Original Article#

Community Empowerment - A Successful Model for Prevention of Non-communicable Diseases in India - The Chennai Urban Population Study (CUPS - 17)

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Abstract

Background and objective : Randomized clinical trials have documented that lifestyle changes through physical activity can prevent diabetes. However there is no data whether such strategies are applicable at community level, that is, in a real life setting. This study demonstrates the first attempt in India, to our knowledge, of increasing physical activity through community empowerment in an attempt at primary prevention of non communicable diseases.

Methods : The Chennai Urban Population Study [CUPS] was conducted in the year 1996 in two residential areas: a middle income group the Asiad colony at Tirumangalam, and a low income group at Bharathi Nagar in T. Nagar. The Asiad colony was selected for this study. Of the 524 eligible individuals available at baseline in 1998 [age ≥ 20 years], 479 individuals consented for the study (response rate:91.4%). After seven years, in 2004, the number of eligible individuals increased to 712 of whom 705 consented for the study (response rate:99%). Education regarding the benefits of physical activity was provided by mass awareness programmes like public lectures and video clippings. Both at baseline and during follow-up, details about the physical activity were collected using a validated questionnaire, which included job related and leisure time activities, and specific questions on exercise. Study individuals were then graded as having light, moderate and heavy physical activity using a scoring system.

Results : In response to the awareness programmes given by our research team, the colony residents constructed a unique public park with their own funds. Though the occupation grades did not change, there was a significant change in the pattern of physical activity. At baseline, only 14.2% of the residents did some form of exercise more than three times a week, which presently increased to 58.7%[p<0.001]. The number of subjects who walked more than three times a week increased from 13.8% at baseline to 52.1% during follow-up [p<0.001].

Conclusion : This study is a demonstration of how community empowerment with increased physical activity could possibly lead to prevention of diabetes and other non communicable diseases at the community level. This study also highlights the importance of sharing the results of research studies with the community.

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Introduction

The most obvious change among the global health transitions has been the rising burden of non-communicable diseases [NCDs] in the developing world.[1,2] Indeed, India appears to be the most affected as there is a rising trend in the prevalence of NCDs, particularly diabetes, coronary artery disease and hypertension in India.[2,3] India currently leads the world with 35 million people with diabetes and these numbers are expected to reach 80 million by 2030.[4] It is also projected that India would lead the world in coronary artery disease deaths within the next 15 years.[5] A rising prevalence of hypertension has also been documented in India, with the current prevalence ranging from 15% to 45%.[6] It is predicted that the prevalence of obesity in India would increase by 89% in men and 82% in women between 2002 and 2010,[7] which is one of the main contributors to insulin resistance, and metabolic syndrome. These data suggest that NCDs pose a serious

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economic threat in India and they can be expected to have a marked impact on the quality of life of the affected individuals.

Physical inactivity is one consequence of the economic transition in India and other developing countries. Increasing physical activity has been shown to reduce cardiovascular risk factors[8,9] as well as the risk for diabetes.[10-12] However, these studies are restricted to clinical trials where individuals at high-risk for diabetes are invited to a clinic and advised to undergo an intensive life style modification program supervised by a clinical trial team.

There remain several unanswered questions: Are such approaches possible at the community level, i.e. in a real life setting? Can findings of research studies be translated to simple approaches that could provide benefit to the community? Finally, how will the community respond to such approaches? These questions are particularly relevant to India in light of the transition it is currently undergoing, and because of the high prevalence of diabetes and other NCDs. Thus there is a compelling need for broad based, affordable and effective community based preventive programs. In this article, we report on a remarkable success story in southern India of a research study that led to community action to increase physical activity in an attempt to prevent NCDs.

Methods

Community and Baseline Survey

This study was created as a consequence of findings of the Chennai Urban Population Study (CUPS),[10,13] the results of which are also available at our website www.drmohansdiabetes.com under "publications." CUPS was carried out in Chennai (Madras) in the state of Tamil Nadu on the eastern coast of Southern India. The aim of CUPS was to obtain prevalence data on diabetes and its various complications among people of different socio-economic strata in urban Chennai. Briefly, two residential colonies at Tirumangalam and T. Nagar, representing the middle income and lower income groups, respectively, were selected for the study. An initial survey was conducted in 1996 among all residents of these colonies and basic census details such as number of individuals, age, sex and presence or absence of diabetes were obtained.

