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PROJECT REPORT

Diabetic retinopathy screening model for rural population: awareness and screening methodology

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ABSTRACT

Context: Worldwide, the prevalence of diabetic retinopathy is increasing at an alarming rate. WHO has predicted that in India the number of adults with diabetes will be the highest in the world: from 19 million in 1995 to 80 million in 2030. Although originally thought to be a disease of an urban population, the prevalence of diabetes mellitus is increasing in rural areas as well. The socioeconomic burden resulting from visual impairment or blindness caused by diabetic retinopathy, particularly in the working age group, is a serious concern.

Issue: In order to combat diabetic retinopathy related blindness, Sankara Nethralaya, the premier eye institute of India, in collaboration with the Lions Clubs International Foundation (LCIF) and the RD Tata Trust, Mumbai, India launched a major diabetic retinopathy screening program in the rural community of South India. The objectives were to create awareness among the rural population of diabetic retinopathy with emphasis on early detection, to conduct diabetes and diabetic retinopathy screening camps, and to bring to the base hospital patients who have sight-threatening diabetic retinopathy, for ancillary investigations such as fluorescein angiography, ultrasound and to perform laser photocoagulation or vitreous surgery, or both. Other objectives included training general ophthalmologists and general physicians in order to develop an integrated diabetic retinopathy model. To address the question as to why certain individuals run the risk of developing sight threatening diabetic retinopathy, biochemical and genetic factors were also studied. The program was launched in June 2003 and 3 rural districts have been screened. To the time of writing, 128 screening camps had been organized, 103 awareness meetings conducted, 23 ophthalmologists trained and 43 general physicians attended the continuing medical education program on diabetic retinopathy.

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Lessons: The key elements in the successful implementation of this program have been a team approach, involvement of community leaders and voluntary organizations, and support of the district and state administrators.

Keywords: diabetes mellitus, diabetic retinopathy, India, screening model.

Context

WHO and the International Diabetes Federation have predicted that the number of adult-onset diabetics worldwide would more than double by 2030 from the present level of 171 million to 366 million[1]. This increase would be approximately 42% in developed countries and approximately 150% in developing countries. The maximum increase is in expected in India. In India, diabetic retinopathy was the 17th cause of blindness 20 years ago; today it has ascended to the 6th position. A third of the people with diabetes are unaware that they have the disease. A person with diabetes is 25 times more likely to go blind than a person in the general population. The annual cost of treating a person with diabetes at risk is much lower than the welfare benefits paid to a blind person per annum, particularly in some developed countries[2].

Issue

'Right to Sight' is a global initiative (Vision 2020) designed to eliminate avoidable blindness by 2020. This concept was built on the foundation of community participation, along with an emphasis on the development of human resources infrastructure and technology for eye care, plus cost-effective disease control interventions. Currently diabetic retinopathy is considered one of the priority areas in the Vision 2020 program.

Sankara Nethralaya, a non-profit, non-commercial ophthalmic organization was founded in 1978, in Chennai, Tamil Nadu, India. Today, it is a renowned Indian tertiary eye institute with a track record of undertaking community services since its inception. Recognizing its social responsibility, Sankara Nethralaya has embarked on a major outreach program on diabetic retinopathy with financial support from the Lions Clubs International Foundation and the RD Tata Trust, Mumbai, India.

Preparatory phase

Target areas: This program envisages covering six rural districts and urban slums of Chennai city, Tamil Nadu state of South India, over a period of 3 years (Fig 1).

Team: The project team includes four retinal specialists, one genetic researcher, one epidemiologist, two optometrists, two research fellows, one fundus photographer, and 10 social workers. A detailed manual covering all the important activities of the field operation was prepared.

Survey: Prior to screening, a survey was conducted by social workers in the selected villages to discover available resources and possible locations for screening camps. In order to increase the referral of persons with diabetes to the screening camps, social workers met local diabetologists and GPs. A database of addresses was also created for continuing medical education program. This type of survey assisted in assessing the extent of existing eye care facilities with respect to diabetic retinopathy.

