

Original Research Article

NCD Risk Factors and Social Determinants of Health: the India's Picture- an Analysis of WHO SAGE Data

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ABSTRACT

Introduction: Non-communicable diseases are undoubtedly one of the most prominent public health challenges faced by the countries worldwide. With the knowledge that Social Determinants Influence the individual's vulnerability to NCDs we tried to look in to how various social determinants might influence vulnerability to various NCD risk factors.

Methodology: The Study basis on the secondary data analysis of India's Data of WHO SAGE Study Wave 1. The Variables of Interest are selected and the Data is Analyzed Using Statistical package for social sciences version 21. Descriptive Statistics, Chi-square tests and Regression models are the statistical tests used for analysing the Data.

Results: Total number of 12198 in sample, with 4709 males and 7489 females, mean age 49.97 (SD 16.765) NCD risk factors: 4714 (42%) admitted tobacco use, 1457 (13%) informed alcohol use, 567 (4.6%) of the respondents replied that they do vigorous fitness exercise, whereas 1582 individuals responded that they do moderate physical activity. servings of fruits per day, 4215(38.3%) had 1 serving per day, 1977 (16.2%) had 2 servings per day, 303 (2.8%) had three servings per day; servings of vegetables per day 3028 (27%) had 1 serving per day, 5999 (53.5%) had two servings per day, 1487 (13.3%) had 3 servings per day.

Conclusion: Risk factors of Non-communicable diseases change with that of the individuals' social status and purchasing power. Individuals who are more vulnerable are more at risk of NCD risk factors thus should be the prime focus of NCD prevention policies.

Key words: Social determinants, Non-communicable diseases, Tobacco, WHO SAGE.

INTRODUCTION

Raising health inequalities are evident in majority of the countries across the world and the alarming situation calls for the initiatives to tackle them. The millennium development goals (MDG's) which were established following the millennium summit of United Nations in the year 2000 ^[1] gained attention of the policy makers and national governments of its 193 signatories. At least 7 out of 8 MDGs are directly or indirectly related to various

aspects of health ^[2] with Goal 4 and Goal 5 particularly targeting at reducing Child mortality and Maternal Mortality respectively. ^[1] In India The Under 5 Mortality declined from 126 in 1990 to 52 in 2012, ^[3] and Maternal Mortality Rate declined from 560/1 lakh live births in 1990 to 167/1 lakh live births in 2013, ^[4] this considerable decline in IMR and MMR can be attributed to several national level programmes taken up by the government of India. Though IMR and MMR reduced

significantly the Mortality and Morbidity related to Non Communicable Diseases (NCD) is constantly raising posing a significant public health challenge. Out of 57 million deaths which occurred globally in 2008, 36 million i.e., almost 66% were because of NCD's, between 2010-2020 mortality due to non-communicable diseases is projected to raise by 15% and to a total of around 52 million deaths because of NCDs by the year 2030. [6] Cancer, Cardiovascular disease, Stroke, COPD and Diabetes are among those which account for the majority of mortality and morbidity because of NCDs.

Numerous studies and wide amount of research has proven life style aspects like tobacco use, inadequate physical exercise, imbalanced diet pattern and alcohol use as the most prominent risk factors for development of majority of NCDs, [6,8-10] Tobacco by itself is responsible for more than 6000000 deaths per year making it one of the leading causes for deaths due to NCDs. [9] Moreover a significant proportion of mortality because of NCDs is added up by other risk factors like inadequate physical exercise, Imbalanced diet, and over use of alcohol, because of which it is not surprising to see that prevention and control of these risk factors is the focus of attention for the several global strategies and action plans to combat the growing burden of NCDs. Several public health programmes and interventions were initiated worldwide in order to reduce the growing incidence of these NCD risk factors.

