Doctor Diagnosed Non-Communicable Diseases: A comparison between younger and older adult in an urban set up of West Bengal (India)

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by

Kaushik Chakraborty

MPH, Cohort 4 (2016-18)

under the guidance of

Dr. Arindam Das

(Associate Professor and Associate Dean of Research)

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Kaushik Chakraborty
MPH, Cohort 4 (Roll No. 18)

CERTIFICATE BY SCHOLAR

This is to certify that the Capstone Project titled "Doctor Diagnosed Non-Communicable Diseases: A comparison between younger and older adult in an urban set up of West Bengal (India)" under the supervision of Dr. Arindam Das for award of Master of Public Health embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other institute or other similar institution of higher learning.

Kaushik Chakraborty

Kaushik Chakraborty
(MPH, 2016-18)
Roll no. IIHMR-U/07/2016-2018/0018

Contents

Abstract:

Non-communicable diseases (NCDs) are the leading causes for morbidity as well as mortality. Seventy five percent death occur in low-middle-income countries such as India due to NCDs. However, there are limited data available on longitudinal study and associated in risk factors for NCDs in India. The current study enrolled 3654 participants aged 18 years and above from Barrackpore Health Study, a longitudinal study conducted general health including and NCDs demographic questionnaire survey 2001 and 2011 of Barrackpore, West Bengal, India. The objective of the study embarked to estimate prevalence of NCDs, determine the association of socio-behavioral risk factors with NCDs and compare NCDs between baseline and mid-line survey among younger and older population in urban set up of West Bengal (India).

Among the participants, older adult age group was five times likely to be higher in diabetic group in adjusted model [AOR= 5.66, CI: 3.76,8.52] baseline survey and four times likely to be higher in diabetic group in adjusted model [AOR= 4.42, CI: 3.24,6.04] in midline survey compared to the young adult population. Always snorers with hypertensives were twice likely to be higher than never snores with non-hypertensive group. Prevalence of stroke was reported 1.97 percent, osteo arthritis 4.27 percent, gout 7.06 percent in the midline survey.

In the cohort, several NCD risk factors have increased from baseline to mid-line survey. Both surveys results were revealed the factors like smoking, alcohol consumptions, dietary patterns, physical exercise and sleep patterns are modifiable so with reversibility of the factors and with proper intervention of the NCDs are related complications can be reduced.

Introduction:

Non-communicable diseases (NCDs) are the leading causes of mortality and morbidity across the globe. Near about 45 percent of the adults in low-middle-income countries were suffering to non-communicable diseases. About 90 percent of premature deaths arise in developing countries and nearly 80 percent deaths arise in low-middle-income countries due to NCDs (1). The burden of NCDs is increase in increasing rate and it is a barrier to achievement of Sustainable Development Goals (SDGs) (2). Higher prevalence of NCDs in developing nations were reported and India is one of them. In 2015, 70 percent (39.5 of 56.4 million) deaths worldwide occurred due to NCDs. Cardiovascular diseases (CVDs) are one of the leading cause of deaths due to NCDs, In 2015, 17.7 million deaths, or 45 percent of NCD deaths were reported; 8.8 million, or 22 percent of NCD deaths were occurred due to cancer; 3.9 million deaths occurred due to chronic obstructive pulmonary disease (COPD) and other respiratory disorder. In middle-income countries, more than 80 percent deaths were reported dur to cardiovascular and diabetes, and near to 40 90 percent of deaths from COPD and other respiratory disorder (3).

India is the second most populated country and seventh largest country (as per area) in the world. In India, due to NCDs, 5.87 million deaths that account for 60 percent of all types of deaths. South-East Asia Region (SEAR) of WHO reported that India took place more than two-third of the total deaths due to NCDs (4).

