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Original Article

"Diabetes care at doorsteps": A customised mobile van for the prevention, screening, detection and management of diabetes in the urban underprivileged populations of Delhi

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ABSTRACT

Diabetes is on the rise in India and recently shown to be increasing in the urban underprivileged. Lack of awareness of the disease, its complications, combined with lack of financial resources among the underprivileged, often results in late detection and more complications in them. To combat this, healthcare delivered at the doorstep through the use of a customised mobile medical van is a potentially attractive option.

We used a customized mobile van (included trained personnel, glucose meters, fundus evaluation camera, apparatus for detection of neuropathy and foot circulation and net enabled Skype calling for remote consultation) for educating general population regarding healthy lifestyle and screening, management and intervention in patients with diabetes.

The project covered 10 underprivileged areas (n, 2,31,000 people) in Delhi. Total of 24,072 individuals (10.9% of total population) attended 352 awareness sessions. A total 3,12,347 visits (included repeat visits) were carried out for screening, education and management for obesity and diabetes. During screening (n, 16,834), 2933 subjects (18.7%) had high random blood glucose levels (>200 mg/dL) and had a blood pressure averaging 127.1 ± 23.6/81.3 ± 16.6 mm of mercury (n, 16,339). A pre-post intensive lifestyle counselling for 6 months in a subset of 352 diabetic patients (of which 77.8% i.e. n, 274 were overweight/obese) showed a significant lowering in weight ($p < 0.001$). In addition, 292 frontline workers and 256 paramedical workers were given training regarding lifestyle and diabetes, over 20 sessions.

Based on achievements of this project of spreading awareness, screening, and management of diabetes and obesity in the large number of individuals in urban underprivileged colony, we believe this project could be extended to other cities and rural areas of India, and to other developing countries as well.

1. Introduction

With a transitioning society, India faces a massive health challenge with 8.8% (n, 72, 946, 400) of its population suffering from the diabetes [1]. Imbalanced diets and sedentary lifestyle are prime drivers for the increase in obesity, metabolic syndrome and type 2 diabetes mellitus (T2DM) [2]. Obesity and T2DM are emerging diseases in populations belonging to low socio-economic strata in urban, semi-urban and rural areas [3]. This could also be attributed to lack of awareness [4] illiteracy, poorly trained physicians and paramedical staff [5,6,23] and limited access to health care.

In metropolitan cities like New Delhi, populations in underprivileged areas consist largely of migrants from neighbouring states. Nearly half of the migrants in various underprivileged colonies are from the state of Uttar Pradesh, followed by Bihar [7]. These migrant people survive on meagre incomes and do not have health insurance.

Further, cost of commuting to any healthcare facility and waiting

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in long queues at the hospitals precludes the underprivileged population from seeking adequate care. Visiting health facilities means loss of the day's wages and out-of-pocket expenses on health for such a population. Metropolitan cities also tend to be dominated by private healthcare providers (high-end corporate hospitals, solo-private practitioners etc.), that can be unduly expensive. All the above factors may contribute to delay in detection of diabetes, poorly controlled glycaemia, early and severe complications, and premature mortality.

Providing improvements in terms of (i) easy location access (ii) low cost and (iii) good quality treatment, to underprivileged communities becomes imperative to limit the rising numbers of obesity, T2DM and complications. To such a population, diabetes-related healthcare could be delivered by using a customized mobile medical van that has the necessary wherewithal for prevention, screening and care for diabetes and is available to the population almost at the doorstep of the individual [8]. Besides providing free quality medical care, it could also decrease out-of-pocket expenses.

There remains a paucity of research on whether interventions with trained medical personnel in customised mobile van could help in spreading awareness, screening and management of diabetes, education and also impacting end points (e.g. weight reduction) in underprivileged urban populations. In this study, we have evaluated if this is possible through awareness and education of diabetes and obesity by the trained technicians, nutritionists, and physicians provided at the doorstep of this population.

2. Methodology

The diabetes care at doorsteps in underprivileged populations using customized mobile van - (Hindi name of customised vehicle 'Diabetes Rath') project was initiated in March 2015 with the aim of spreading awareness on appropriate lifestyle practices and diabetes and providing screening, standard care and management of diabetes and its co-morbidities including retinopathy, foot ulcers, peripheral neuropathy, cardio-vascular disease, and nephropathy for the under-privileged population of Delhi at their doorsteps. The project concluded in June 2018.

