Efficacy of Using Who's Steps Approach to Identify "At Risk" Subjects for Diet Related Non-Communicable Diseases

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Abstract

Aim: The efficacy of using non invasive method of WHO’s STEP approach as compared to traditional biochemical assessment to identify “at risk” subjects (having constellation of ≥3 risk factors) was determined in productive industrial population.

Methods and Materials: Information on the presence of metabolic risk factors in the employee’s was collected from the existing medical records and subjects with ≥3 risk factors by using NCEP ATP III definition of Metabolic Syndrome were identified. The behavioral and physical measurements of the identified metabolic syndrome subjects was done using pre tested and adapted WHO STEPS Questionnaire.

Results: Out of 1059 employees, 251 employees (23.5%) were identified at risk through medical records. The most common (37.85%) combination prevalent was hypertension, obesity with dyslipidemia. The leading risk factors in them were overweight and obesity (89.54%), followed by low intake of fruits and vegetables (79.74%), high waist circumference (73.20%) and Physical inactivity (52.29%). The prevalence of hypertension was 46.41 % and pre hypertension was 57.52%. Tobacco usage in any form and alcohol consumption was 33.33% and 25.49% respectively.

Conclusion: By non invasive STEPS methodology, 87.58% of the metabolic syndrome subjects were identified “at risk subjects”. Thus, it can be inferred that in place of routine biochemical assessment of the entire population, WHO STEPS methodology could be used for the identification of “at risk” subjects. This measure will also reduce the biochemical assessment costs. STEPS approach could thus be recommended to industries as an occupational safety measure to identify at risk subjects for diet related non communicable diseases.

Introduction

The low and middle income countries (Bangladesh, Pakistan, India etc) are facing huge health and economic burden due to chronic diseases and these are projected to escalate tremendously over the next 10-15 years. In India in the year 2005, alone, an estimated 53% of all deaths and 44% of disability-adjusted life years (DALYs) lost was reported. Also it has been estimated that in the next 10 years, there will be an overall increase of 18% of death burden (60 million people). Coronary Heart Diseases (the leading cause of deaths) followed by cancer and diabetes among all the regions are the most significant contributors of deaths in adults. Cardio Vascular Diseases (CVD) in India is estimated to have attributed to 29% of the deaths. Also CVD deaths are concentrated in people of working age between 35-64 years, in whom 35% of CVD deaths occur. India suffers the highest loss in potentially productive years of life due to deaths from CVD in people aged 35-64 years. By 2030 this loss is expected to rise to 17.9 million years.

A few, largely preventable, risk factors account for most of world’s disease burden. About 75% of CVD can be attributed to the majority of risks like high cholesterol, high blood pressure, low fruit and vegetable intake, over weight and obesity, inactive lifestyle and tobacco usage.

It is well understood now that a moderate elevation of more than one risk factor multiply the risk of diseases and its complications, therefore, suggesting prevention and control of these risk factors in population. The constellation of risk factors like dyslipidemia (hypertriglyceridaemia and decreased HDL-C), elevated blood pressure, impaired glucose tolerance and central obesity is identified now as metabolic syndrome, also called syndrome X. Metabolic syndrome is an operational definition of cardio metabolic risk as it increases the risk of CVD and progression to diabetes mellitus. According to Wannamethu et al, (2005) metabolic syndrome is an effective clinical tool for identification of “at risk” subjects predisposed to CVD and diabetes mellitus. The prevalence of individual risk factors for CVD like obesity, hypertension, dyslipidemia and hyperglycemia and their clustering i.e. metabolic syndrome is
increasing worldwide. According to a report of the American Heart Association (2006), several ethnic groups, including south Asians from the Indian subcontinent seems to be particularly susceptible to the syndrome. For the prevention aspect of these diseases surveillance of major risk factors known to cause these diseases is an appropriate starting point. The WHO STEPS APPROACH, which is based on well-functioning NCD surveillance system and is an integral part of Nutrition Health Promotion Program is used to carry out the surveillance which is done in two steps. Step 1 involves collecting information on key risk behaviors using a questionnaire, Step 2 involves simple physical measurements and Step 3 involves biochemical estimations on blood samples of the at-risk subjects.