The rise of public health as an interdisciplinary field of knowledge and the shift from emphasizing on traditional curative medicine to the of preventive medicine in the recent decades has brought a revolutionary change in understanding illness from the laboratory oriented clinical etiology perspective to understanding disease/illness as the result of more social differences and inequities (i.e., Societal inequities as etiology). The publication of WHO committee report on Social determinants of Health has rejuvenated the

interest on SDH and re-emphasized how important it is to tackle the social determinants if at all one has to prevent/control a disease. [10] It advocates that biological (such as hypertension, High cholesterol) and behavioral (such as smoking, inadequate physical exercise) risk factors are not actual causes, but are intermediaries coming in between the cause and effect paradigm of social determinants (position) as the cause and Disease as the outcome. Improving the circumstances in which people live and work i.e., making the societal circumstances friendly to health will reduce the burden of majority of diseases, and unlike clinical perspective of viewing the disease it is not just the responsibility of health department but is collective responsibility which requires cohesion and intersect oral collaboration of all the departments responsible for making various policies. [8] The UNICEF discussion paper on social determinants of NCDs shed light on how various social determinants such as individual's social position, material availability in terms of purchasing power, educational status, working conditions and deprivation etc., have serious impact on increasing the vulnerability to the development of several NCD risk factors eventually leading to premature mortality and morbidity because of NCDs. [10] The world Health organization's 2008-2013 Global strategy for prevention and control of Non-communicable diseases calls for promoting research for prevention and control of NCD as one of its prime objectives and emphasizes on monitoring the impact of various SDH on the distribution of NCD risk factors among populations, [11] a similar voice was raised by global strategy for 2013-2020 which called for promotion of research and reducing the risk factors with emphasis on underlying SDH. The impact of various social determinants and their effect in increasing the risk for NCDs is one of the major areas which is well researched as evidenced by research from several well cited research articles. [8,10,12-14]

Similarly there is some research showing how SDH influence the individuals risk towards developing various behavioral risk factors toward NCDs. [15-17] However, majority of such research is based on single risk factor or disease and were done with relatively small sample size and confined to a single geographical region. Though there have been several studies in low and middle income countries (LMIC) the number of studies from India focusing on SDH and NCD are less and further those focusing on NCD risk factors and SDH are fewer. In India considering the high burden of NCD, [5] growing elderly population, [7] and sustained social and economic disparities it can be said that the toll of NCDs are to raise in the years to come. With several government policies and programmes coming up to reduce the incidence and prevalence of NCDs by reducing their risk factors, there is a need that these policies and programmes are supported and backed up by quality data and research so that priority areas might be identified and tackled with. This paper capitalizes this need and tries to look at the prevalence primary four of NCD risk factors and how various social determinants of health influence the development of these risk factors. Using the data from WHO SAGE Wave 1, this paper adds up to the growing data on NCD risk factors and social determinants of health and tries to reflect the importance of SDH in terms of NCD risk factors and shed light on priority areas and vulnerable populations where the interventions should focus upon.

Objectives:

- 1) To estimate the prevalence of various NCD risk factors among the respondents in the sample.
- 2) To understand the association between various NCD risk factors and social determinants
- 3) To measure the degree of change in the NCD risk factors with respect to change in various SDH.

METHODOLOGY

The current Research paper derives on the secondary data analysis of Wave 1 India's data of World Health organization's "study on global ageing and adult health" (SAGE).

Sampling

The sampling was done using "stratified multi stage cluster sampling design". Of the total number of 28 states during the year 2000, 19 states were included into the sampling frame. The sampling frame was made by using the census 2000 data. Taking in to consideration the level of development and geographical position 6 (Maharashtra, Assam, Karnataka, Rajasthan, Uttar Pradesh, and west Bengal) out of 19 states were further selected. Among the selected states there were two strata (urban and rural) for each state totaling to 12 strata. In urban strata three stage sampling was adopted, where as in rural strata two stage sampling was adopted. The villages (rural areas) which were the PSUs (Primary sampling units) were selected probability proportional to size. The Households were the SSUs (secondary sampling units) which were selected using systematic sampling. The individuals were considered as TSUs (Tertiary sampling units) who were selected respective SSUs using Kish tables. The city wards (Urban areas) were considered as PSUs and were selected probability proportional to size. Two Census enumeration blocks (SSUs) were randomly selected from each city wards. The Households were the TSUs and were selected using systemic sampling from each SSU. The Individuals were the QSUs and were selected using Kish tables from each Household (TSU). In total from the six states and 12 strata, a total of 12198 individuals were surveyed who make up the sample for India.