The specific objectives were to:

- Make the underprivileged population of Delhi aware about diabetes and its co-morbidities including foot ulcers, renal failure, heart attacks, blindness and stroke and their prevention.
- Provide screening, standard counselling, nutritional advice, care and management of diabetes in customised Diabetes Mobile Unit at their doorsteps.
- Train primary healthcare workers [ASHA (Accredited Social Health Activist), AWW, (Anganwadi Worker), local Self-Help Groups (SHGs), Community ambassadors of the National Diabetes Obesity and Cholesterol Foundation (N-DOC) group], Registered Medical Practitioners (RMPs) and paramedics such as helpers associated with doctors, lab technicians, pharmacists regarding diabetes, its causes, screening and management.
- Provide linkages for consultation with specialists at tertiary care centre with diabetologists, ophthalmologists, podiatrists with facilities for transmission of fundus images and electrocardiograph from the Mobile Unit.
- Assess the process and impact of intensive intervention in a subset of patients.

The project WDF14-911 supported by the World Diabetes Foundation, Denmark, https://www.worlddiabetesfoundation.org/) was undertaken in 10 urban underprivileged areas (Fig. 1) of the Delhi National Capital Region (NCR) in northern India, with a total

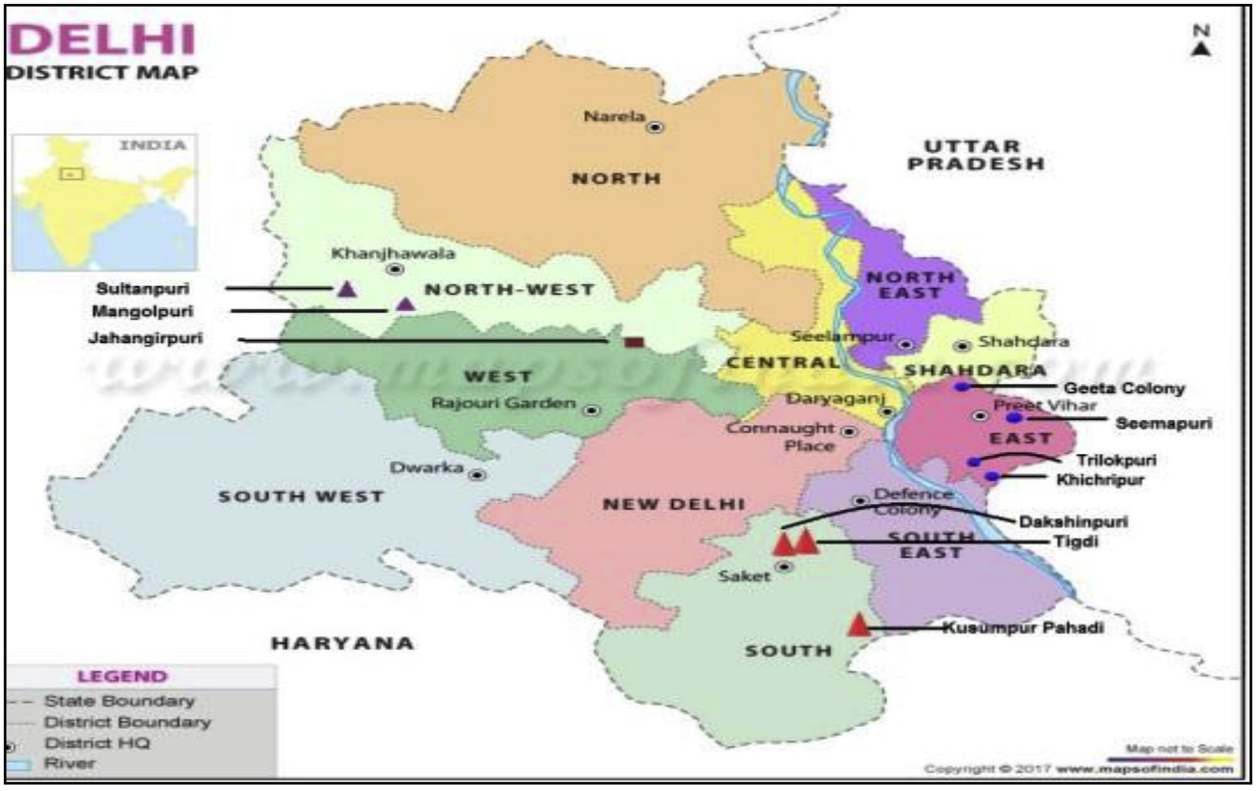

Fig. 1. Map of Delhi located in north of India showing field sites (n, 10) of the underprivileged areas where intervention was carried out.
Source: Adapted from mapsofindia www.mapsofindia.com (© 2014): areas red triangle in South Delhi, Blue dot in east Delhi, purple triangle in north-west Delhi and purple square in west Delhi.

