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Risk factor profile of noncommunicable diseases in an industrial productive (25-59 years) population of Baroda

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AIM: The profile of noncommunicable disease (NCD) risk factors was identified in an industrial productive population of Baroda city using WHO's STEPS questionnaire. **SETTINGS AND DESIGN:** One of the chemical industries, with approximately 900 employees, was purposively selected. **METHODOLOGY:** Behavioral risk factor profile and history of hypertension and diabetes (STEP I) was obtained by interview technique; this was followed by anthropometric measurements (STEP II) and biochemical assessment (STEP III) of 'at-risk' subjects (≥3 risk factors). **STATISTICAL ANALYSIS:** Calculation of the percentage of the subjects having NCD risk factors and the odds ratios between risk factors and NCDs. **RESULTS:** The majority (93.2%) of the subjects had low daily intake of vegetables and fruits; 79.4% of the subjects had high BMI (≥23 kg/m²). Subjects having a high waist-to-hip ratio and high waist circumference were 78.1% and 48.1%, respectively. Tobacco usage (32.1%), physical inactivity (19.0%), and alcohol consumption (18.4%)) were also prevalent among the study subjects. History of hypertension and diabetes was present in 19.5% and 15.3% of subjects, respectively. About 74.4% of the subjects were identified as being 'at risk' (i.e., had ≥3 risk factors). **CONCLUSIONS:** The very high prevalence of NCD risk factors in an industrial productive population shows an urgent need to initiate lifestyle modification and nutrition and health promotion programs in industries to curtail the rising epidemic of NCD. It is also necessary to review the possibility of making NCD control an integral part of mandatory occupational safety measures.

KEY WORDS: Industrial productive population, noncommunicable diseases, risk factors

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Introduction

Noncommunicable diseases (NCDs), especially cardiovascular diseases (CVD), cancer, and type 2 diabetes mellitus, account for 53% of all deaths and 44% of all disability-adjusted life years (DALYs) in India.[1] CVD deaths are concentrated in people of working age (between 35 and 64 years), in whom 35% of CVD deaths occur.[2] The prevalence of diabetes and its adverse health effects have risen very rapidly in South Asia, including India. By 2030, while most people with diabetes in developed countries will be aged 65 years or more, in the developing countries the majority will be in the 45-64 years age bracket - being affected in their most productive years.[1,3] Cancer accounted for 14% of the mortality in the South East Asia region in 2002.[4,5] In India alone, in the year 2005, 7% of the deaths were attributed to cancers.[6]

The relation between improper dietary intake and inactivity and the NCDs is especially strong.[7] These factors, i.e., diets extremely high in fats (especially animal fats); low in fruits, vegetable and complex carbohydrates; along with reduced physical activity, habitual smoking and alcohol consumption) are interrelated to each other so closely that the appearance/occurrence of one factor paves the way for the other, thereby leading to the development of NCDs.[6] The risk operates in a continuum, with modest elevation of many risk factors having a multiplicative effect.[8] Therefore, primordial prevention of the occurrence of risk factors, along with early identification and management, can help delay the progress to NCDs. Similarly, since all the NCDs have common underlying factors, identifying and modifying these risk factors have been recommended as a strategy for prevention and control of NCDs in various settings.[8,9]

Paper presented at International Conference on Urban Health Initiative, 9th-11th Feb 2006, Surat, Abstract No 28, Page 49.

The Jakarta Declaration (1997) gave a new direction to health promotion in the 21st century by giving the utmost priority to workplace settings and emphasizing on multi-sectoral cooperation in addressing the NCDs. Out of the different settings suggested, 'workplace' is one of the most important settings affecting the physical, mental, economical, and social wellbeing of the workers and, thereby, the health of their families, community, and society. It also offers an ideal setting and the infrastructure to support national health promotion programs for large audiences.[10]

WHO's STEPS methodology provides the framework for the surveillance of risk factors of NCDs.[11,12] According to a sentinel surveillance conducted in ten industries across India, the industrial population also has a high burden of cardiovascular disease risk factors, which is a major cause of death in India.[12] Therefore, this study was planned with an objective of identifying the risk factors of NCDs in an industrial productive population of Baroda. The results could help to motivate industries to initiate lifestyle modifications and nutrition and health promotion programs for the prevention and control of NCDs.