Pilot study including time-motion to ensure quality control: All of the team members underwent intensive training for one week, 8 hours a day. All team members were given orientation to the anatomy and physiology of the eye, and also to diabetes and diabetic retinopathy. Training was given for accurate measurement of blood pressure (BP) and

estimation of capillary blood glucose. Each trainee was evaluated before he or she was allowed to participate in the study. Expert diabetic educators and dieticians held counseling sessions. A pilot study involving 100 volunteers was conducted; time-motion study was conducted to estimate the time needed for each task. The aim was to avoid biases or errors in any of the procedures employed and to ensure that each member of the team was well trained in the screening procedures, including filling out the study data sheet. In order to ensure quality control, the BP apparatus and glucometer were validated and calibrated at regular intervals. Random monitoring of the team members was conducted as they counselled patients.

Sankara Nethralaya diabetic retinopathy model

This program aimed to achieve the following objectives:

1. To create awareness about diabetes and diabetic retinopathy in the general population in Indian rural areas.
2. To conduct diabetic screening camps for early detection and prompt treatment of sight threatening diabetic retinopathy.
3. To train general ophthalmologists and general physicians in diagnostic techniques to identify patients at risk of developing diabetic retinopathy.
4. To perform relevant biochemical and genetic investigations to discover the risk factors associated with the development of diabetic retinopathy

Awareness strategy: Approximately 12.5 million people live in the study areas. A targeted awareness strategy was implemented using several methods.

Meetings Awareness meetings were held in the target areas at least a month prior to the screening camps. The target was to organize approximately eight to nine such meetings in each district over a period of 5-6 months. The target group for awareness meetings included persons with diabetes, high-risk general population, Lions Club members, young persons and pensioners, women's self-help groups, para-medical staff, pharmacists and industrial workers.

Visual aids These were pamphlets, leaflets, banners, lamp pole kiosks (a cylindrical structure on which awareness message containing card boards were displayed), wall paintings, stickers on city buses, posters, and audiovisual CDs containing information on diabetes and diabetic retinopathy. Leaflets were distributed approximately one week before starting a screening camp. Lamp pole kiosks were displayed at prominent locations. Pamphlets were distributed to people attending awareness meetings and screening camps. Two audiovisual CDs were prepared; one was an educational CD on diabetic retinopathy, and the other in traditional Tamil folk art medium, called *Villupattu*, being an effective awareness medium among the rural population (Fig 2).

Media All types of media were used to propagate and disseminate information; these included newspaper articles, press releases, radio talks, cable TV advertisements, SMS and internet messages, and digital display in post offices and railway stations.

Celebrations Special events were organized on special days such as the World Sight Day (October 14), and the World Diabetic Day (November 14) during the project period.

Outcome measure of awareness campaign: A KAP (knowledge, attitude, practice) study was conducted before and after each awareness meeting. Separate KAP questionnaires were prepared for the general population, general physicians, and general ophthalmologists.

Screening strategy: It was envisaged that approximately 250 persons with diabetes would be screened in one day; therefore, various recruitment approaches were adopted to attain maximum yield (Fig 3).

