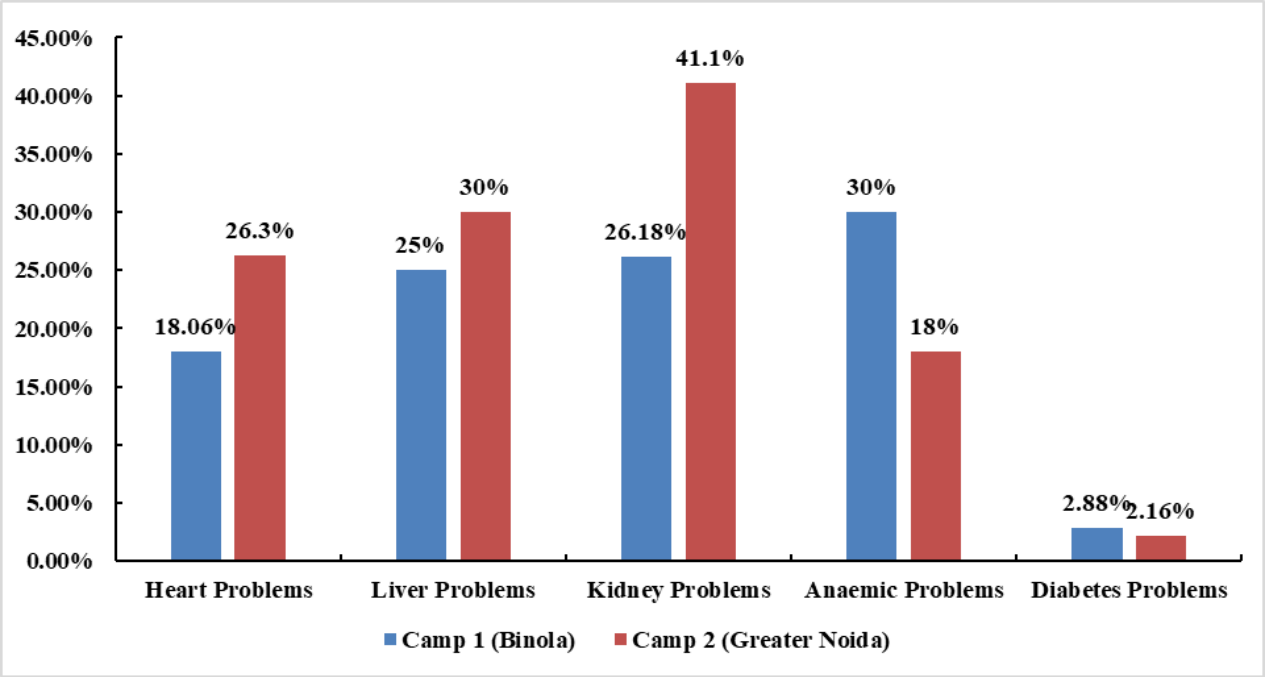

Figure 3: Comparison of organ-specific health issues among participants at Camp-1 (Binola) and Camp-2 (Greater Noida).

DISCUSSION

This study highlights the significant burden of NCDs among truck drivers, a population often overlooked in public health surveillance. Utilizing a portable, app-based biochemistry analyzer (Mobilab), we conducted community-based screenings in Binola (Camp-1) and Greater Noida (Camp-2), offering valuable insights into prevalent health risks within this occupational group. Our findings reinforce the utility of decentralized diagnostics in reaching underserved populations, particularly those with mobile, high-risk occupations.

The analysis revealed a higher prevalence of cardiovascular risk markers, including elevated cholesterol and triglyceride levels, particularly among participants in Camp-2. These findings align with previous studies reporting increased lipid profile derangements among transport drivers due to sedentary lifestyles, high-calorie diets, and stress-induced behaviors.[4,5] A similar trend was observed in HDL and LDL alterations, corroborating global evidence of dyslipidemia as a primary cardiovascular risk factor among truck drivers.[13,15,24]

Liver function indicators, including total bilirubin and protein markers, were more commonly altered in Camp-2. This observation is consistent with earlier research indicating hepatic stress in commercial drivers linked to irregular meal timing, alcohol consumption, and inadequate hydration.[3] Protein parameters such as albumin and globulin were analyzed, and the albumin-to-globulin ratio (A/G), a marker linked to systemic inflammation and liver function, showed abnormalities similar to trends reported in recent meta-analyses.[25,26]

A notable concern in our study was the prevalence of kidney function abnormalities, especially elevated serum creatinine and uric acid levels. Camp-2 exhibited higher renal risk (41.1%) compared to Camp-1 (26.18%). These outcomes mirror previous findings on renal dysfunction

among transport workers, attributed to prolonged sitting, insufficient fluid intake, and limited access to sanitation facilities.[5,16,17]

Anaemia prevalence was higher in Binola (18%) than in Greater Noida (13%), which may be attributed to regional dietary disparities and differences in iron intake or absorption. Previous Indian studies similarly documented high anaemia rates among truck drivers, particularly those with inconsistent access to nutrient-rich diets.[6,20]

Interestingly, the prevalence of diabetes was relatively low across both camps (2.88% in Camp-1 and 2.16% in Camp-2), lower than the national average of 8.9% in adults Lalla-Edward et al.[7] However, subclinical glucose irregularities suggest a potentially larger pool of undiagnosed pre-diabetic individuals, consistent with trends reported in professional driver cohorts.[8,9]

The occupational hazards associated with long-haul trucking such as prolonged sitting, erratic schedules, limited dietary choices, stress, and low physical activity have been well documented as contributors to chronic diseases.[10-12] Our findings further reinforce these associations and underscore the importance of integrating preventive healthcare services into transport hubs.

Overall, this study supports the feasibility and impact of portable diagnostics for early NCD detection in underserved populations. Regular health monitoring, lifestyle counselling, and longitudinal follow-up could significantly reduce the burden of preventable diseases in this essential workforce. Expanding such programs across transit corridors may be instrumental in achieving broader public health goals set forth in the WHO Global Action Plan for NCDs.[1]

The Limitation of the study includes considerations regarding the convenience sampling approach, which may limit generalizability, the cross-sectional design of the study, and the lack of longitudinal follow-up, which prevents us from drawing causal conclusions. Additionally, we acknowledge the absence of self-reported lifestyle data, which could have provided further insights into the behavioral risk factors among the truck driver population. These points have now been clearly stated in the manuscript to maintain transparency and rigor in our interpretation of the findings.

CONCLUSION

This study provides valuable evidence on the burden of non-communicable diseases among long-haul truck drivers in India, a workforce often underserved in routine health systems. By leveraging a portable, battery-operated, and IoT-enabled diagnostic tool Mobilab we successfully demonstrated the feasibility of conducting community-based screenings in transit hubs. The findings highlight a concerning prevalence of kidney dysfunction, dyslipidemia, liver abnormalities, and anemia, reinforcing the urgent need for targeted preventive health interventions in this high-risk occupational group. Importantly, the study advances current knowledge by illustrating how decentralized diagnostic approaches can bridge critical gaps in access, early detection, and disease monitoring among mobile populations. These insights lay the groundwork for scaling up mobile health technologies and integrating them into public health strategies aimed at reducing the NCD burden in India and similar low-resource settings. Future efforts should focus on longitudinal monitoring, behavioural risk assessment, and policy-level integration to sustain the impact of such community-based health initiatives.

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