Methodology

Selection of sample

One of the chemical industries, with a total strength of 900 employees, was purposively selected to study the profile of the risk factors for NCDs by using the WHO STEPs questionnaire.[13] The questionnaire was pretested in adults between the ages of 25-58 years in five industries (other than sample selected for this study) and was adapted to include local terms and translated into the local language for clarity. A total of 190 employees who consented to participate in the study were randomly selected. The majority of the subjects (66.8%) performed sedentary activities, i.e., were engaged in sitting or desk work during the major part of the day, while about 23.7% of the subjects did work which involved both sitting and standing (moderate activity); very few subjects (9.4%) were heavy workers, undertaking mostly jobs that required them to remain standing. Ethical clearance was obtained from both the institutions before conducting the study.

Step I: Socioeconomic and behavioral risk profile

Information on the socioeconomic status and behavioral risk factors of the subjects was collected with the help of the STEPs questionnaire by using the interview technique. This step focused on self-reported information on risk factors like tobacco usage (cigarette/bidi smoking, oral tobacco, and snuff) and alcohol consumption and the average amount consumed in a day. A standard measure of 30 ml was used to assess information on amount of alcohol consumption. Details of dietary habits and physical activity pattern and past history of hypertension and diabetes was also obtained. Information on the total amount of fruits and vegetables (excluding tubers) consumed daily was obtained by asking about the number of servings (100 g of fruits and vegetables consumed was taken as one serving) of fruits and vegetables consumed in the last 24 h with the help of standard (200 ml) cups; this information was cross-checked by obtaining information about the amount of fresh fruits and vegetables purchased by the family every day and the portion consumed by the target subject. Similarly, an assessment of per capita consumption of fat, fruits, and vegetables at the workplace was obtained by collecting information on the number of employees served lunch and snacks daily and the amount of fresh fruits, vegetables, and cooking oil used daily. Cooking practices at the workplace were also assessed by interviewing the catering staff in charge of the industrial canteen.

The type of physical activity undertaken by the subjects was assessed according to the guidelines provided by the Centre for Disease Control (CDC).[14] Based on the guidelines, the amount of activities undertaken as part of work, travel and leisure was measured and classified as being of mild, moderate, or heavy intensity. Subjects undertaking at least 30 min of moderate-intensity activity daily, in any sphere of their daily routine (activities during working hours, traveling, or leisure time), were considered as 'active.' For assessing physical activity during traveling, information was obtained on whether the subject walked or used a motorized vehicle or cycle. The usage of a motorized vehicle was considered as 'light activity.' Usage of a bicycle (<30 min) and walking (<20 min) was considered to be 'moderate activity,' while more time (>20-30 min) spent on these activities was considered as 'heavy activity.'

Step II: Physical measurements

Anthropometric measurements like weight, height, waist circumference and hip girth were taken. Blood pressure of all the study subjects were also measured by trained investigators (certified by the industry doctors) using standard procedures. High blood pressure (>120/80 mmHg) is the leading risk factor for NCDs and is therefore included as a risk factor in the WHO STEPs methodology. However, the overall prevalence of diabetes was assessed based on history only.

The indices of body mass index (BMI), waist circumference (WC), and waist-to-hip ratio (WHR) were calculated from the recorded measurements. Classification of overweight and obesity was done by both the global and the Asia-Pacific criteria.[14] Central obesity was determined according to the recommendations of Lean *et al*. and Webb.[15,16]

The subjects having three, or more than three, behavioral and/or anthropometric risk factors from step I and II were identified as 'at-risk subjects.'