Variables under study

In accordance with the objectives of the study the variables were selected from the data. Basing on the prior research and evidence from published literature Use of

tobacco, Alcohol, physical activity and diet are considered as the primary variables for risk factors (which were the Dependent variables in the study). The respective variables are chosen accordingly from the data set. Since the question for physical activity is not specific and three questions which could be talking about physical are there, all the three were included as the dependent variables for the component of physical activity as a risk factor. The questions about number of servings of fruit and vegetables per day are considered as variables for diet component of the risk factors.

The variables Age, Marital status, gender, place of stay (rural/urban), Economic status (need to be changed), Age at work, Mothers education, father's education, Caste/tribe/ethnic background are considered as the independent variables for the various social determinants. These variables are selected from the data set basing on the available literature and prior research supporting their selection.

Data analysis

Data is analyzed by using various statistical methods. Preliminary analysis is done using the descriptive statistics. 2 by 2 tables are constructed to give further insight in to the data. The data is further analyzed using the chi-square models. The variables of risk factors were considered as the dependent variables in these models, whereas the variables related to social determinants of health are considered as the independent variables for the model.

RESULTS

The total number of individuals in the sample is 12198. The age of the respondent in the sample was between 18 and 108 years with a mean age of 49.97 years with a standard deviation of 16.765 years. The number of males in the sample is 4709 which accounts for 38.6% of the sample and the number of females was 7489 accounting for 61.4% of the total sample size. Around 3132 (25.7%) were from urban areas and 9066 (74.3%) were from the rural

strata of the sample. Out of the total sample 5442 (44.6%) were with no formal education, 1255(10.3%) were with less than primary education, 1860 (15.2%) were with education completed up to primary school, 1517(12.4%) were with education up to secondary school level, 1364 (11.2%) were with education up to high school level, 557 (4.6%) completed college/university and 202(1.7%) completed till post-graduation. 9462 (77.6%) were married whereas 1957 (16.0%) were widowed and 689 (5.6%) were never married. 774 (6.3%) belonged to ST, 1978 (16.2%) belonged to SC, 64989(53.3%) belonged to other castes and 1910 (15.7%) doesn't belong to any of the above. Considering the Income levels 2114 (17.3%) belong to the lowest income quintile, 2317 (19.0%) belong to lower middle income quintile, 2323 (19.0%) belong to middle income quintile, 2551 (20.9%) belong to upper middle income quintile and 2815 (23.1%) belong to higher income quintile. More than 60% of the sample stated that they ever worked for money where as 31% stated that they never worked. Considering Age at work as an important social determinant around 5194 (42.6%) started working at the age of 11-20 years, 401 (3.3%) of the respondents started working at the age of 1-10 years and 1365 (11.2%) of the respondents started working at the age of 21-30 years. Considering mother's education as an important determinant in the development of individuals' behavior mother's education was also considered as a variable. 9338(83.2%) of respondents had mothers with no formal education and only 7 (0.1%) individuals had mothers who completed post-graduation.