It took 18 months to complete the baseline survey and all individuals aged 20 years and above living in these colonies were invited to participate in a subsequent screening programme. A total of 479 out of the 524 eligible participants in the Tirumangalam Colony (91.4% rate) and 783 of the 875 eligible participants in the T. Nagar colony (89.4% rate) participated (overall response rate 90%).

Data on physical activity were collected using a validated questionnaire,[7,10] which had four questions on job related and leisure time activities and exercise: 1) How do you get to work? 2) Overall, is your work very demanding / fairly demanding / not demanding? 3) How many days per week do you take exercise and what type of exercise? 4) How much do you walk during the whole day?

Level of physical activity was then scored as light, moderate and heavy. Individuals were categorized as heavy grade if the occupation was very demanding, mode of transport to work was walking or bicycling, or if they did regular exercise. Classification as light grade was made if the occupation was not demanding, the mode of transport was motorized vehicles and they did no exercise. Those with intermediate physical activity were graded as moderate. This questionnaire showed good agreement with a standardized questionnaire validated previously in our population[9]. All study participants were classified according to their job title: professionals (such as doctors, lawyers, businessmen and executives), clerical (accountants and clerks), manual labourers and others (house wives, elderly and disabled). This report focuses on the Tirumangalam colony as it had high prevalence rates of diabetes and other metabolic abnormalities and low levels of physical activity.

Increasing Awareness And Empowerment Of Community

Education regarding the benefits of physical activity was introduced to the residents of the colony at the time of the baseline survey, when participants were first informed of their clinical condition, including their diabetes status. Individuals with diabetes and the community in general were taught about the beneficial effects of physical activity. Individual counseling was given to participants at high risk for diabetes (e.g., those with impaired glucose tolerance, impaired fasting glucose, and family history of diabetes or obese participants).

Mass awareness programmes included public lectures, video clippings, short skits emphasizing the importance of diabetes and physical activity and distribution of educational materials in the form of pamphlets. The residents were motivated to exercise every day by a social worker who regularly visited the colony.

Public lectures

Weekly health education lectures were tailored to the cultural background, gender and age group of the community and focused on adopting healthier lifestyles and physical activity. 65-80% of the community actively participated in these lectures. Family activities, such as exposing children to the healthy life-style of the adults, were encouraged in the community.

Educational materials

Educational materials on diabetes, its risk factors, signs and symptoms, complications and lifestyle factors were prepared both in English and Tamil [local language]. Initially, these pamphlets were provided to the secretary of the colony, who distributed them to the colony residents. Later, in view of the importance of educating all members of the community, we provided pamphlets for every household.

Programmed approach

The following strategies were used to increase the awareness among the residents: interactive sessions were conducted every two months, public lectures every three months and educational materials were distributed every six months. Lifestyle changes are never easy to achieve; it took both time and a consistent effort for us to convince the members of the colony. The community realized the importance of physical activity after three years of continuous education programmes.

Follow-up Study

In 2004, seven years after the initial survey, we did a repeat survey and invited all individuals above the age of 20 years living in this colony to participate. The number of eligible participants were 712, in contrast to 542 eligible for the baseline survey. We suspect this increase is due to an increase in the overall population itself since the number of houses in the colony had increased; however, the park could also have been an attraction for people to move into this colony. Finally, since this study was conducted seven years after the baseline study, all those in the adolescent age group during the baseline survey had reached the age of over 20 years old and therefore, were eligible to participate in the follow-up study. These numbers exceed the number of deaths and outmigration.

Of the 712 eligible participants, 705 responded (99.0% response rate). The physical activity questionnaire used at baseline was repeated to obtain the current physical activity level.

Results

Community Action – Building of the park

Having been empowered with knowledge about the importance of NCD and preventive steps that can be taken, community members felt the need to increase their level of physical activity. However, the most important limitation was finding a place for exercise. After several meetings, a colony committee decided to construct a park. They mobilized resources from the local municipality authorities, philanthropists, and from residents in and around the colony and raised approximately Rs.15,00,000 [US$ 34,000]. After accumulating these funds, the residents identified some open land in their area and approached the local government officials for permission to build a park. A beautiful park was constructed in 2002 with a walkers' lane [0.25 km] with bushes, trees, water fountains and a playground for children. Music systems were installed for additional entertainment. The residents pay a nominal amount as an annual fee for the maintenance of the park. Today, the park is used not only by the residents of this colony but also by neighbouring colonies. The steps leading to the construction of the park are shown in Fig. 1.