Statistical analysis

Data were analyzed using Microsoft Excel (2002) and Epi Info (2000) developed by CDC, USA, and WHO, Geneva. All values were expressed as percentages for qualitative variables, with mean ± SD calculated for quantitative variables. Odds ratios were calculated between risk factors and NCDs.

Results

Socioeconomic and behavioral risk factor profile of the selected study subjects (Step I)

A total of 190 subjects (males only) were taken as the study subjects. Almost 43.2% (82/190) of the subjects were in the age group of 45-54 years, 23.2% (44/190) in the age group of 34-44 years, 17.4% (33/190) in the age group of above 55 years, and 16.3% (31/190) were between 25 and 34 years. All the subjects were in their productive years, with almost all subjects between the ages of 25-58 years. With respect to educational qualifications, 51.6% (98/190) of the subjects were graduates and 22.1% (42/190) were postgraduates; 12.6% (24/190) had been educated up to the 10th class. The monthly income of the subjects ranged from a low of <Rs. 6000/month to a high of ≥Rs. 18000/month. However, 47.4% (90/190) of the subjects had incomes ranging from Rs. 6001 to Rs. 12000 and 33.2% (63/190) had their income between Rs. 12001-Rs. 18000, suggesting that the majority of the study subjects were well paid. The prevalence of total current smokers (cigarette/bidi) in the industrial population was 13.2% (25/190) and that of total current tobacco users (chewing tobacco/snuff) was 32.1% (52/190). Total tobacco usage habit (in any form) was 32.1% (61/190). The majority (80.0%; 20/25) of the smokers smoked 11–10 cigarettes/bidis daily, while 28.0% (7/25) and 12.0% (3/25) smokers smoked 11-20 cigarettes/bidis and 21-30 cigarettes/bidis daily, respectively. More than two-third or 77.8% (35/45) of oral tobacco users consumed ≤5 packets daily, while 20.0% (9/45) consumed 6-10 packets daily. Alcohol consumption habit was present in 18.4% (35/190) of the study subjects. Gujarat being a dry state, details about frequency and amount of consumption were not revealed by the subjects. A possibility of underreporting also cannot be ruled out.

The mean (±SD) total daily fruits and vegetables consumption of the study subjects was 307.0 ± 98.37 g/day. The majority of the study subjects, 93.2% (177/190), consumed suboptimal amounts of fruits and vegetables (<500 g/day). The estimated mean per capita consumption units of oil for the study subjects, including that at home and in the industrial canteen, was 1.50 ± 0.853 kg/month, which was more than the safe level suggested for oil consumption (i.e., 1.11 kg/month; based on an intake of 37 g/day as the upper limit for daily oil consumption for normal weight adults consuming not more than 25% of calories from fat, providing approximately 2000 kCal/day). None of the subjects, including the workers, were engaged in heavy activities at the workplace. The majority (62.1%; 118/190) of the subjects were engaged in light activities like desk work, working on computers, paperwork, etc. Only 37.9% of the subjects (72/190) reported performing moderate activities at work, such as using the stairs for moving between floors, walking (as a break from work), brisk walking at the workplace, playing table tennis in the gymnasium, etc. With regard to the means of transportation, 70.0% (133/190) of the subjects used motorized vehicles for traveling; 27.9% (53/190) of the population had the habit of walking for short distances. More than half of the subjects (63.7%; 121/190) were engaged in light activities such as TV viewing or reading newspapers during their leisure time. About one-third of the population (36.3%; 69/190) was involved in moderate activities at leisure time, e.g., walking for pleasure, playing badminton, and gardening. About 19.0% of the subjects (36/190) were physically inactive (in all the spheres of daily activity). Figure 1 highlights the behavioral risk factor profile of the study subjects. A history of hypertension and diabetes was reported in 19.5% (37/190) and 15.3% (29/190) of subjects, respectively [Figure 2].