NCDs like cancer, cardiovascular diseases, chronic respiratory diseases, and diabetes make the major part for morbidity and mortality (5). Deaths due to cardiovascular diseases (coronary heart disease, stroke, and hypertension) took first position due to all NCD deaths (45 percent), whereas death due to chronic respiratory disease took second (22 percent) and cancer took third position (cancers 12 percent). Diabetes alone took immediate next to cancer (3 percent) (1).

Throughout the world diabetes encountered a major public health challenge due to its increasing prevalence(6)(7). 366 million people suffered due to diabetes in 2014 and the prevalence was 8.5 percent; It is estimated by 2030 the number will have risen to 552 million. In the low-middle-income countries (LMICs) 80 percent of people will suffer by diabetes. Higher prevalence of diabetes was found among age group between 40 to 59 years. A study by the International Diabetes Federation (IDF) estimated that in 2012, 4.8 million persons died due to diabetes. Prevalence of undiagnosed diabetes was 50 percent in 2012also it has been noticed that the type-2 diabetes among general population is increasing rapidly across the globe (7). WHO reported that the mortality rate of diabetes will be the seventh position in 2030 (8).

India is facing a rapid burden of diabetes (9), In 2015, 69.1 million people with diabetes were reported and it took second position in the world after China (10). IDF estimated that by 2040 the number of diabetic people expected to rise to 642 million by 2040 (11). World diabetes atlas reported that near to one-fifth of all adults in the world in the South-East Asia Region live with diabetes. Current estimates indicate that 8.8 percent of the adult population, or 78.1 million people, have diabetes, 69.2 million of whom live in India (12). Diabetes prevalence in India ranges from 5-17 percent, urban areas of the southern part of India reported higher prevalence (11) .

Hypertension play a key role to the worldwide epidemic of cardiovascular and cerebrovascular diseases (CVD). It is the major contributing factor, answerable for 54 percent of all kind of strokes and 47 percent of all types of coronary heart diseases globally (13). WHO reported 17.5 million people died from CVD which represents 31 percent of global deaths in 2012. It is estimated that by 2030, 23.3 million people will die globally from CVD each year. As per WHO Global Health Observatory (GHO) data, raised blood pressure is estimated to cause 7.5 million deaths, about 12.8 percent of the total of all deaths in global perspective. Due to morbidity of the raised blood pressure

57 million disability-adjusted life years (DALYS) or 3.7 percent of total DALYS accounted. It is estimated that by 2025, 29·2 percent of the adult population are projected to have hypertension (14). Compare to developing countries, epidemiological shift in the prevalence of hypertension is more in the developed countries (15). An Indo-Bangladesh study has reported that the upward trend in the prevalence of hypertension. The prevalence of hypertension ranges from 20-40 percent in urban and 12-17 percent in rural in India among the adult population. Compare to 2000 hypertensive population, the projected population with hypertension is increase from 118 million to 214 million in 2025, without gender difference. Epidemiological review study in India, suggests that the prevalence of hypertension has increased in both urban and rural subjects. Also the study reported that the current prevalence is 25 percent in urban adults and 10-15 percent among rural adults (16) (17). In the low-middle income countries, more than 80 percent death were reported due to hypertension (8) and by ranked India and China took highest place.

Cardiovascular diseases (CVDs) are the leading cause of death globally. More people die annually from CVDs than from any other disease. In 2015, 17.7 million people died globally due to CVDs, which representing 31 percent of total deaths. Among them, estimated numbers were 7.4 million for coronary heart disease and 6.7 million for stroke. In low-middle-income countries, percent of CVD deaths were reported. Out of the 17 million premature deaths reported under the age 70 years due to noncommunicable diseases in 2015, in low and middle income countries 82 percent was reported (18). Ischemic heart disease (IHD) one of the commonest cause of CVD mortality (1). It is estimated that the rising burden of NCD deaths are increased by 15 percent throughout the world between 2010 and 2020 and annual NCD deaths also rise significantly to 52 million by 2030 (1).