Considering the risk factors for NCDs around 4714 (42%) admitted that they used tobacco in some form or another, 1457 (13%) informed that they used alcohol. Multiple variables were used as indicators for diet and physical activity. Under physical activity 4349 (38.7%) of the respondents said that they do vigorous work, 8045 (71.7%) individuals responded

that they do moderate work, 567 (4.6%) of the respondents replied that they do vigorous fitness exercise, whereas 1582 (12.96%) individuals responded that they do moderate physical activity. For Diet as a risk factor the number of servings of fruits and vegetables per day are considered as indicators. 4305 (39.1%) of the respondents reported to have 0 servings of fruits per day, 4215(38.3%) had 1 serving per day, 1977 (16.2%) had 2 servings per day, 303 (2.8%) had three servings per day, 133 (1.1%) had four servings per day, and 75 (0.6%) had 5 or more servings per day. 116 (1%) of the respondents reported to have 0 servings of vegetables per day. 3028 (27%) had 1 serving per day, 5999 (53.5%) had two servings per day, 1487 (13.3%) had 3 servings per day, 399 (3.6%) had four servings per day and 190 (1.7%) had five or more servings per day.

Chi-square tests:

Tobacco usage: Chi square test between use of tobacco and rural and urban areas yielded significant association between the variables, $X^2(3, N= 11226) = 151.0$, $p < 0.01$. Significant association with tobacco use was further observed with the variables Gender $X^2(3, N=11226) = 2411.6$, $p < 0.01$, Marital Status, $X^2(15, N= 11226) = 154.43$, $p < 0.01$, Highest education attained, $X^2(21, N= 11226) = 144.36$, $p < 0.01$, Social background (caste), $X^2(12, N= 11183) = 88.76$, $P < 0.01$, Mother's education, $X^2(21, N= 11226) = 298.50$, $p < 0.01$, Income Quintile, $X^2(12, N= 11155) = 266.45$, $p < 0.01$.

Alcohol Usage: Chi square test between use of alcohol and rural and urban areas yielded significant association between the variables, $X^2(2, N= 11226) = 32.38$, $p < 0.01$. Significant association was further observed with the variables Gender $X^2(2, N= 11226) = 1742.40$, $p < 0.01$, Marital status $X^2(10, N= 11226) = 57.78$, $p < 0.01$, Highest education attained $X^2(14, N= 11226) = 46.79$, $p < 0.01$, social background (caste) $X^2(8, N= 11183) = 391.91$, $p < 0.01$, Mother's education $X^2(14, N= 11226) = 41.23$, $p < 0.01$, Income quintile $X^2(8, N=$

11155) = 35.03, $p < 0.01$, Age of the person when he/she started to work $X^2(7, N= 7390) = 33.32$, $p < 0.01$.

Physical activity: Chi square between the variables vigorous physical work and rural and urban areas yielded significant association between the variables $X^2(2, N= 11226) = 230.06$, $p < 0.01$. Significant association was further observed with the variables Gender $X^2(2, N= 11226) = 48.85$, $p < 0.01$, Marital status $X^2(8, N= 11226) = 197.05$, $p < 0.01$, Highest education attained $X^2(5, N= 6146) = 52.37$, $p < 0.01$, Social background (Caste) $X^2(8, N= 11183) = 64.70$, $p < 0.01$, Mother's education $X^2(14, N= 11226) = 62.73$, $p < 0.01$. Income quintile $X^2(8, N= 11155) = 139.17$, $p < 0.01$, Age of starting work $X^2(7, N= 7390) = 76.26$, $p < 0.01$. Chi square between the variables vigorous physical exercise and rural and urban areas yielded significant association between the variables $X^2(2, N= 11226) = 30.74$, $p < 0.01$, significant association was further observed with the variables Gender $X^2(2, N= 11226) = 124.59$, $p < 0.01$, Marital status $X^2(8, N= 11226) = 143.99$, $p < 0.01$, Highest level of education attained $X^2(5, N= 6146) = 61.24$, $p < 0.01$, Social background $X^2(8, N= 11183) = 19.24$, $p < 0.05$, Mother's education $X^2(14, N= 11226) = 78.63$, $p < 0.01$, Income quintile $X^2(8, N= 11155) = 62.48$, $p < 0.01$, Age of starting to work $X^2(7, N= 7390) = 24.95$, $p < 0.05$. Chi square test between the variables Moderate physical exercise and place of living yielded significant results $X^2(2, N= 11226) = 181.78$, $p < 0.01$, similarly significant association was observed with the variables Gender $X^2(2, N= 11226) = 82.1$, $p < 0.01$, marital status $X^2(8, N= 11226) = 157.91$, $p < 0.01$, Highest level of education attained $X^2(5, N= 6146) = 105.63$, $p < 0.01$, Social background (caste) $X^2(8, N= 11183) = 39.93$, $p < 0.01$, Mothers education $X^2(14, N= 11226) = 151.20$, $p < 0.01$, Income quintile (8, N= 11155) = 87.70, $p < 0.01$, Age at he/she started working $X^2(7, N= 7390) = 34.95$, $p < 0.01$.