However, medical checkups with biochemical assessment are being initiated in many industries to screen at risk employees, who are simply referred to private practitioners for treatment of identified conditions with no emphasis on their prevention, causing huge escalations of costs for assessment only of at risk employees. The efficacy of the STEPS approach to correctly identify subjects at risk as compared to the traditional use of biochemical tests for screening subjects with metabolic syndrome has not been tested in an Indian industrial setting. Keeping this in view the present study was planned to assess the efficacy of using WHO’s Steps Approach to identify “at risk” subjects for non communicable diseases in an industrial setting of Baroda city.

Methods

A large scale private industry was purposively selected for conducting the study, on the basis of their willingness to participate. The workforce of the industry is predominantly males with very few (n=16) females working in the areas of Administration. Therefore only males were selected for the study.

The prevalence of NCD’s in the employee’s was also assessed based on the existing medical records of the selected industry for the last one year and selection of “At Risk” subjects with ≥3 risk factors using NCEP ATP III definition of Metabolic Syndrome was done.

Out of a total of 1456 employee’s, data of only 1059 employees was available at the time of selection of subjects on the basis of existing medical records. According to National Cholesterol Education Program Adult Treatment Panel III criteria for Metabolic Syndrome, it is defined as presence of any three out of five risk factors:

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting Glucose</td>
<td>&gt;100 mg/dl</td>
</tr>
<tr>
<td>Waist Circumference</td>
<td>Men: &gt;102 cm (40 in); 90 cm or 34 inch (for Asian Indians)</td>
</tr>
<tr>
<td></td>
<td>Women: &gt;88 cm (35 in); 80 cm or 32 inch (for Asian Indians)</td>
</tr>
<tr>
<td></td>
<td>TG ≥150 mg/dl</td>
</tr>
<tr>
<td></td>
<td>HDL-C</td>
</tr>
<tr>
<td></td>
<td>Men: &lt; 40 mg/dl</td>
</tr>
<tr>
<td></td>
<td>Women: &lt; 50 mg/dl</td>
</tr>
<tr>
<td>Blood Pressure</td>
<td>&gt;130/ or &gt;85 mm Hg</td>
</tr>
</tbody>
</table>

Based on the above criteria, 251 employees (23.70%) out of 1059 with available medical records were identified as “at risk”. Behavioral and physical measurements risk factor profile of the selected “At Risk” subjects of the industry, as outlined in WHO STEPS METHODOLOGY was collected. Only 153 subjects consented to participate in the study out of the 251 identified as at risk subjects. According to WHO STEPS methodology behavioral and physical measurement profile of the subjects is taken first with the help of adapted and pretested questionnaire and those having ≥3 risk factors from the following risk factors are considered as “at risk” of developing various types of NCDs including CVDs. They are:

Behavioral risk factors:
- Smoking or Tobacco Usage
- Alcohol Consumption
- Low Fruits and Vegetables Intake
- Physical Inactivity

Physical measurements:
- i. History of Hypertension & Diabetes
- ii. High Blood Pressure (≥ 120/80 mm Hg)
- iii. High BMI (≥ 23 kg/m2)
- iv. High Waist Circumference (≥ 90 cm)

Statistical Analysis: Data was processed and statistically analyzed. Percentages, means and standard deviations were calculated for various risk factors of NCD’s.

Results

Assessment for prevalence of diet related NCD’s in
the employee's based on the existing medical records. To map the prevalence of various NCDs like overweight/obesity, hypertension, diabetes mellitus II and dyslipidemia in all the employees of the industry, the pre-existing medical records of the health check-ups which were done for the last one year were analyzed. Out of total 1456 total employees data at of only 1059 employees was available at the time of analyzing the data.

On the basis of records of physical measurements, prevalence of obesity and hypertension was determined. More than 1/4th (34.66%) of the population was found to be obese when Asia-Pacific cutoff (BMI: ≥25 kg/m²) was used to classify obesity as compared to 4.16% as per WHO classification (BMI: ≥30 kg/m²). More than half of the population (57.13%) was found to be overweight as per WHO criteria (BMI: 25-29.9 kg/m²) and 22.47% according to the Asia pacific criteria (BMI: 23-24.99 kg/m²). Majority (57.13%) of the study subjects was in the BMI range of 25-29.99 kg/m².

Indicators for abdominal obesity were not taken into account as no data was available for waist circumference in the pre-existing medical records. Looking at the blood pressure profiles of the study subjects, it was found that more than 3/4th (78.94%) of the population had blood pressure higher than the normal range (BP: ≥140/ ≥90 mm Hg).