CVDs are the major cause of mortality in India. WHO reported 17.7 million people died from cardiovascular disease (CVD) in 2015 which comprising 31 percent of all global deaths. Among the reported data by WHO, nearly 82 percent of deaths took place in low-middle-income countries

including India (19). World Heart Federation reported that 35 percent of all CVD deaths in India occur among the age group 35-64 years (20). Ischemic heart disease (IHD) is the leading cause of mortality in economically developed countries and is rapidly transforming to the developing countries. By the year 2015 it is expected that IHD would be the single most significant cause of death in India (19).

Worldwide, stroke is the commonest cause of mortality after coronary artery disease. Also, it is the commonest cause of chronic disability among adult population throughout the world. The lifetime risk of stroke is increased after 55 years of age and it is estimated that one out of five for female and one out of six for male (21). In the developing countries, more than 80 percent of all strokes event reported (22). Stoke is the second leading cause of death in the world, comprising approximately 5.5 million people encountered and 10 percent of all deaths reported each year. 44 million disability-adjusted life-years (DALYs) lost by the stroke diseases (23)(24). There were 16.9 million strokes worldwide reported in 2010, of which 70 percent in low-middle-income countries, also it is expected that the same trend is to increase over the next two decades (23)(25). The low-middle-income countries accounted for more than 85 percent of the global stroke mortality (25).

Stroke play an important role for the early death and disability in low-middle-income countries. In India, a population-based surveillance have reported that age-adjusted annual incidence of stroke varies from 119-145 per lakh population (20). The increase in CHD is common scenario in the largely an urban population in India. It is estimated that the adjusted prevalence rate of stroke range, 84-262 per lakh in rural and 334-424 per lakh in urban population in India. A resent population based study in India reported that the incidence rate varies 119-145 per lakh (26).

Epilepsy is one of the most common neurological diseases causing significant medical and social morbidity. It has a heavy burden in the society also it is the second most leading disrupted caused in the healthcare system globally. Currently, 50 million people living with epilepsy worldwide, and most

of the affected population reside in developing countries (27). The global burden of stroke is accounted for one percent, among them 80 percent of are reside in the developing world People with epilepsy varies 80-90 percent without treatment and regime (28). A study estimated that the median prevalence of epilepsy in urban population 1.54 percent and rural population in the developing countries (27).

Conventional estimation showed that one percent prevalence of epilepsy in India and number are more than 12 million persons, which contributes more than 16 percent of the global burden. A hospital based study in India reported that the case fatality rate of 29 percent among 117 hospitalized patients with single epileptic seizure (SE), while another study reported 29.7 percent mortality rate among SE patients with central nervous system infection (27).

Musculoskeletal (MSK) disorders are the second most common cause of disability worldwide. Years lived with disability (YLDs), with low back pain being the most frequent condition for MSK. MSK disorders is estimated to have increased by 45 percent from 1990 to 2010, among them numbers of osteoarthritis (OA) play significant role, and it is expected the trend is continuing rise with obesity, sedentary lifestyle, and aging population (29). Osteoarthritis, rheumatoid arthritis, gout, ankylosing spondylitis are common disorder of MSK. Symptomatic osteoarthritis among 9.6 percent of men and 18 percent of women aged ≥60 years has been reported by global burden study. Prevalence and burden of MSK conditions were exceptionally high throughout the world (30).

MSK is an important public health problem in developing countries, It has a negative impact on the quality of life as well as a economic burden in termed as compensation costs, lost wages, and productivity (31) in the society. Urban Region of Pune conducted a study on rheumatic musculoskeletal disorders and found 14.1 percent prevalence in India (32). Another study reported that the incidence of knee joint in pain is high among the urban and rural elderly population in

northern India. Females were reported more low back pain particularly rural population. The prevalence is 19.17 percent in urban and 18.97 percent in rural population India (33).

Review of Literature:

A comprehensive literature review for English language was done for the current study with a combination of electronic and manual methods. PubMed, Scopus, Medline, Cochrane and Google Scholar databases were searched for the literature review. The keywords and "Medical Subject Headings (MeSH)" used for electronic search were "NCDs" combined with each of the following: "epidemiology", "prevalence", "incidence", "mortality", "morbidity", "risk factors", "trend", "diagnosed", and "Burden".