Diet Pattern: Chi square test between the variables number of servings of vegetables per day and place of stay (urban/rural) yielded significant association $X^2 (5, N = 11219) = 107.91, p < 0.01$, similarly significant association was obtained with the variables Gender $X^2 (2, N= 11219) = 176.49, p < 0.01$, Marital status $X^2 (20, N= 11219) = 167.03, p < 0.01$, Highest education attained $X^2 (25, N= 6143) = 170.33, p < 0.01$, Social background (caste) $X^2 (20, N= 11176) = 335.21, p < 0.01$, Mother's education $X^2 (35, N= 11219) = 92.12, p < 0.01$, Income quintile $X^2 (20, N= 11148) = 480.22, p < 0.01$, Age at which he/she started working $X^2 (35, N= 7383) =$

89.32, $p < 0.01$. Chi square test between the variables number of servings of fruits per day and place of stay (urban/rural) yielded significant association $X^2 (5, N= 11008) = 485.90, p < 0.01$, similarly significant association was observed for the variables Gender $X^2 (5, 11008) = 50.84, p < 0.01$, marital status $X^2 (20, N= 11008) = 101.78, p < 0.01$, Highest level of education $X^2 (25, N = 6025) = 348.76, p < 0.01$, Social background (caste) $X^2 (20, N= 10974) = 615.47, p < 0.01$, Mother's education $X^2 (35, N= 11008) = 437.99, p < 0.01$, Income quintile $X^2 (20, N= 10937) = 1101.86, p < 0.01$, Age at which he/she started working $X^2 (35, N= 7260) = 111.91, p < 0.01$.

Table 1: Table showing the distribution of various risk factors according to place of residence

Place Of Residence	Risk Factors							
	Tobacco		Alcohol		Moderate Exercise		3 Servings Of Fruit	
	Yes	No	Yes	No	Yes	No	Yes	No
RURAL	3798	4581	1175	7205	964	7416	1080	6971
URBAN	916	1928	282	2562	616	2228	407	2272
TOTAL	4714	6509	1457	9767	1580	9644	1487	9243