Table 1
Population covered (n) in the 10 underprivileged areas in Delhi.

Area	Location in Delhi	Males	Females	Total
Dakshinpuri	South	9000	6000	15000
Geeta Colony	East	8000	7000	15000
Jahangirpuri	West	18000	12000	30000
Khichripur	East	17000	8000	25000
Kusumpurpahari	South	14000	11000	25000
Mangolpuri	North-west	10000	8000	18000
Seemapuri	East	12000	8000	20000
Sultanpuri	North-west	12000	8000	20000
Tigri	South	17000	16000	33000
Trilokpuri	East	16000	14000	30000
Totals	**-**	**133000**	**98000**	231000

population of ~2,00,000 people (Table 1).

A mobile van (Force Traveller Ambulance, Forte 3350WD, Mahindra and Mahindra, India) was fitted with equipment (specified below) necessary to screen for obesity, diabetes and its complications (Fig. 2) was used for above purpose.

- Stadiometer (ADE MZ10038 Mechanical Stadiometer)
- Weight machine (regular bathroom scale)
- Blood pressure monitor [Omron™ Blood Pressure Monitor (Omron Corporation, Kyoto) Japan)]
- Glucose meter (Accu-Chek Active, Glucose Monitor, Roche Diabetes Care, India)
- Ankle Brachial Index (ABI) machine to screen for peripheral vascular disease (Automated AB Index Peripheral Vascular Doppler Model, Diabetik Foot Care, India, Ltd.)
- Vibration Perception Threshold (VPT) machine for testing feet for peripheral neuropathy (Digital Biothesiometer Model VIBROMETER-VPT, Diabetik Foot Care, India, Ltd.)
- Electrocardiogram machine.
- Fundus examination of the eye (3001- 3netra Classic, Forus Innovation, India)
- Strips for micro-albuminuria (used only in selected cases) (Micral test, Accu-Chek Product, Roche Diagnostics, Australia).
- Complete medical kit including surgical masks, hand sanitizers, soaps, tissue box, essential medicines box for cleaning and dressing foot ulcers.

The project was envisaged in the following 5 components.

1. Education Sessions

These sessions were for creating awareness about obesity, diabetes and its complications and commensurate lifestyle counselling with help of trained physician and nutritionist. Given below for each group are (i) who all were involved and (ii) the content for education (or awareness sessions).

A. Local Area Leaders

(i) Area *Pradhan* (Head), any other important local and religious leaders, and youth groups
(ii) Sensitization on:

- Diabetes and its management
- Issues related to diabetes, its complications, busting myths surrounding the disease.
- Importance of lifestyle changes:

〉 promotion of physical activity.
〉 Impart advice on healthy foods, methods of cooking, use of right amount/quality of cooking oils.

B. Primary Health Workers

(i) ASHA, AWW, local SHGs, community ambassadors of N-DOC.
(ii) Intensive training on

〉 risk factors of diabetes,
〉 types of diabetes and it's complications
〉 importance of preventing and controlling diabetes and its complications. (Training of CAs was a method to "buy in" the

Fig. 2. Customized mobile van used in the project.

community for implementation of such programs and also ensure sustainability after the end of the project).
〉 first aid and further care of diabetic foot lesions

C. Medical and Paramedical Workers

(i) RMPs and paramedics such as helpers associated with doctors, lab technicians, pharmacists.
(ii) Content for education was similar to B. (ii)

D. General Population

(i) Adult men and women from the selected underprivileged community were invited to attend the sessions.
(ii) Talk sessions with medical professional and a nutritionist were carried out using audio-visual aids like films and video clips. Simplified information regarding early symptoms of diabetes and its prevention, awareness and recognition of complications were presented [Fig. 3(a)].
(iii) Informative reading material on diabetes developed in the local language was distributed (Fig. 4).
(iv) Counselling sessions (40 min each session) regarding diet, exercise, cessation of smoking. The counselling was imparted (n, 30 each session) 6 days a week.

E. Other Population-based Awareness Activities

(i) On occasions such as World Diabetes Day (14th November), walks for children and special programs on healthy living were organized.
(ii) Pamphlets/leaflets were developed on physical activity, diet management and about the health camp held by N-DOC. These contained simple messages on topics were distributed during awareness sessions.