Scopus, Google Scholars, PubMed and Cochrane are being used for the reviewing for the references. The aforesaid keywords were collectively used with other search keys "India", "South Asia", "developing countries", "low-middle-income countries", "Asia" using specific "Boolean operator" "AND" for retrieving studies related to India. Manual search was done from the Johns Hopkins Medical Institution (JHMI,), Welch Medical Library (USA) and Indian Institute of Health Management Research (IIHMR) library. Form the selected articles, reference lists were "Snowballed", and from that, the most appropriate articles. Relevant abstracts, and book chapters related with the study were reviewed further.

In this literature review, studies related to epidemiology on NCDs (time considered: January 2005 to August 2017) from India have been included. Population-based NCD studies, paper published in peer-reviewed journals, standard working definitions, and methodology with adequate information on NCDs, along with diagnostic information (if available) were included for the review of literature. Study related relevant international guidelines and set protocol were also included.

Rationale:

The major determining factors of health and sickness are environment and genetics. To know the normal physical health of a community, it needs to compile and record the parameters of healthy individuals of the community, similarly for knowledge of sickness need information of prevalence, burden, risks, and causatives. Genetics cannot be altered; an environment can be modified to have a positive outcome from the knowledge of normal parameters of health and essential aspects of sickness (disease burden).

Several serial cross-sectional studies have shown the prevalence of NCDs and significant association with risk factors in India (34) (35). But those serial cross-sectional surveys have some limitations like: (a) most of the studies were conducted in the different regions of the country or within a state, it would be more relevant to find out the association within the similar population with considering time; (b) sampling framing varies according to the nature of study conducted in different population; (c) Most of the surveys were focused on disease (For example, diabetes, hypertension), associated risk factors and historical data were missed out to find out temporality. Identifying risk factors is more economic and easy to collect relevant data than diagnostic procedure for diseases. (d) Best of the literature review few longitudinal studies were conducted in urban areas.

Compare to other epidemiological studies, longitudinal studies provide valid and reliable estimates of associated NCDS risk factor in changes in a population. Gathering information of health and sickness require longitudinal (in time) study and to establish a cohort. Limited reliable useful information so far been recorded of any eastern Indian population especially in the West Bengal. NCD risk factor in the Indian state of West Bengal is remarkable than elsewhere in the country (36). In this context, the current study is very useful, relevant and significant.

Objectives of the study:

1. To estimate prevalence of NCDs among younger and older population in urban set up of West Bengal (India).
2. To find out incidence of NCDs over 10 years (for individual diseases) in the study population.
3. To determine the association of socio-behavioral risk factors with NCDs (for individual diseases) population in urban set up of West Bengal (India).
4. To compare non-communicable diseases (NCDs) and associated factors between two surveys (Baseline Phase-I Survey-2001-02 and Phase-II Survey 2011-12) in the study population.

Material and Methods:

Study population

"Barrackpore Population Health Study", an open population cohort established by "Barrackpore Population Health Research Foundation", in the "Barrackpore Municipal" arear of North 24-Parganas district, West Bengal in 2001. The said municipal area divided into 24 administrative divisions which are termed as "wards". Total 144391 persons residing in 31715 households as per the 2001census in the mentioned area. Six wards (No. 3, 6, 11, 15, 18 and 22) among the 24 wards were chosen randomly for established the cohort. Before baseline survey, a comprehensive household list was prepared for the selected wards through household mapping. Hence from the ward mapping list, 3030 households from six selected wards with 12734 residents were recruited for the longitudinal cohort. Recruited participants are being continuously followed. Participants have been assessed regularly with physical examinations, medical histories, and, at some examinations by pulmonary function test (Lung function test), obstructive sleep apnoea (OSA) study. The last survey (Phase-II), conducted in the year 2011, which consisted 9057 adults aged 18 years or above and 3677 aged less 18 years. Participants were removed from the cohort by 'migration-out' and 'death'. For inclusion criteria follows by "birth" or "migration-in" during the periodical survey.