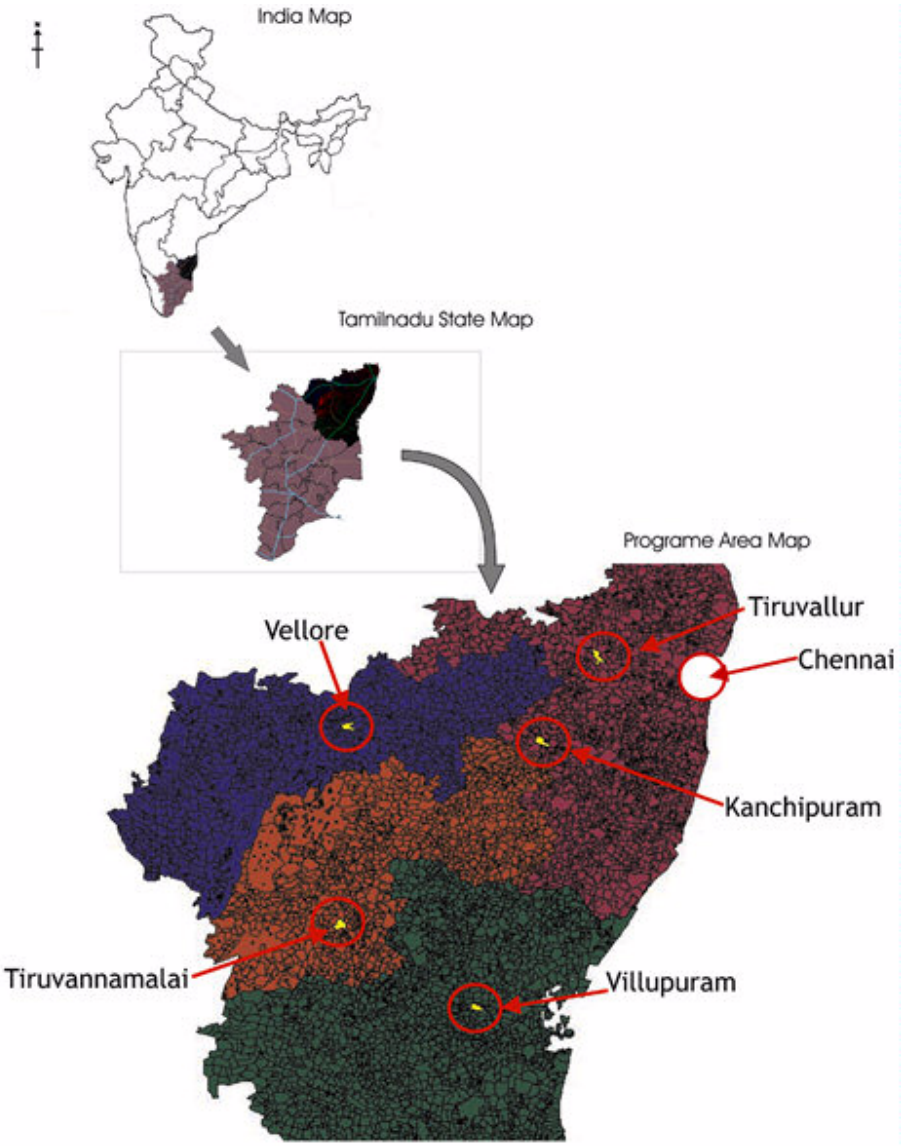

Figure 1: Map of the project area.

Figure 2: Various awareness aids used in the campaign.

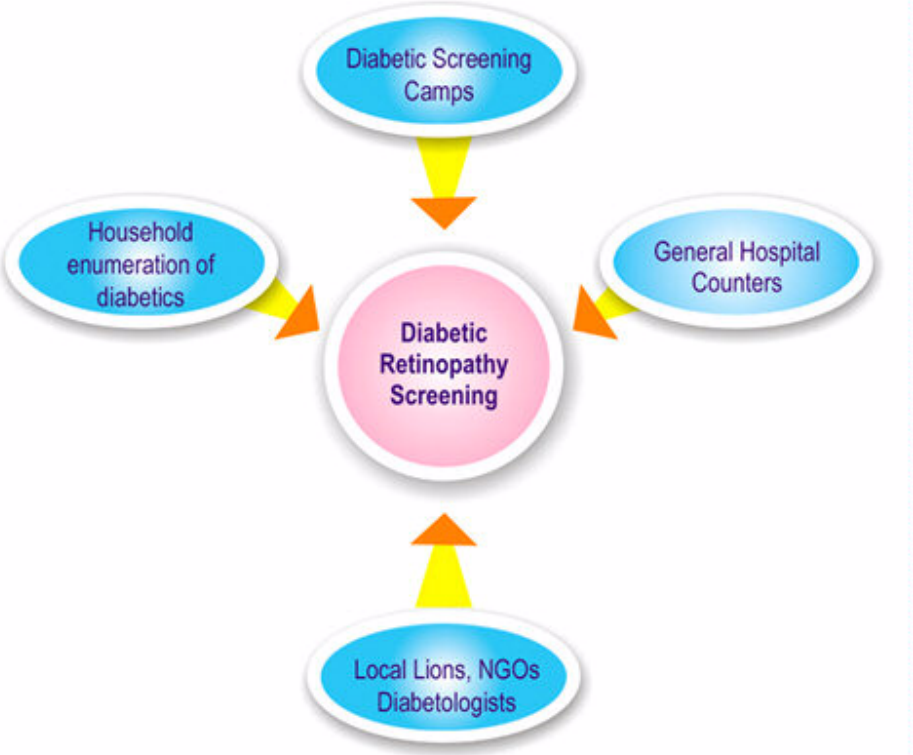

Figure 3: Various recruitment strategies.