〉 Leaflets on physical activity highlighted its importance for healthy living. Simple exercises that could be done at home were shown. Both light exercise and heavy exercises were depicted on the leaflets along with time to be spent on each.
〉 Leaflet on diet management covered issues on how to 'self-manage' obesity and diabetes conditions through diet regulation to avoid further complications. Examples of foods to be consumed minimally along with those that could be consumed liberally were depicted through use of the pictorial food pyramid in the leaflet.
〉 A single page information about the diabetes and its complications, and simple care tips was also distributed
〉 Set of 3 PowerPoint presentations (a total of 1 h projection time) on diabetes, physical activity and diet were shown during awareness sessions.

2. Opportunistic Screening Using Random Blood Glucose and Blood Pressure Measurement

A. During the screening camps weight and height were obtained using standardized techniques. Body mass index (BMI) was calculated using the following formula: weight (kg)/height (m^2).
B. Random blood glucose was done using a hand-held glucose monitor. Those who had random capillary blood glucose (CBG) $\geq$200 mg/dl were labelled as possible patients with diabetes and were called in for an oral glucose tolerance test (OGTT) to confirm diabetes. Those confirmed to have diabetes and all self-reported patients with diabetes underwent screening for diabetes-related complications. Glycosylated haemoglobin estimation was not done due to cost concern.

(i) Those identified as having pre-diabetes and diabetes:

〉 received diet and physical activity advice, and awareness of complications and how to recognise them and measures to avoid them
〉 were followed up on a regular basis for reduction in body weight and control of blood glucose levels.

(ii) Those who tested normoglycemic were also given standard advice regarding healthy living.

Blood pressure was recorded in the sitting position in the right arm to the nearest 2 mm Hg using the electronic Omron™ Blood Pressure Monitor. Averages of three readings were taken if initial reading was abnormal. Hypertension categories were adapted from 2017 Guideline for High Blood Pressure in Adults (JNC7) [9] was defined as.

Fig. 3(a). General education and screening sessions at Seemapuri (West Delhi, India).

〉 Normal: Systolic Blood Pressure (SBP) < 120 & Diastolic Blood Pressure (DBP) < 80 mmHg
〉 Hypertension SBP>130 or DBP >90 mmHg

(i) Subjects identified with high blood pressure during screening were provided with lifestyle advice including reduction in salt intake.

C. Screening for co-morbidities in patients with diabetes

(i) Evaluation for peripheral neuropathy was done in mobile van. In selected patient's fundus photographs were taken [Fig. 3(b)].

3. Referral

Subjects detected with diabetes requiring further treatment were referred to the nearest local hospital.

4. Intensive intervention in a sub-group (n, 352) identified with overweight/obesity and random blood glucose over 200 mg/dl

- A sub-group of the population identified during screening as having diabetes and overweight/obesity were provided with intensive diet and exercise counselling. These individuals were first counselled about the intervention, and only those who were willing to follow up for 6 months were included.
- Individual dietary counselling was carried out for ~15 subjects for 10 min per day each: ~180 people per week).
- A dietary survey was also carried out using a diet questionnaire to assess for changes (calorie, salt, sugar and oil intake). The following indicators were evaluated for successful lifestyle changes: 10% decrease in consumption of sugar, oil and 10% increase in vegetable intake 25% increase in physical activity.
- Body weight was used as end point parameter of efficacy of intervention.

3. Results

The project covered a population of 2,31,000 (1,33,000 men, 98000 women) in ten selected underprivileged areas. The study had more women participants since men were at work on most weekdays and not available for screening and education camps. A total of 10.4% (n, 24,072) individuals attended education sessions on lifestyle modifications and 3, 12, 347 individuals attended screening camps for diabetes. Data for 16,834 individuals of whom 28.8% (n, 4845) were males and 71.2% (n, 11,989) were females (Tables 2 and 3) are presented here. The mean (median) age (years) of males was 48.9 ± 14.7 (50) and for women 46.2 ± 13.7 (45).

1. Educational Sessions
A. Local Leaders

The local population numbers and total number of sessions given in 1. D are inclusive of local leaders also.

B. Training of Frontline Workers

A total of 292 frontline workers from various categories were trained (20 training workshops) on issues relating to diet, lifestyle and diabetes.

C. Medical and Paramedical Workers

A total of 256 people were trained on diabetes related issues in 20 training workshops.