At the end of Step I, 40.5% of the subjects (77/190) had two risk factors and 35.8% (68/190) had at least one risk factor. Only 6.8% of the population (13/190) were classified as 'at risk' (i.e., ≥3 risk factors) after Step I [Table 1].

Physical/anthropometric measurements of the study subjects (Step II)

As per the JNC VII classification of hypertension [Figure 2], at Step II, it was found that the overall prevalence of hypertension, including newly diagnosed

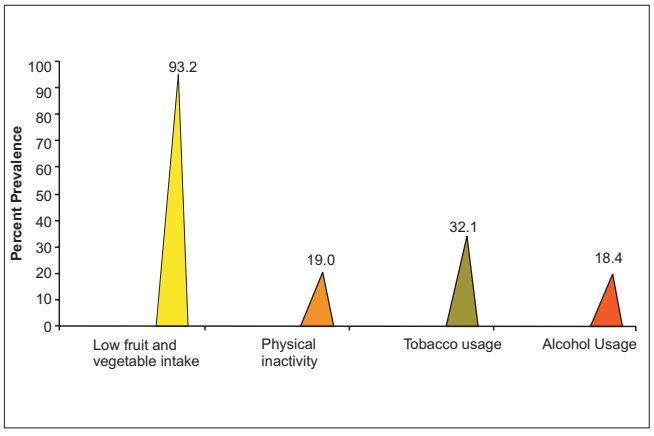

Figure 1: Behavioral risk factor profile of the subjects

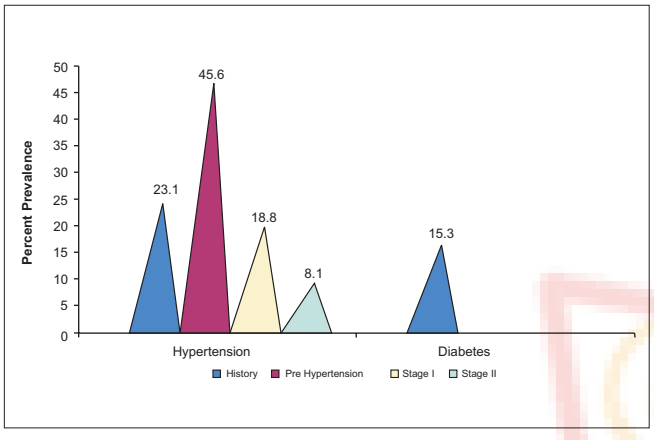

Figure 2: Prevalence of high blood pressure and diabetes in the study subjects

Table 1: Risk factor profile of the industrial population at the end of Step I

Presence of risk factors	Total	
	n	%
No risk factor	02	1.1
One risk factor	68	35.8
Two risk factors	77	40.5
Three risk factors	30	15.8
Four risk factors	13	6.8
Five risk factors	00	0.0

Risk factors in Step I: 1. Smoking or tobacco usage, 2. Alcohol consumption, 3. Low fruit and vegetable intake, 4. Physical inactivity, 5. History of hypertension and diabetes

cases (16.3%, 26/160) and those with a past history of hypertension (23.1%; 37/160) was 39.4% (63/160). Also, a very large percentage (45.6%) of subjects were in the prehypertension category; 18.8% had stage I hypertension (140-159/90-99 mmHg), and 8.1% had severe (stage II) hypertension (≥160/≥100 mmHg).