At the diabetic screening camps (Fig 4a), the finger-prick method for random blood sugar estimation (glucose oxidase method) was performed using a glucometer (Accutrend Alfa; Boehringer Mannheim, Germany). General population above the age of 30 years underwent initial diabetic screening. Newly diagnosed (provisional) diabetes was defined as the one whose random blood glucose was more than 200 mg/dL (11.1mmol/L)[3]; these patients did not undergo further tests such as oral glucose tolerance test. All persons with diabetes (known, provisional or borderline – random blood sugars between 144 and 149 mg/dL or 7.8-11 mmol/L) were counseled and referred to the diabetologists for further evaluation and management.

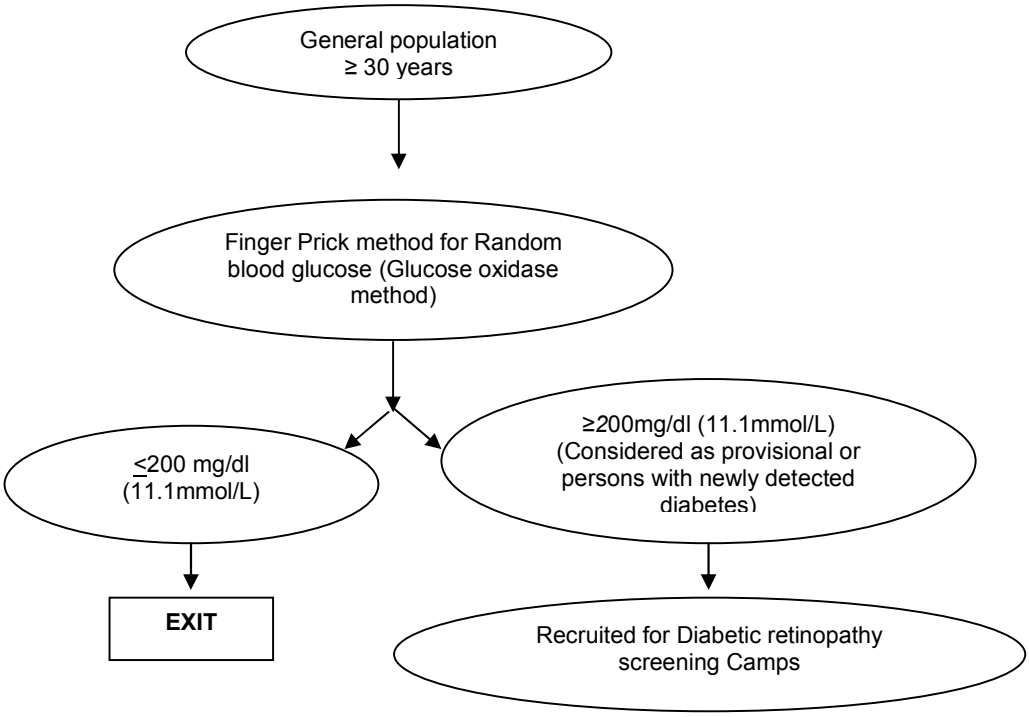

Figure 4a: Flow chart illustrating diabetes screening strategy.

At the diabetic retinopathy screening camps, all persons with newly diagnosed (provisional) diabetes, plus persons with known diabetes (referred from general physicians and diabetologists) were screened. The flow of diabetic retinopathy screening is illustrated (Fig 4b). In diabetic retinopathy screening camps a detailed history was obtained containing study variables such as duration of diabetes, type of treatment, physical activity status, alcohol intake, smoking status, family history of diabetes[4] and family income[5]. Ocular history included details of first and last eye examination, nature of present eye complaint, any laser or ocular surgery. Anthropometric measurements such as height and weight for calculating body mass index (BMI) were measured for all persons with diabetes attending diabetic retinopathy screening camps[6]. Community halls or schools were selected for conducting screening camps through 10 centres (Fig 5).