D. General Population

The population (numbers provided above) was sensitized and made aware of diabetes and its risks. About 120–130 people attended each session. A total of 352 awareness sessions were held in the 10 field areas.

E. Other Population based Awareness Activities

Besides the above 3 awareness walks were carried out, 300 posters were displayed, 3 PowerPoint presentations on diabetes, physical activity and diet were presented and 3000 pamphlets/ leaflets were distributed.

2. **Opportunistic Screening Using Random Blood Glucose and Blood Pressure Measurements**.

Fig. 3(b). A technician taking a picture of the fundus of patient using Trinetra camera. Fundus image can be seen on screen of the laptop on the right.

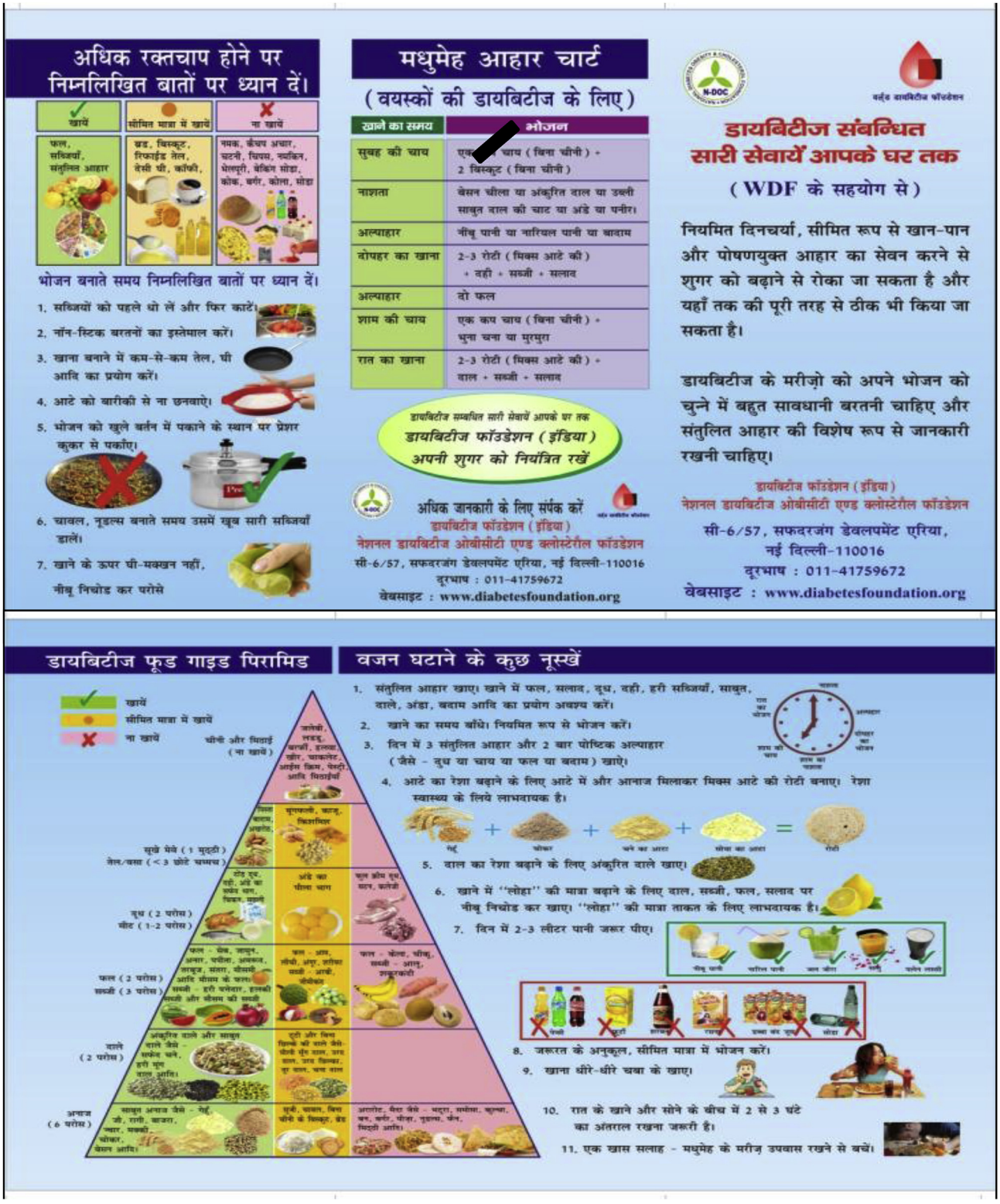

Fig. 4. Informative leaflets explaining various facets of hypertension, diabetes and balanced diets in Hindi.