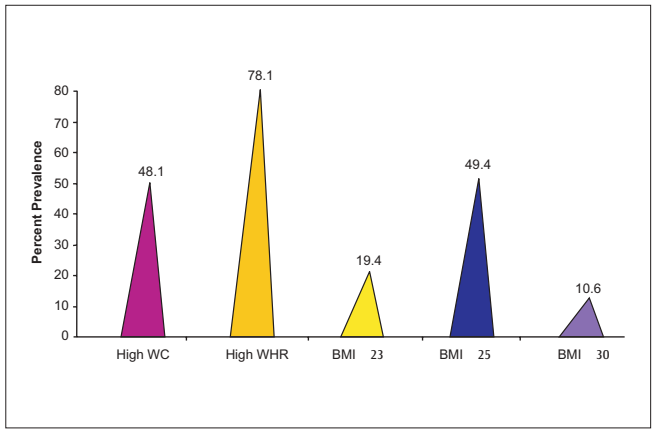

Figure 3: Anthropometric profile of the study subjects

Table 2: Clustering of risk factors in the industrial population at the end of Step II

Presence of risk factors	Total	
	n	%
No risk factors	00	0.0
<3 Risk factors	41	25.6
≥3 Risk factors	119	74.4

Risk factors of Step I + BMI, WC, WHR, blood pressure were the risk factors considered

The obese population was found to be 10.6% (17/160) as per WHO's global criteria for measuring obesity (BMI ≥ 30 kg/m²) which markedly increased to 60.0% (96/160) by using the Asia-Pacific criteria (BMI ≥ 25 kg m²). Similarly, a large proportion (48.1%; 77/160) of the study subjects had high waist circumference (≥94 cm), with 78.1% (125/160) having high WHR (≥0.9). Figure 3 gives the physical measurement profile of the study subjects. Table 2 reveals the behavioral risk factors and physical measurement profile of study subjects at the end of Step II.

A total of 74.4% (119/160) of the population had the presence of ≥3 risk factors.

Discussion

The risk factors of today are the diseases of tomorrow. Identifying these risk factors in populations occupies a central place in the surveillance system because of the lag time between exposure and disease.

Among the behavioral risk factors, there was high (93.2%) prevalence of low fruit and vegetable intake (<500 g/day). The total tobacco usage habit of 32.1% found in the industrial population in the present study

is consistent with the findings of another study in an industrial population.[16] The prevalence of physical inactivity (19.0%) in the present population was also supported by SEARO figures[5] for free-living populations as well as in industrial settings.[16] This implies that no large difference exists between the type of physical activities performed by free-living or industrial populations.

Alcohol intake in the present study was much higher (18.4%) than that reported earlier by a study in another industry (5%); this could be due to the fact that the industry showing lower alcohol consumption was one going through recession, with an irregular payment of wages, suggesting a close relationship of increased alcohol usage with better and regular earnings in men. This suggests that people working in profit-making industries are more vulnerable to developing the alcohol usage habit.

Whereas 23.1% of the subjects had a past history of hypertension, after screening for blood pressure the prevalence of hypertension was found to be 39.4%. Also, a very high percentage of the population was detected to be prehypertensive (45.6%), suggesting a need to regularly screen for hypertension to identify at-risk subjects for prevention of cardiovascular morbidity and mortality in the industrial setting. High blood pressures in industrial populations have been reported earlier.[17-19] The data clearly suggests the need to plan strategies for blood pressure control in industrial settings, as it is very well recognized that high blood pressure is the leading risk factor for mortality globally as well as in South East Asia.[5]

The percentage of obesity, according to the Asia-Pacific criteria, in the earlier reported study[18] was 37.7% which has nearly doubled to 60.0% in the present study, indicating that unhealthy eating practices need to be modified. Measures of central obesity such as increased waist circumference and high WHR also increased from 32.3% and 72.7%[16] to 48.1% and 78.1%, respectively, which again implies that CVD risk factors dramatically increase in profit-making industries.