On the basis of pre-existing records of biochemical measurements, prevalence of Diabetes mellitus-II (DM-II) and Dyslipidemia (high total cholesterol, triglyceride, non HDL-C and LDL-Cholesterol; low HDL-C - as per the NCEP ATP III guidelines) was determined. Profile of the study subjects with respect to their biochemical measurements depicted that a very large section (68.55%) of the population was found to have dyslipidemia. The leading type of dyslipidemia prevalent in the population was high LDL-C (36.92%) followed closely by high non HDL-C (34.74%) and low HDL-C (32.00%). Almost 1/4th of the population had high TG and it is noteworthy that high TC was present in very few i.e. 8.68% of the population only.

High fasting blood glucose i.e. glucose intolerance (>100mg/dl) was seen in 10.58% of the study subjects, out of which more than 3/4th (83.93%) suffered from impaired glucose tolerance (100-125 mg/dl) and rest 16.06% subjects had DM-II. Thus Overall prevalence of DM-II in the study population was 1.70% and that of impaired glucose tolerance was 8.88% showing that comparatively more number of subjects are at risk of developing frank diabetes.

Selection of “at risk” subjects with ≥3 risk factors by using NCEP ATP III definition of Metabolic Syndrome

The subjects having presence of any three risk factors from the available risk factor data on Obesity (High BMI≥23 kg/m²), High Blood Pressure (>130/ >85 mm Hg), Dyslipidemia (Total Cholesterol >200 mg/dl; Triglyceride ≥150 mg/dl; Low Density Lipoprotein Cholesterol >100 mg/dl; High Density Lipoprotein Cholesterol130 mg/dl), High fasting Blood Glucose (>100 mg/dl) were considered as ‘At Risk’ subjects according to NCEP ATP III criteria for Metabolic Syndrome.

Out of 1059 employees whose pre-existing medical records were available, 251 employees (23.70%) were identified as “at risk” subjects having ≥3 risk factors according to the above mentioned criteria for metabolic syndrome. Illustration 1 shows that majority of the subjects (85.6%) had combination of three risk factors followed by four risk factors (14.74%). The most common combination was of hypertension, obesity along with dyslipidemia (37.85%) followed by 17.53% having a combination of pre-hypertension, obesity and dyslipidemia (Illustration 2 & 3).

Behavioral and physical risk factor profile of selected “at risk” subjects of the industry, as outlined in WHO STEPS METHODOLOGY

The pre-existing medical records used for identification of the “At Risk” subjects did not include any information regarding behavioral risk factors such as tobacco usage, alcohol consumption, fruits and vegetable’s intake and physical inactivity. Information regarding these risk factors was collected from the selected “at risk” subjects (N=251) who consented to participate in the study (n=153) using WHO STEPS methodology

STEP I: Socio-Economic and Behavioral Risk Factor Profile of the Selected Study Subjects

The WHO STEPS questionnaire was used for collecting the socio-economic status of the selected “At Risk” subjects.

All the “at risk” subjects were males with majority (61.44%) in the age group of 30-39 years followed by those in the age group of 40-49 years (26.14%). The mean age group of the “at risk” subjects was 36.23±6.46. With respect to educational qualifications, majority (72.34%) of the supervisory staff were Technically qualified (engineers) whereas in case of non-supervisory staff majority (28.30%) were post-graduates followed by 12th+diploma (25.47%) and 10th+ diploma (24.64%).

The monthly income of the subjects ranged from a low of ≤Rs.10,000/month to a high of >Rs.40,000/month, however, majority of the subjects had their income ranging from Rs.10,001 to Rs.20,000 (63.21%) suggesting that the majority of the study subjects were well paid. Similar trend was observed with respect to
per capita income of the subjects.

Regarding the type of tobacco usage, majority of the “at risk” subjects had oral tobacco usage (24.18%), followed by the use of cigarettes (14.37%). A total of 33.33% of the selected at risk subjects were tobacco users who consumed tobacco in any form. Out of those who had tobacco usage habit in any form, more than half (56.86%) were oral tobacco users followed by smokers (27.45%), rest 15.69% of the at risk subjects had both cigarettes and oral tobacco.

It was alarming to note that in spite of Gujarat being a dry state, 1/4th (25.49%) of the at risk subjects had the habit of alcohol consumption. Majority (64.10%) of the “at risk” subjects were consuming alcohol within the prescribed limits for alcohol consumption (\(\leq 2\) pegs/day) as compared to 35.89% of subjects who were consuming alcohol beyond the prescribed limits. More than 3/4th of the “at risk” subjects (79.74%) consumed sub optimal levels (Regarding individual fruit and vegetables intake among “at risk” subjects it was seen that the mean intake of fruits was 109.54±69.25 and the mean intake of vegetables was 173.86±80.73.