Visual acuity was measured using LogMAR chart. A hand-held (Heine HSL 100 CE; HEINE Technical, Germany) slit-lamp was used for anterior segment evaluation including the depth of anterior chamber and rubeosis iridis. Intraocular pressure measurement was performed with Schiotz indentation tonometer (Schiotz, John Weiss & Son Ltd, London, UK). Dilated fundus evaluation was done with binocular indirect ophthalmoscope (Keeler Instrument Inc., PA, USA) and +20D Nikon lens. Diabetic retinopathy was graded as per the new disease severity scale given by the American Academy of Ophthalmology[7]. Patients with narrow angles and sight threatening diabetic retinopathy were re-examined at the base hospital in order to undergo fluorescein angiogram or ultrasound and treatment such as laser photocoagulation or vitreous surgery.

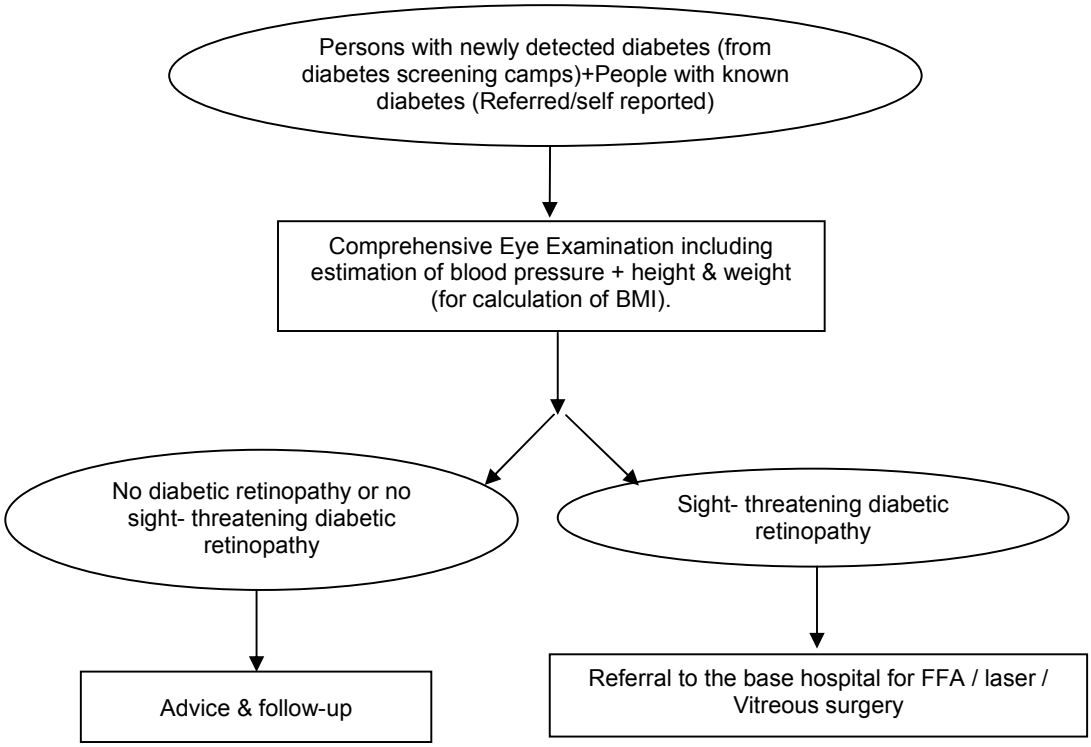

Figure 4b: Flow chart illustrating diabetes retinopathy screening strategy.

Educational strategy: Continuing medical education (CME) programs were organized for GPs for updating themselves in diabetes and diabetic retinopathy. The focus was to encourage fundus evaluation for all diabetics for early recognition of diabetic retinopathy.