Impact on Physical Activity

Though there was an increase in the number of individuals in the colony and participating in the survey, there was no difference in the age or gender distribution between the baseline and follow up surveys [Table 1]. However, there was a significant difference in the occupation grades. During the follow-up period, the number of manual labourers had decreased markedly compared to baseline [p=0.001].

Physical activity scores at baseline and follow up are compared in Table 2. A marked reduction in the proportion of light grade activity was observed during the follow-up visit. This change was seen for both men and women. Further, at every age interval, the proportion of participants with light grade activity decreased significantly during the follow-up visit [Fig. 2]. We also computed the proportion of participants

Table 1 : Clinical details at baseline and follow-up

Factor	Baseline study 1996 (n = 479)	Follow-up study 2004 (n = 705)	p value
Age (Years)	48 ± 14	47 ± 15	0.241
Male (%)	43.8	48.8	0.093
Occupation (%)			
Professionals	24.8	24.8	
Clerks	22.5	24.3	
Manual laborers	4.4	0.9	
Others	48.2	50.1	0.001

Table 2 : Percent of survey respondents classified by physical activity level for the baseline screening (1996) and the follow-up survey (2004), Tirumangalam colony

Physical activity	Baseline Survey 1996	Follow-up Survey 2004	p value
Total (%)			
n	479	705	
Heavy	5.2%	6.4%	<0.0001
Moderate	29.9%	46.7%	
Light	64.9%	47.0%	
Males (%)			
n	210	344	
Heavy	5.9%	11.0%	<0.0001
Moderate	39.3%	52.6%	
Light	54.8%	36.3%	
Females (%)			
n	269	361	<0.0001
Heavy	4.8%	1.9%	
Moderate	21.0%	41.0%	
Light	74.0%	57.1%	

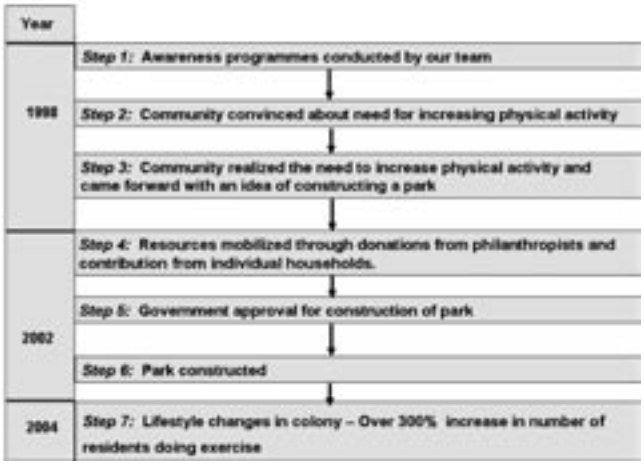

Fig. 1: Steps in community response that led to building the park

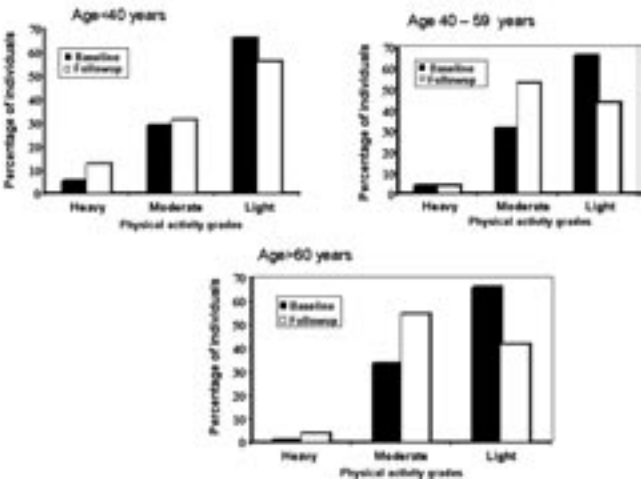

Fig. 2: Physical activity at baseline vs follow-up at different age intervals

who did some form of exercise, defined as more than three times a week. At baseline, only 14.2% of the residents exercised but these numbers increased to 58.7% [p<0.001] at follow up representing a 313% increase in exercisers. The number of participants who walked more than three times a week increased from 13.8% at baseline to 52.1% during follow-up [p<0.001], representing a 277% increase [Fig. 3].