Regarding the frequency of consumption of fruits, approximately half i.e. 46.41% of the “at risk” subjects consumed fruits 1-3 days a week.

The estimated mean consumption of oil for “at risk” subjects including their oil consumption both at home and in the industrial canteen, was 1.07±0.46 kg/month, which is more than the amount suggested for oil consumption (0.84 kg/month; PUFA:MUFA – 1:1, 42 gm/day is considered as the upper limit for daily oil consumption).

While considering the quality of oil it was found that, the most common form of oil used was groundnut oil (24.84%) followed by sunflower oil (22.88%) and cotton seed oil (21.57%). Thus majority of the “at risk” subjects consumed PUFA rich oil which is considered as unhealthy if consumed alone. The consumption of healthy oils like mustard oil and soy bean oil was almost negligible in the “at risk subjects”. Only 15.67% of “at risk subjects” consumed groundnut and mustard oil in combination.

On classifying the at risk subjects according to their activity pattern, it was revealed that approximately half (52.29%) of the at risk population were physically inactive (Less than 30 minutes of moderate intensity activity per day at least five days a week / 2.5 hours of moderate intensity activity per week).

The physical activity of the “at risk subjects” was defined in three spheres of their daily routine i.e. physical activity at work, physical activity while travelling and physical activity during their leisure time. Depicts the level of physical activity of the “at risk subjects” in these 3 spheres. Majority of the “at risk subjects” (77.12%) were found to be sedentary during working hours. For assessing physical activity while traveling, information was obtained on usage of motorized vehicle, cycle or walking, the usage of motorized vehicle was considered as light activity also usage of bicycle (>20 minutes) and walking (>30 minutes) was considered to be moderate activity. A large section of the “at risk subjects” (83.67%) were found to be sedentary while traveling as they used motorized vehicles as a means of transportation. Very few (16.34%) of the subjects were engaged in moderate intensity activity during traveling mostly in the form of walking for short distances. When considering physical activity during leisure time it was found that 3/4th of the “at risk subjects” (75.82%) were sedentary. 21.57 % were involved in moderate activities during leisure time.

Out of the total population, about 39.87% and 7.19% of the study subjects were aware of being hypertensive or diabeti respectively.

About half (49.67%) of the “at risk” subjects were found to have family history of either hypertension or diabetes or both. Also, majority (22.22%) were found to have family history of hypertension, followed by family history of diabetes (16.99%) and family history of both hypertension and diabetes (10.46%).

STEP II: Physical / Anthropometric Measurements of the selected “at risk” subjects

Profile of the selected “at risk” subjects with respect to their physical measurements are depicted in terms of obesity and hypertension. At risk subjects had higher BMI and WC although the difference in the mean BMI of the subjects having 3 and 4 risk factors respectively was found to be insignificant.

A large section (11.76%) of the selected “at risk” subjects were found to be obese as per WHO criteria and the prevalence further increased markedly when Asia-Pacific cutoff was used to classify obesity (68.62%). Overweight was found to be prevalent in more than half (56.86%) of the selected “at risk” subjects when WHO criteria was used (BMI: 25-29.9 kg/m2) and in 20.91% according to the Asia pacific criteria (BMI: 23-24.99 kg/m2).

Waist circumference was used as an indicator of abdominal obesity and 3/4th (73.20%) of “at risk” subjects were found to have waist circumference >90 cm (Indo Asian criteria). About 41.82% of the “at risk” subjects were at high risk (>94-101 cm) with respect to high waist circumference and 20.92% were at higher risk (WC≥102 cm) of developing NCD by the criteria of abdominal obesity given by WHO.

