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Original Article

Rising trend of cardiovascular risk factors between 1991–1994 and 2010–2012: A repeat cross sectional survey in urban and rural Vellore

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ABSTRACT

Background: Repeat cross sectional surveys document the trend of prevalence rates for non-communicable diseases and their risk factors. In this study, we compare the prevalence rates for risk factors for cardiovascular disease in urban and rural Vellore between 1991–1994 and 2010–2012.

Methods: Cross sectional survey was carried out in 1991–1994 in a rural block in Vellore district and in Vellore town, to study the prevalence of cardiovascular risk factors among adults aged 30–60 years. A repeat survey was done in 2010–2012 using the WHO STEPS method. In both surveys, socio-demographic and behavioral history, physical measurements, biochemical measurements, and medical history were obtained. Age adjusted rates were used to compare the rates in the two surveys.

Results: In the rural areas, there was a three times increase in diabetes and body mass index (BMI) ≥25 kg/m^2 (overweight/obese) with a doubling of the prevalence of hypertension. In urban areas there was a tripling of diabetes, doubling of proportion with BMI ≥ 25 kg/m^2 and 50% increase in prevalence of hypertension. While the proportion of male current smokers reduced by 50% in both rural and urban Vellore, lifetime abstainers to alcohol decreased in the rural area from 46.8% to 37.5% ($p < 0.001$).

Conclusions: There has been an alarming rise in diabetes, hypertension, and overweight/obese with an even greater increase in rural areas. Alcohol use is increasing while smoking is on the decline. Primary prevention programs are required urgently to stem the rising incidence of non-communicable diseases in India.

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1. Introduction

The prevalence of coronary heart disease in India has been found to be progressively increasing from approximately 6.5% in urban areas in the 1960s to 10.5% in 2000, and from 2% in the 1970s in the rural areas to about 4.5% in 2000.[1] Traditional risk factors such as diet, physical activity, abnormal lipids, diabetes, and hypertension have been shown to account for most of the risk for myocardial infarction worldwide.[2] Various cross sectional surveys throughout the country have shown the increasing prevalence of cardiovascular risk factors such as diabetes and hypertension.[3–6] However, evidence from repeated cross-sectional surveys in the same location is limited with only a few such periodic surveys e.g. Jaipur, Chennai.[7–10] Cardiovascular risk factor surveillance is an important component of control programs for non-communicable diseases (NCDs) and repeated cross sectional surveys drawn from the same population are useful for monitoring population trends.[11]

This paper compares the findings from two cross sectional studies conducted in urban and rural areas of Vellore, Tamil Nadu, in 1991–1994 and 2010–2012, assessing the changes in prevalence of risk factors for coronary heart disease. The detailed results of the repeat survey conducted in 2010–2012 have been published separately.[12]

2. Methods

2.1. Study design

A cross sectional study done in 1991–1994 in Vellore town and a rural block of Vellore district was repeated in 2010–2012 in the same location. These surveys were conducted as part of a multi-centric study with the other centers being rural and urban Delhi.

2.2. Setting and sample selection

In 1991–1994 a study was conducted in 20 urban clusters of Vellore town and 23 clusters of Kaniyambadi, a rural block in Vellore district, using probability proportional to population size, to document the prevalence of coronary heart disease and its risk factors.

A repeat survey was done in 48 urban clusters (12 consecutive clusters each from four urban zones) and nine randomly selected clusters out of the 23 rural clusters surveyed earlier, between June 2010 to December 2012, in the same town and rural block.

In the first survey, all individuals aged 30–60 years currently residing in the selected urban and rural clusters were invited to participate. In the repeat survey, the first 40 consecutive households from a randomly selected street in each of the 48 urban clusters were selected for the survey in the urban area, while all eligible individuals aged 30–64 years in the selected rural clusters were invited. As the first survey was done among adults aged 30–60 years and the second among 30–64 years, the comparison of results in this paper is restricted to the population aged 30–60 years in both surveys. There were no other exclusion criteria except age as mentioned.

The eligible populations (all those aged 30–60 years) in the study areas and response rates obtained in the two surveys are shown in Fig. 1. Overall the numbers of participants examined in the first survey were 7342 (4693 rural, 2649 urban) and 4845 (3058 rural, 1787 urban) in the second survey (Fig. 1).

2.3. Measurements and data collection

In the first survey, the questionnaires used were prepared jointly by both the study sites in conjunction with experts at the Indian Council of Medical Research, pre-tested and checked for reliability using repeated pilot surveys before administration by field workers through house-to-house interviews. In the repeat survey, the WHO STEPS method and questionnaire[13] were used with information being collected by trained field workers through home visits and details of the methodology have been described in an earlier paper.[12] In both surveys, special clinics were arranged at the villages/wards for the interviewed participants to collect clinical data, physical measurements, and fasting blood samples.

While in the 1991 survey, a random zero sphygmomanometer was used to record blood pressure, taking an average of three readings, the second survey used an automated apparatus (Omron HEM 7080), taking an average of two readings. Height was measured using an SECA 213 stadiometer and weight using a digital weighing machine (Essae, accuracy 0.01 kg). Venous blood samples were collected early morning after an overnight fasting of at least 8 hours. In both surveys plasma glucose was tested using the enzymatic calorimetric glucose-oxidase peroxidase method and lipids by calorimetric CHOD-PAP method, using autoanalysers. In the first survey accuracy of the biochemical measurements was checked by analyzing quality control sera from M/S Boehringer Mannheim Co., West Germany along with every batch of samples. The values obtained from the quality control sera and the study samples were comparable throughout the study period of the first survey. The quality control methods for the second survey have been described in the earlier paper.[12]

Written informed consent was obtained from the participants, and the study was approved by the Institutional Research Committee and Ethics Board of the tertiary healthcare institution conducting the study.

2.4. Statistical methods

Sample sizes calculated for the second survey based on expected prevalence of CHD of 1.7% in the rural area and 6% in the urban area were 5000 and 3000 respectively, as described in the earlier publication.[12] Age adjustment was done by direct standardization of the results of the second survey to the survey population in 1991–1994, to enable comparison of the rates obtained in both surveys. Comparison of proportions was done using the chi-square test and of means using the independent *t*-test. Due to lack of complete availability of raw data from the initial survey and differences in data collection tools and definitions, only those parameters could be compared for which comparable information was available from both surveys. Therefore, the comparison is restricted to comparison of prevalence rates of current smoking, lifetime abstainers (alcohol), diabetes (fasting blood sugar ≥126 mg% or