Discussion

Regular physical exercise influences health favorably through several mechanisms. Continued physical training may be beneficial for prevention and management of diabetes and cardiovascular disease [9-12]. Physical activity can also reduce mortality, particularly due to coronary artery disease and ameliorate cardiovascular risk factors such as blood pressure, triglyceride and HDL cholesterol levels.[14-16]

The epidemic of NCDs sweeping the globe is associated with decreasing levels of physical activity and an increasing prevalence of obesity and thereby diabetes. Mass education programmes and public exhibitions are one way of increasing awareness of diabetes. However,

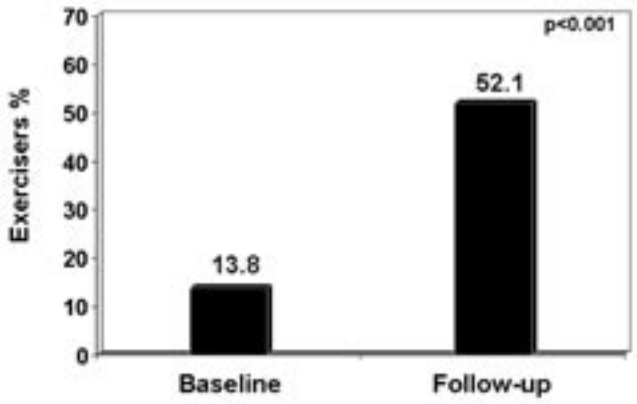

Fig. 3: Proportion of participants who did walking as exercise at least three times a week at baseline and follow-up

even after conducting three major diabetes exhibitions during the last 6 years, which have been attended by several thousand people,[17] the knowledge about diabetes in Chennai (the city where this study was done) remains poor, with less than 25 % knowing that diabetes can be prevented.[18] This indicates the need for taking diabetes education and prevention measures directly to homes through community involvement.

Life style modifications, including smoking cessation, weight control and exercise are among the most difficult risk-reduction strategies to implement. The present study is an example of how a community can be motivated to take charge of its own health. The fact that the community itself came forward to create facilities for exercising is commendable and is an encouraging sign for public health workers. Moreover this has led to positive benefits by increasing physical activity levels during the follow-up compared to baseline. This is even more significant as there was a change in the occupation grades, with a decrease in the proportion of manual labourers thereby leading to reduced physical activity in their occupation. Despite this, the overall level of physical activity levels have increased, indicating that leisure time activity (physical activity) has substantially increased due to the construction of this park.

Participants who reported no exercise during the baseline visit in 1996 - 1997 have now started walking after construction of the park and there was a 277% increase in the proportion of walkers from baseline to follow-up. This clearly shows that a motivated community can help to increase their physical activity levels. This is the first study to our knowledge from a developing country to report on community empowerment, leading to increased physical activity levels.

A study from Japan shows a clear association between walkable green spaces and longevity.[19] Another study on senior citizens reported that the space available for walking is directly proportional to the amount of physical activity undertaken.[20] Prevention of NCDs such as diabetes, obesity, hypertension and coronary

artery disease is a societal effort and one of the most important steps is to encourage people to increase physical activity. Town planners, government, architects and the public should give priority to build roads with pedestrian and bicycle paths, build new and repair existing parks and play grounds. Such efforts could go a long way in preventing the epidemic of NCDs now threatening to loom large in many developing countries of the world.

This experience also highlights the importance of sharing results of a research study with study participants. Treating the community as a partner can result in the community taking action leading to potential health benefits. By altering the social environment and changing the attitudes of people, it is possible to stimulate the community to get most interested in preventive health. Community participation such as the one described above, can play a significant role in strengthening the efforts of the government in controlling the diabetes epidemic in India and other developing countries.

One of the obvious limitations for exercising in urban cities like Chennai is space constraints as most people live in small apartments on narrow and busy roads with no footpaths meant for walking. Thus this model of the community constructing a park to enable the residents to do exercise is a good one to be emulated by others. Further, the effect can be multiplied since, as a consequence of reports of the success in Tirumangalam in local newspapers, two more parks were built in Chennai with community participation. This was soon followed by the administration constructing or repairing over 200 parks in Chennai city alone with similar ripple effects in smaller towns in the state of Tamilnadu and elsewhere. This, in the long run, will play a significant role in preventing non-communicable disease in general, and diabetes and cardiovascular disease in particular.