A. Anthropometric Measurements

Average (and SD) values were as follows; men (n = 4798): weight of 65 ± 13.6 kg and a BMI (n = 4796) of 24.5 ± 4.5 kg/m^2; women (n = 11,899) weighed 59.7 ± 12.8 kg and BMI (n = 11,892) of 26.6 ± 5.3 kg/m^2.

B. Blood Glucose

A total of 2933 subjects (18.7% of total population screened) had

random blood glucose levels above 200 mg/dl (Table 2).

C. Blood Pressure

Blood pressure averaged 127.1 ± 23.6/81.3 ± 16.6 mm of mercury in screened individuals (n, 16,339). High blood pressure was observed in 9190 (56.2%) individuals.

D. Screening for Co-Morbidities

A total of 856 patients with diabetes were screened for various complications. Due to limited availability of resources all patients were not screened for all co-morbidities, only those with symptoms were investigated. Peripheral neuropathy was seen in 255/378 and retinopathy in 98/292 patients.

3. Referrals and Consultations
   A. **Referral to Hospitals**: A total of 768 subjects who required further follow-up and management were referred to nearby tertiary care centres of government/private hospitals.
   B. **Remote Interned-Based Consultation using Skype**: Skype call was done in selected patients with doctors at the referral hospital. Abnormal fundus photos were also sent remotely to ophthalmologist for diagnosis.
4. Intensive Intervention in a Sub-group Identified as Overweight/Obese and Random Blood Glucose Value over 200 mg/dl

A sub-group of subjects (n, 352), were evaluated for changes in parameters dietary behaviour, weight, BMI, and adherence to prescribed treatment after intensive intervention for 6 months (March 1, 2017 to August 31, 2017). The following are observations;

- We recorded improved overall dietary behaviour in 79.6% of subjects (n, 282) while the physical activity improved 71.1% subjects (n, 250).
- Decrease in body weight of 0.7 ± 11.6 kg ($p < 0.001$) with a significant reduction in BMI was seen. (Table 3).

During this intervention period, 82% (n, 289) of the patients followed advised treatment regimen. More than 40% (n, 143) of the patients were referred to the tertiary care centres available in their areas. Of these referred patients, 93% (n, 327) were compliant with the prescribed medications and 76% (n, 268) were compliant with diet and physical exercise guidance.

4. Discussion

Urban underprivileged populations are increasingly vulnerable to non-communicable diseases (NCDs) in developing countries [8]. Determinants of poor general health and also NCDs include poverty and access to standard healthcare. There is also a need to strengthen healthcare systems (primary-tertiary) in context of NCDs [10,11]. Mobile medical vans with proper equipment and manpower offer an expedient solution to create awareness about healthy lifestyle, and prevent, screen and manage obesity and T2DM at the 'doorsteps' of such underprivileged communities. This innovative approach has been inadequately researched in urban underprivileged. In this study, we have not only successfully used customised mobile van for educating general population and specific sub-groups, but also screened and managed diabetes, and changed lifestyle behaviour and body weight in the smaller sub-groups using intensive approach. Specifically, this project has had a large outreach screening 3, 12,347 individuals and made 24,072 individuals aware of T2DM. Apart from this, 352 health workers were trained regarding balanced diet, regular physical activity, awareness and recognition of diabetes and its complications. The benefit of intensive intervention in terms of improved lifestyle and diet practices was also observed.

In India, mobile van based medical intervention projects are few, largely funded by government or some National Associations and mostly focussed on specialities other than diabetes; e.g. ophthalmology and dental sciences. Among the oldest and most successful programs of mobile van delivering services is the "Services on Wheels", run by the National Association for the Blind, India. This association use a Mobile Service provider (customised van to include vision testing and management tools including Braille books and audio books) to the visually challenged beneficiaries [12]. Mobile dental vehicles have also been studied as an alternative strategy to supplement the traditional oral healthcare. This program was more curative with limited orientation towards preventive services [13]. Further, use of X-ray unit mounted in a mobile van for screening (n, 596) of tuberculosis [14] among rural population was carried out in the district Mewat, Haryana during Jan–March 2016. These projects show that such mobile van based facilities can help in facilitating the accessibility, affordability and the sustainability of detection and treatment of commonly prevailing diseases in underprivileged populations in India.