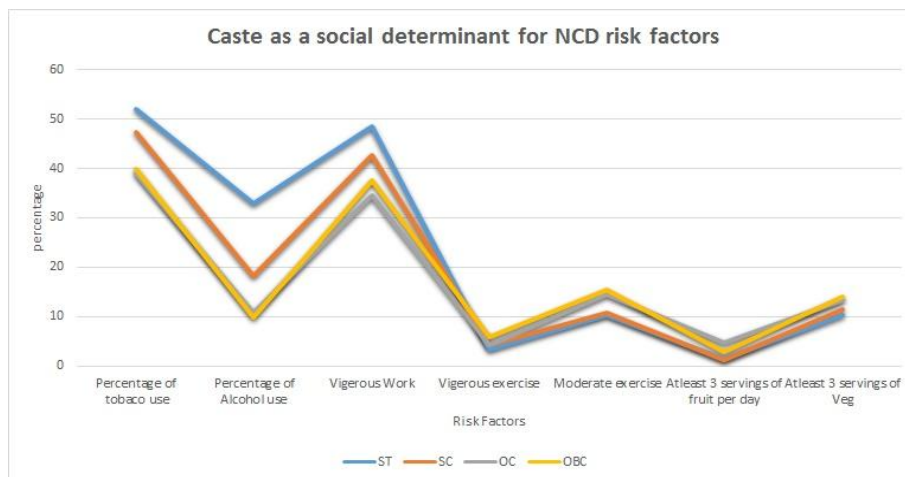


Figure 1: Figure showing the distribution of various risk factors across different Social backgrounds

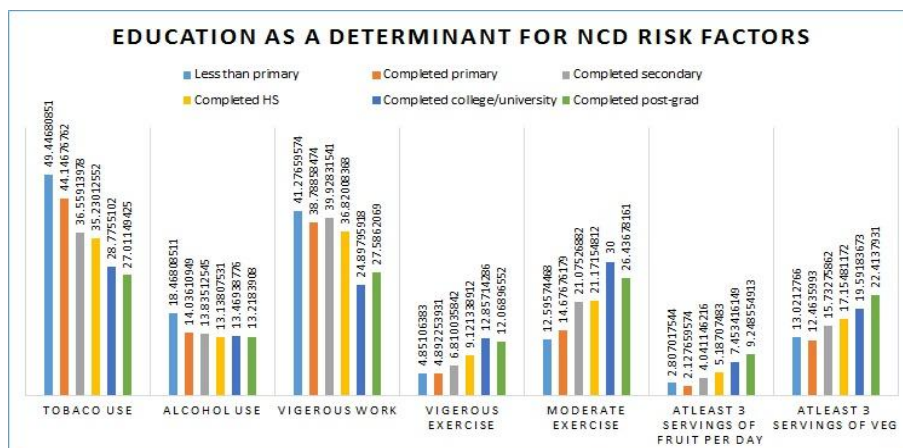


Figure 2: Figure Showing the distribution of various risk factors across various education levels.

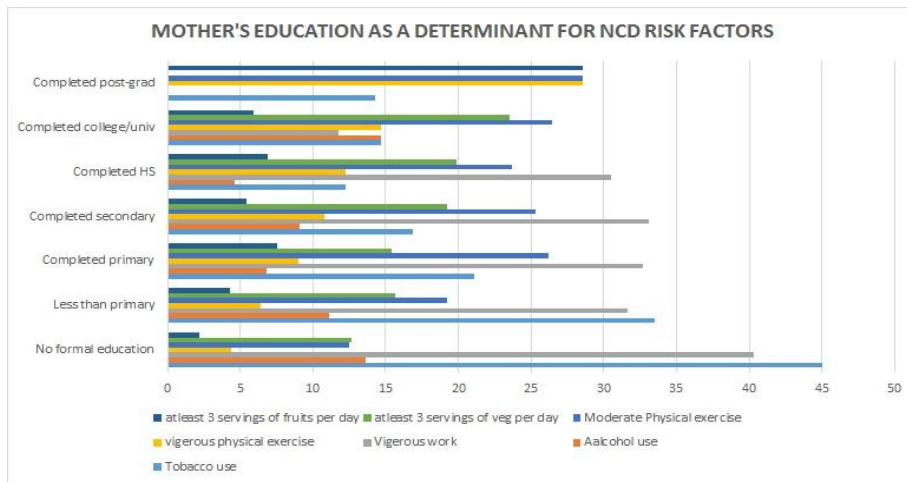


Figure 3: Figure showing the distribution of various risk factors across different levels of education of mother