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References

1. Omran AR. The epidemiologic transition. A theory of the epidemiology of population change. *Milbank Mem Fund Q* 1971;49:509–38.
2. Srinath Reddy K, Shah B, Varghese C, Ramadoss A. Responding to the threat of chronic diseases in India. *Lancet* 2005;366:1744-49.
3. Mohan V, Deepa R, Shanthirani S, Premalatha G. Prevalence of coronary artery disease and its relationship to lipids in a selected population in south India. The Chennai Urban population Study (CUPS No. 5). *J Am Coll Cardiol* 2001;38:682-87.
4. Wild S, Roglic G, Green A, Sicree R., King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes Care* 2004;27:1047-53.
5. Reddy KS, Yusuf S.. Emerging epidemic of cardiovascular disease in developing countries. *Circulation* 1998;97:596– 601.
6. Gupta R Trends in hypertension epidemiology in India. *J Hum Hypertens.* 2004;18:73-78
7. Yach D, Stuckler D, Brownell KD. Epidemiologic and economic consequences of the global epidemics of obesity and diabetes. *Nat Med* 2006;12:62-66.
8. Rennie KL, McCarthy N, Yazdgerdi S, Marmot M., Brunner E.. Association of the metabolic syndrome with both vigorous and moderate physical activity. *Int J Epidemiol* 2003;32:600-06.
9. Mohan V, Gokulakrishnan K, Deepa R, Shanthirani CS, Datta M.. Association of physical inactivity with components of metabolic syndrome and coronary artery disease – The Chennai Urban Population Study (CUPS No. 15). *Diabet. Med* 2005;22 :1206-1211.
10. Knowler WC, Barrett-Connor E, Fowler SE, *et al*. Diabetes Prevention Program Research Group. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med* 2002;346:393-403.
11. Tuomilehto J, Lindstrom J, Eriksson JG, *et al*. Finnish Diabetes Prevention Study Group. Prevention of Type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *N Engl J Med* 2001;344:1343–50.
12. Ramachandran A, Snehalatha C, Mary S, Mukesh B, Bhaskar AD, Vijay V; Indian Diabetes Prevention Programme (IDPP). The Indian Diabetes Prevention Programme shows that lifestyle modification and metformin prevent type 2 diabetes in Asian Indian subjects with impaired glucose tolerance (IDPP-1). *Diabetologia* 2006;49:289–97.
13. Shanthirani CS, Rema M, Deepa R, *et al*. The Chennai Urban Population Study (CUPS) – Methodological details – (CUPS Paper No.1). *Int J Diab Dev Countries* 1999;19:149-57.
14. Sandvik L, Erikken J, Thaulow E, Erikssen G, Mundal R, Rodahl K. Phyical fitnes as a predictor of mortality among healthy middle-aged Norwegian men. *N Eng J Med* 1993;328:533-37.
15. Ratner R, Goldberg R, Haffner S, Marcovin S, Orchard T, Fowler S, Temprosa M. Diabetes Prevention Program Research Group. Impact of intensive lifestyle and metformin therapy on Cardiovascular Disease Risk Factors in the Diabetes Prevention Program. *Diabetes Care* 2005;28:888-94.
16. Halle M, Berg A, Baumstark MW, Keul J. Association of physical fitness with LDL and HDL subfractions in young healthy men. *Int J Sports Med* 1999;20:464–69.
17. Mohan V. Thinking big to raise awareness in India: the mega diabetes show. Diabetes Voice-Bulletin of the International Diabetes Federation 2003;48:39-42.
18. Deepa M, Deepa R, Shanthirani CS, Manjula Datta, Unwin NC, Kapur A, Mohan V. Awareness and knowledge of diabetes in Chennai – The Chennai Urban Rural Epidemiology Study (CURES – 10). *J Assoc Physicians India* 2005;53:283 – 87.
19. Takano T, Nakamura K, Watanabe M. Urban residential environments and senior citizens' longevity in megacity areas: the importance of walkable green spaces. *J Epidemiol Community Health* 2002;56:913-18.
20. Booth ML, Owen N, Bauman A, Clavisi O, Leslie E. Social-cognitive and perceived environment influences associated with physical activity in older Australians. *Prev Med* 2000;31:15-22.