The National Health Mission includes guidelines for States in India to use mobile medical units for underprivileged populations (e.g. ragpickers, homeless, migrants etc.). [15]These mobile medical units provide point of care technologies, apart from the routine haemoglobin, pregnancy testing, blood glucose testing, and urinalysis using dipsticks (albumin, glucose). Pan India a total of 1427 Mobile Medical Units were available in the 36 states/Union territories in the year 2018 [16]. Specific data regarding screening for diabetes using for this program are not available. A pilot study in Jharkhand state stated that mostly curative services were availed of [17].

There are no studies using mobile van among the urban underprivileged populations in India, but some data in rural populations are available. Medical mobile vans have been used to screen for diabetes and its complications in the rural area of

Table 2
Categorisation according to random blood glucose levels.

Sex	Random blood sugar	N	Mean	Std. Deviation
Male	<200 mg/dl	3589	120.0	28.9
	>200 mg/dl	970	294.4	76.3
	Total	**4559**	**157.1**	**83.6**
Female	<200 mg/dl	9203	119.4	26.9
	>200 mg/dl	1963	296.5	77.7
	Total	**11166**	**150.5**	**78.8**
Total	<200 mg/dl	12792	119.5	27.5
	>200 mg/dl	2933	295.8	77.3
	Total	**15725**	**152.4**	**80.3**

Table 3
Weight and body mass index values pre- and post-intensive intervention in a subset (n, 352) of overweight/obese individuals with random blood glucose more than 200 mg/dl.

Blood Glucose in mg/dl	Mean in mg/dl	*t*-test
Initial	227.8 ± 94.5	P < 0.01
Final	215.6 ± 88.3	
Weight in kg	**Mean in kg**	***t*-test**
Initial	62.9 ± 11.6	P < 0.001
Final	62.1 ± 11.6	
BMI in kg/m^2	**Mean in kg/m2**	***t*-test**
Initial	26.8 ± 4.7	P < 0.001
Final	26.3 ± 4.9	

Chunampet, Tamil Nadu for a period of 5 years (2006–11). In this project 23,380 individuals from the underprivileged rural areas were screened for diabetes and adviced on management of the disease and provided awareness on prevention of the same (16). Another project, focussing on diabetes-related eye disease, using equipped mobile van carried out work in 8 rural districts of Karnataka (south India) for a period of 6 years (2006–12). This project, though overall like ours, was predominantly carried out in rural area (*vs.* urban underprivileged area in our project) and was not of similar expanse e.g. did not include training of health workers, and intensive intervention etc., and focussed only on diabetic retinopathy. The van visited each rural community to treat patients who were detected for the diabetes. Overall, the van provided service to 29,000 patients, and 1017 fluorescein angiograms and 6998 laser treatments. This model has also enhanced local capacity and skills through training and sharing of expensive equipment among semi-urban and rural ophthalmologists, empowering them to provide hitherto non-available services to their local communities [18,19]. The Aravind Teleophthalmology Network (ATN) utilized remote vision centres staffed by ophthalmic technicians. Photographs were sent from the vision-centres to physicians at central grading centres and real-time consultation can be performed with video-teleconference technology [20]. Other studies e.g. Sankara Netralaya Tele-ophthalmology Project (SNTOP) using the mobile healthcare van focused on comprehensive eye examination in patients with diabetes using tele-ophthalmology in rural areas of South India [21,22].

The mobile van with medical facilities serves as a potential solution to overcome various barriers providing a services at the doorstep thus eliminating the burden of an out-of-pocket, travel expenses and helps in the identification of only those patients requiring special attention and further intervention. Such service may also help-decongest patients from crowded hospitals. This intervention can also act as a solution to prevent the underprivileged from resorting to incorrect treatment from local unqualified practitioners. Intensive intervention on the sub-group indicated that counselling even in real life community settings can improve outcomes if provided appropriately and repetitively.

No community project succeeds unless it has the cooperation of the community itself. Hence the study relied deeply on their trained community ambassadors and local resource persons-as grass-root workers. Our study also developed strong community links through engagement of local leaders a crucial for support of the project. Lessons learnt from the implementation of this project are applicable to underprivileged populations in semi-urban and rural in India, and even in other developing countries where it would be useful [8].

Ethical clearance

This is to state that the work has been approved by the ethical committees of Fortis C-DOC related to the National Diabetes Obesity Cholesterol Foundation (N-DOC) from where the study was undertaken.