Thus, it can be concluded that all industrial employees demonstrate unhealthy eating and lifestyle practices. These practices appear to worsen in profit-making industries, where the profits made by the industry translates into better pay packages for employees, suggesting an urgent need to frame and adopt a healthy worksite wellness policy, to give incentives to industries for adopting such policies, and to recognize such industries as 'employee friendly.' Experiences of western countries have shown that such strategies work to improve the dietary and lifestyle habits in populations and reduce not only the medical reimbursement bills but also increase employee retention and satisfaction.[20-22]

References

1. World Health Organization. Report on preventing chronic diseases: A vital investment. WHO: 2005.
2. Leeder S, Raymond S, Greenberg H, Liu H, Esson K. A race against time. The challenge of cardiovascular disease in developing economies. Columbia University: New York; 2004.
3. Ramachandran A, Snehalatha C, Kapur A, Vijay V, Mohan V, Das AK, *et al*. High prevalence of diabetes and Impaired glucose intolerance in India: National urban diabetes survey. Diabetologia 2001;44:1094-101.
4. World Health Organization. Report on Non-communicable diseases: Regional situation. WHO: 2003.
5. World Health Organization. The World Health Report 2002. Reducing risks, promoting healthy life. WHO: 2002.
6. Srinath Reddy K, Shah B, Varghese C, Ramadoss A. Responding to the threat of chronic diseases in India. Lancet 2005;366:1744-9.
7. North American Association for the Study of Obesity. 2003.
8. Bahl VK, Prabhakaran D, Karthikeyan G. Coronary artery disease in Indians. Indian Heart J 2001;53:707-13.
9. World Health Organization. The report of third global forum on NCD prevention and control. WHO: 2004.
10. Jakarta Declaration on Leading Health Promotion into the 21st Century.The Fourth International Conference on Health Promotion: New Players for a New Era - Leading Health Promotion into the 21st Century, meeting in Jakarta from 21 to 25 July 1997.
11. Bonita R. WHO's response: An integrated approach to NCD Surveillance and prevention consultation on Stepwise Approach to Surveillance of NCD Risk Factors STEPS, STERO, WHO: 2002.
12. Reddy KS, Prabhakaran D, Chaturvedi V, Jeemone P, Thankappan KR, Ramakrishnan L, *et al*. Methods for establishing a surveillance system for cardiovascular diseases in Indian industrial populations. Bull World Health Organ 2006;84:461-9.
13. Bonita R. Surveillance of risk factors for the NCD's: The WHO STEPS approach, WHO: 2001.
14. World Health Organization. The asia pacific perspective: Redefining obesity and its treatment. WHO: 2000.
15. Webb GP. Nutrition: A health promotion approach. 2nd ed. London; 2002. p. 86.
16. Mehan MB, Srivastava N, Pandya H. Profile of non communicable disease risk factors in an industrial setting. J Postgrad Med 2006;52:167-71.
17. US Department of Health and Human Services, Public Health Service, Centres for Disease Control and Prevention, National Centre for Chronic Disease Prevention and Health Promotion, Division of Nutrition and Physical Activity. Promoting physical activity: A guide for community action. Human Kinetics: Champaign, IL; 1999.
18. Prabhakaran D, Shah P, Chaturvedi V, Ramkrishnan L, Manhapra A, Reddy KS. Cardiovascular risk factor prevalence among men in a large industry of northern India. Natl Med J India 2005; 18:59-65.
19. Nilsson PM, Kiasson EB, Nyberg P. Life style intervention at the worksite- reduction of cardiovascular risk factors in a randomized

study. Scand J Work Environ Health 2001;27:57-62.
20. Aldana SG. Financial impact of health promotion programs: A comprehensive review of the literature. Am J Health Promot 2001;15:296-320.
21. Ozminkowski RJ, Goetzel RZ, Smith MW, Cantor RI, Shaughnessy A, Harrison M. The impact of the Citibank, NA, health management program on changes in employee health risks over time. J Occup Environ Med 2000;42:502-11.
22. Pelletier KR. A review and analysis of the clinical and cost-effectiveness studies of comprehensive health promotion and disease management programs at the worksite: 1995-1998 update (IV). Am J Health Promot 1999;13:333-45.

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