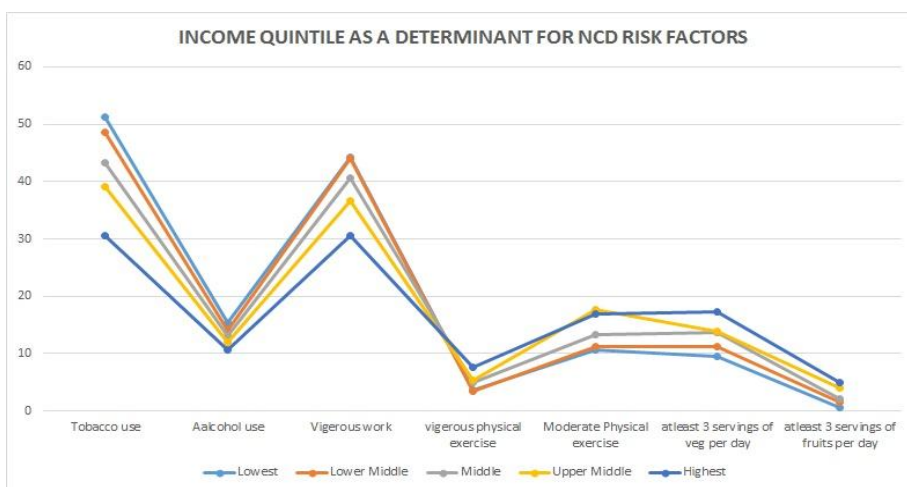


Figure 4: Figure Showing the Distribution of various risk factors with respect to income Quintile

DISCUSSION

Non communicable diseases account for majority of mortality and morbidity around the world and projections reflect that developing world will be the one bear the major burden of NCD mortality and morbidity in the years to come. India too has a significant burden of NCD as reflected by previous research, but there is a scant research on SDH and NCD risk factors which were the major advocated sites for NCD prevention interventions to focus on. Using the WHO SAGE Wave 1 data for India this paper tries to reflect the various social factors as determinants for NCD risk factors of Tobacco use, alcohol consumption, diet and physical activity. In the sample around 25% of respondents who are urban residents and more than 70% of the respondent who are rural residents, which was according to the population

composition during 2001 census. The results of association showed that the place of residence is significantly associated with all the above stated risk factors for NCDs. This association can be further understood by looking at Table 1. It can be seen that for risk factors like usage of tobacco and alcohol were in higher proportion for respondents from rural areas compared to their counter parts, thereby reflecting that the place of residence influences the individual's behavioral risk towards NCDs. Contrary to the other studies in LMICS which showed that smoking and tobacco are high among urban population than that of rural, [18,19] these results show that in India it is the rural population who are more vulnerable towards these risk factors. A similar kind of results were seen in another study in republic of Benin which showed that although NCD's incidence is higher in

urban areas the prevalence of risk factors is higher in rural areas than that of their urban counterparts. [20] Considering the other two variables moderate physical exercise and at least 3 servings of fruits per day (which are considered as proxy for physical activity and Diet) which are considered to be reducing NCD risk, it can be seen that the urban population clearly outnumbers the rural population in terms of physical exercise and fruit intake. With higher prevalence of risk factors like smoking and alcohol, and lowered physical exercise and fruit intake it can be said that the population of rural areas are at increased vulnerability to the four preventable NCD risk factors, clearly reflecting the higher risk of NCD epidemic among rural population which might be already underlying. Social background (caste) also plays an important role in influencing the health status of an individual, [21] this statement is particularly valid in Indian context as majority of times it is detrimental in deciding the individual's access to health services and indirectly influences health by other intermediaries such as poverty, purchasing power, inequity and other social determinants of health. [22] The chi square test suggests a strong association between caste and various NCD risk factors, this association could be well explained by figure 1. The figure gives a clear picture that for the risk factors of tobacco and alcohol consumption were high among respondents from Scheduled tribes and scheduled castes (which were considered most vulnerable castes), with over 52 and 32% and 47% and 18 percent respectively, on contrary for the variables moderate exercise and fruit consumption these two groups shared minimal percentage whereas respondents from OCs and OBCs had better indicators. As we move from the lower caste strata to higher caste strata the tobacco and alcohol consumption reduced whereas consumption of fruits and physical exercise which were considered protective increased, clearly reflecting that those who are at lower caste strata are at higher vulnerability to NCDs risk factors than