Declaration of competing interest

The authors have no conflicts of interest to declare.

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References

[1] International Diabetes Federation. IDF SEA members. *International diabetes federation*. Available at: https://www.idf.org/our-network/regions-members/south-east-asia/members/94-india. Accessed: 27th April 2019.
[2] Misra A, Jayawardena R, Shajith A. Obesity in South Asia: phenotype, morbidities, and mitigation | SpringerLink. Curr Obes Rep 2019;8:43–52.
[3] Hills AP, et al. Epidemiology and determinants of type 2 diabetes in south Asia. Lancet Diabetes Endocrinol 2018;6:966–78.
[4] Gopalan HS, Misra A, Jayawardena R. Nutrition and diabetes in South Asia. Eur J Clin Nutr 2018;72:1267–73.
[5] Pakhare A, Kumar S, Goyal S. Assessment of primary care facilities for cardiovascular disease preparedness in Madhya Pradesh, India. BMC Health Serv Res 2015;15(408). https://doi.org/10.1186/s12913-015-1075-x.
[6] Venkataraman K, Kannan AT, Mohan V. Challenges in diabetes management with particular reference to India. Int J Diabetes Dev Ctries 2009;29:103–9.
[7] Lakra A. Migration to Delhi – Primary Survey. Final Report tudy on counter magnet areas to Delhi & NCR. New Delhi: NCRPB; 2001. p. 1–18. https://www.academia.edu/9062490/Final_Report_STUDY_ON_COUNTER_MAGNET_AREAS_TO_DELHI_and_NCR_URBAN_and_REGIONAL_PLANNING_3_MIGRATION_TO_DELHI_PRIMARY_SURVEY. [Accessed 27 April 2019].
[8] Misra A, et al. Diabetes in developing countries. J Diabetes 2019:1–18.
[9] Whelton P, Carey R, Aronow WS, et al. Guideline for high blood pressure in Adults. American College of Cardiology; 2017. Available at: http://www.acc.org%2flatest-in-cardiology%2ften-points-to-remember%2f2017%2f11%2f09%2f11%2f41%2f2017-guideline-for-high-blood-pressure-in-adults. Accessed: 28th September 2019.
[10] Sinha Rajeshwari, Pati Sanghamitra. Addressing the escalating burden of chronic diseases in India: need for strengthening primary care. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5848382/. Accessed: 24th May 2019.
[11] Satish Kumar, Sanjiv Kumar & Basab Gupta. Urban health: needs urgent attention. Indian J Public Health 62, 214–217.
[12] National Association for the Blind. India annual report 2017 - 2018. 2018.
[13] Sandesh N, et al. Utilization of mobile dental vans at post graduate dental institutions in India. Oral Health Dent Manag 2014;13:20–6.
[14] Datta B, et al. Comparison of clinical and cost-effectiveness of two strategies using mobile digital x-ray to detect pulmonary tuberculosis in rural India. BMC Public Health 2019;19.
[15] Operational NHSRC. Guidelines for mobile medical Units.pdf. 2015.
[16] Bhushan Shashi. State/UT-wise mobile medical units (MMUs) operational under national health mission (NHM) during (From : Ministry of Health and Family Welfare). *data.gov.in* (2019). Available at: https://data.gov.in/resources/stateut-wise-mobile-medical-units-mmus-operational-under-national-health-mission-nhm; 2018 (Accessed: 24th June 2019).
[17] Nandan, D. An assessment of functioning of mobile health units in Jharkhand. vol 38.
[18] Tele-diabetology to screen for diabetes and associated complications in rural India. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4455413/. Accessed: 24th May 2019.
[19] A novel model to deliver Advanced eye care for people with diabetes living in resource-poor settings: results of care provided to date. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3308282/. Accessed: 25th July 2019.
[20] Telemedicine and diabetic retinopathy: review of published screening programs. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4942133/. Accessed: 25th July 2019.
[21] Sreelatha OK, Ramesh SV. Teleophthalmology: improving patient outcomes? Clin Ophthalmol 2016;10:285–95.
[22] Sinha R, Pati S. Addressing the escalating burden of chronic diseases in India: need for strengthening primary care. J Fam Med Prim Care 2017;6:701.
[23] Pakhare A, Kumar S, Goyal S. Assessment of primary care facilities for cardiovascular disease preparedness in Madhya Pradesh, India. BMC Health Serv Res 2015;(15):408. https://doi.org/10.1186/s12913-015-1075-x.