Investigational strategy: Patients with sight threatening diabetic retinopathy underwent biochemical and genetic analysis. Biochemical studies included estimation of total serum cholesterol, high-density lipoprotein, serum triglycerides, and hemoglobin, packed cell volume and glycosylated hemoglobin fraction, and microalbuminuria. Genetic study included screening for polymorphisms and sequence variants (VEGF, PKC-β, receptor for AGEP and ApoE) and their association with the diseases in the candidate genes. The investigations on patients were performed in accordance with the 'Declaration of Helsinki'[8].

Program achievements

Since the launch of the program in June 2003, we have successfully covered three rural districts. Altogether, 103 awareness meetings covering approximately 100 000 population were held. Stickers containing diabetic retinopathy awareness messages were displayed at railway stations, public transport systems and post offices targeting approximately 2.5-3 million people.

Figure 5: Patient flow at the Diabetic retinopathy camp site.

To date, of the 25 313 general population who underwent diabetic screening, the prevalence of diabetes mellitus was found to be 21.7%; however, the point prevalence of newly detected diabetes mellitus was 4.5%. Of the 7770 diabetic patients who underwent diabetic retinopathy screening, the prevalence of any retinopathy was 17.6%; of these 17.6%, sight-threatening retinopathy was evident in 5.9%. Two CMEs on diabetes and diabetic retinopathy were organized, training 23 ophthalmologists and 43 general physicians.

The interim analysis of KAP (knowledge, attitude and practice) data revealed significant improvement in the awareness on several important parameters. These parameters included awareness of diabetes mellitus (before, 76%; after, 98%), awareness of diabetic retinopathy (before, 29%; after, 96%), need for regular eye examinations (before, 57%; after, 98%), and role of laser in preventing visual loss (before, 17%; after, 81%).

Current issues

As the program has been implemented effectively, community response has been very encouraging. On one day, almost 1000 individuals came for diabetic retinopathy screening, against the target of 250. However, in order to ensure quality care, we did not screen beyond 300 persons with diabetes on that day. The others were counselled and registered for the next camp.

Because diabetes and diabetic retinopathy is a chronic disease, the cost of health care calls for constant funding in order to provide free treatment. Due to the high volume patient load, costly equipment like laser machine cable does undergo wear and tear and requires frequent replacement. Keeping the team focused on the objectives of program is an important and challenging task.

The future

Telescreening for diabetic retinopathy as a pilot study is being attempted. This would facilitate examining a large section of the rural community, particularly in those areas where healthcare access is limited.

Awareness campaigns need to be sustained with a slogan: *all people with diabetes need dilated eye examination once a year*.

The training of general physicians and para-medical personnel about referral guidelines on eye examinations is important in the development of an integrated diabetes healthcare network.

Lessons

- Community participation is the key to success for any awareness or screening model. Local village groups like women's self-help groups play an important role in motivating diabetics to attend screening camps.

- The role of social worker was vital in the diabetic retinopathy-screening model for effective implementation; he or she served as a link between the community and diabetes healthcare professionals.
- Community halls and schools are the best locations for conducting camps. These locations facilitate the smooth flow of patients at the campsite.
- Support from voluntary organizations like local Lions Clubs has been outstanding.
- An inbuilt recall system will monitor follow up of treated patients, as well as those patients who drop out of the program.
- Residents develop interest in community programs by participating in the outreach screening camps.
- Training local ophthalmologists and GPs in rural areas helps in the continuity of diabetic care.
- Weekly review meetings among the team members and visits by funding cum monitoring teams assists in keeping the targets in focus.

The effectiveness of this program should inspire others to follow similar diabetes screening models in the overall care of rural people with diabetes, who are underprivileged compared with the urban population.

The present screening model is somewhat different from other reports[9,10]. Differences include an extensive awareness program, besides screening for diabetes and diabetic retinopathy. Another difference is the use of indirect ophthalmoscopy as a screening tool, in contrast to seven-fields photography methods which are not only expensive, but also may not be feasible to adopt in rural areas. In addition, our model incorporates the training of general physicians and ophthalmologists from the study areas, in order to sustain the objectives of this study.

Developing a dedicated and integrated diabetes care team is mandatory for the prevention of blindness caused by diabetic retinopathy.

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