those who are at higher strata. These results support that ethnic background in which ever form it is (caste in India) always has its influence on the health status of the individuals whose worst effects are felt within ethnic minorities. [8] Education is one of the most prominent proven social determinants which has its influence on the health status of the individual, [24] and majority of health interventions are devised according to the educational status of its subjects. In terms of NCDs research shows that Education is strongly correlated with that of development of NCDs and the people with lower education has the more chance of developing NCDs. [25] The tests of association showed a strong significant association between Educational status of an individual and Different NCD risk factors, which was further explained by Figure 2. It can be seen that for Risk factors of Alcohol and Tobacco consumption reduced with that of the educational status of the individual showing that the higher the education the lower the chance of alcohol and tobacco consumption by the individual and lower the education higher the chance. This is in agreement with earlier studies in several countries including Brazil, Mexico and Israel that the high prevalence of episodic drinking and heavy drinking of alcohol is prevalent in those with limited education. [23] For factors related to diet and physical exercise as the educational status of the individual increased respondents tend to be more physically active and move towards higher consumption of fruits. These results show that Education has a protective effect in terms of NCD risk factors and those with lower levels of education are at higher chance of developing NCD risk factors. Mother's education is one of the most studied determinants of health in terms of child health and nutritional status, and children whose mothers are with better education are said to have better health and nutritional status. [26,27] However the aspect of Mother's education in terms of NCDs and NCD risk factors is little studied. The results showed that mother's education is

significantly associated with the NCD risk factors which are further explained by figure 3. It shows that the Risk factors of tobacco and alcohol consumption are highest among the respondents whose mothers were with no formal education or less than primary education, they are minimal for the respondents whose mothers completed college education or post-graduation. Physical exercise and consumption of fruits and Vegetables were highest among the respondents whose mothers are educated above the level of higher secondary schooling and are minimal among their counter parts. This clearly indicates that mother's education could also be an important determinant in developing NCD risk factors and might be a focal point for development of interventions. Income is one of the most prominent social determinants of health and is one of the most well researched variables as a determinant for NCDs and their risk factors. The current study shows that there is a strong association between the income quintile which a person belongs to and his/her development of behavioral risk factors towards NCD. Earlier Studies and reports quote that in the poor countries there is a strong positive association between per capita GDP and alcohol consumption, with later one increasing with increasing GDP. [28,29] However, as seen from figure 4, it can be seen that as the individual's income quintile raises from the lowest income quintile to the highest income quintile, the risk factors of alcohol and tobacco were in decrease, clearly showing that those at the lower level of income quintile are at a higher chance of being in to risk factors of alcohol and tobacco. The previously quoted statement looked to be true in terms of variables of exercise and consumption of fruits and vegetables, where it has been seen that as the individual's income quintile increases they tend to be doing more vigorous/moderate physical exercise, and had more servings of fruits and vegetables per day which are protective in terms of NCD risk. It reflects the similar trend

observed with all the other SDH, and shows that Income status has a significant impact on the development of NCD risk factors with those who are at the lowest income quintile being the most vulnerable.

CONCLUSION

The study reinforces the results of earlier studies which showed that social determinants influence NCDs. Particularly the social determinants of Income, education, place of residence, and caste have substantial effect. Those who are at the bottom quintile of education, caste and income are those who are most effected by harmful risk factors and are least in terms of protective risk factors of Physical activity, Balanced diet the opposite trend is seen in their counter parts who are in the higher ends of these determinants. Interestingly it was seen that mother's education do had quite a strong effect in influencing the NCD risk factors and thus can be used as a tool to prevent development of NCD risk factors in further generations. We advocate that the NCD prevention policies should primarily target those who are most vulnerable so that further health inequities might be prevented.

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