The distribution of “at risk subjects as per the JNC VII classification of hypertension showed that the mean
systolic and diastolic blood pressure of the “at risk” subjects fell in the range of pre-hypertension (120-139/80-89 mmHg) and the differences in the mean blood pressures of the subjects having 3 and 4 risk factors respectively were found to be similar. Looking at the blood pressure profiles of the “at risk” subjects it was revealed that a large section (46.41%) had hypertension (≥140/≥90 mmHg) although majorities (53.59%) were found to be pre-hypertensives. Illustration 4 shows the comparison between physical measurements (BMI and systolic and diastolic blood pressure) of subjects having more than three risk factors i.e. those who were identified to be “at risk” (n=251) according to NCEP ATP III criteria for metabolic syndrome. The table clearly shows that the mean BMI and blood pressure values of “at risk” subjects were higher than their counterparts indicating that the “at risk” subjects having metabolic syndrome could be at higher risk of developing CVD and its complications emphasizing that measures for prevention and control of NCD’s should be adopted to decrease the rising burden of NCDs in industrial population. Thus, on the basis of physical measurements and behavioral risk factors 87.58% of the “at risk” subjects were also identified to be “at risk” having 3 or more than 3 risk factors according to STEP I and STEP II of WHO STEPS methodology (Illustration 5). Thus implying that non invasive methodology of steps could be used as a starting point to estimate population at risk. This will not only curtail the costs of biochemical estimations but also improve compliance because of non-invasive methodology.

**Discussion**

The prevalence of metabolic syndrome is increasing owing to lifestyle changes leading to obesity. This syndrome is a complex association of several interrelated abnormalities that increase the risk for CVD and progression to DM II. A prospective cohort study in a large community based sample (n=2322) of middle aged men concluded that, on adding the metabolic syndrome to models with established risk factors for cardiovascular disease (smoking, diabetes, hypertension, and serum cholesterol) at age 50, significantly predicted total and cardiovascular mortality. Similar results were obtained in a subsample of middle aged men without diabetes or manifested cardiovascular disease. According to Wannamethu et al (2005), metabolic syndrome is an effective clinical tool for identification of “At Risk” subjects and evaluated it as a global risk assessment tool for CVD and DM II. Thus detection, prevention and treatment of underlying risk factors of metabolic syndrome are essential to reduce the CVD burden in population. The prevalence of Metabolic Syndrome was found to be 23.70% (as per NCEP ATP III Criteria) which is slightly higher than the prevalence reported by the Chennai urban rural epidemiological study (18.3%) in the free living population of India in 200313. In all the combination of risk factors pre-hypertension and hypertension was universally present and was found to cluster with overweight, obesity and dyslipidemia as the first four leading risk factors. Thus demonstrating that the leading risk factors prevalent among the population were diet and lifestyle related so a comprehensive nutrition health promotion program for promoting healthy diet and lifestyle should be initiated in the industry focusing on three broad areas: weight management, cholesterol management along with blood pressure control to target “at risk” subjects and control the increasing burden of NCDs in the industry effectively. Seeing the above scenario it can be concluded that industries in India are not yet sensitized to the rising epidemic of NCDs and thus have no policies to map them or control them, emphasizing an urgent need to incorporate nutrition health component in the policies of industry which is possible only when it becomes part of corporate strategy. Initiating a nutrition health promotion program could prove to be most cost effective, as this approach will not only identify at risk subjects but also will be able to identify the risk factors and sensitize the employees to control them early to prevent the onset of NCD’s and reducing their complications. It is noteworthy that health checkups including biochemical assessment of NCD risk factor profile were conducted once a year for all the employees of the selected industry. However if STEPS approach was followed, these costs could be curtailed by conducting biochemical assessment of only “at risk” subjects which were 23.70% of the total population. The money saved from biochemical assessment could be invested in initiating a health promotion program focusing on weight management, cholesterol management, hypertension control etc. or on a comprehensive health promotion program on promoting healthy diets and lifestyle behaviors amongst population. It is high time that industries realize the importance of investing in health promotion program for prevention and control of NCDs. For initiation of a health promotion program, a nutritionist, fitness expert and a health promotion expert can be
appointed. Thus health promotion program on a long run can play a significant role in boosting the morale of the workforce of the industry, enhance productivity, promote health, and reduce health care and absenteeism costs and employee turnover resulting in economic development of the industry which would ultimately lead to sustainable social and economic development of the nation.

Conclusion(s)

Based on the WHO STEPS criteria 87.58% of identified “at risk” subjects by biochemical assessment were also “at risk” by non invasive methodology of taking the behavioral and physical measurements profile thus it can be inferred that instead of doing biochemical measurements for the entire population, WHO STEPS methodology can be used for the identification of “at risk” subjects leading to reduction of costs which would be incurred on biochemical assessment of the subjects. Thus justifying the use of WHO STEPS methodology for the identification of “at risk” subjects.

References

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