Working definition:

1. **Diabetes:**

   "Diabetes is a chronic condition that occurs when blood glucose levels remain above normal limits. This happens if the pancreas does not produce enough insulin (a hormone that regulates blood sugar) or when the body cannot effectively use the insulin it produces. An individual who reports having ever being diagnosed with diabetes, that is, defined as elevated fasting plasma glucose ≥ 7 mmol/l (126 mg/dl) or 2-h plasma glucose ≥ 11.1 mmol/l (200 mg/dl) during oral glucose tolerance test (OGTT) after 75 mg oral glucose load" (36). Fasting is defined as no caloric intake at least 8

hours prior to measurement. The current study considered diabetes as confirmed diagnosed cases by a registered medical practitioner.

2. Hypertension:

An individual who reports having ever being diagnosed with hypertension, that is, who's BP>140/90 mm of Hg or who is on antihypertensive medication (36). The present study considered hypertension as confirmed diagnosed cases by a registered medical practitioner.

3. Cardiovascular diseases (CVDs):

Following CVDs are considered for the current study. Self-reported data had been collected during questionnaire survey after verification and confirmation of prescriptions and diagnosed report by medical practitioner.

a. Angina

"Angina, a symptom of coronary artery disease, is chest pain or discomfort that occurs when the heart muscle is not getting enough blood. Angina may feel like pressure or a squeezing pain in the chest. The pain also may occur in the shoulders, arms, neck, jaw, or back. It may feel like indigestion" (37). The present study considered angina as confirmed diagnosed cases by a registered medical practitioner.

b. Heart failure:

"Although Heart failure may be caused by a variety of disorders, the following comprehensive guideline and this working definition focus on heart failure primarily from the loss or dysfunction of myocardial muscle or interstitium" (38). Data captured through self-reported information validated with the registered medical practitioner prescriptions.

c. Heart attack

"Heart attack, also called a myocardial infarction, occurs when a part of the heart muscle doesn't receive enough blood flow. The more time that passes without treatment to restore blood flow,

the greater the damage to the heart muscle" (39). Data captured through self-reported information validated with the registered medical practitioner prescriptions.

d. Rheumatic heart disease

"Rheumatic heart disease (RHD) is damage to one or more heart valves that remains after an episode of acute rheumatic fever (ARF). Clinical examination was performed by cardiologists with experience in the diagnosis of rheumatic heart disease and reported by the participants in the current study" (40). Data captured through self-reported information validated with the registered medical practitioner prescriptions.

4. Stroke

A stroke is caused by the interruption of the blood supply to the brain, usually because a blood vessel bursts or is blocked by a clot. This cuts off the supply of oxygen and nutrients, causing damage to the brain tissue. The most common symptom of a stroke is sudden weakness or numbness of the face, arm or leg, most often on one side of the body. Other symptoms include: confusion, difficulty speaking or understanding speech; difficulty seeing with one or both eyes; difficulty walking, dizziness, loss of balance or coordination; severe headache with no known cause; fainting or unconsciousness" (40). The data is captured through the question asked that 'Have you ever been doctor diagnosed as having a stroke?'

5. Epilepsy

"Epilepsy is a disease characterized by an enduring predisposition to generate epileptic seizures and by the neurobiological, cognitive, psychological, and social consequences of this conditions" (40). In this paper doctor diagnosed epilepsy is considered as if a doctor ever told to participants that he/she suffer from epilepsy or epileptic attacks.

6. Musculoskeletal Disorder

"Musculoskeletal disorders (MSD) are injuries or disorders of the muscles, nerves, tendons, joints, cartilage, and spinal discs" (41). Also, the term denotes health problems of the locomotor apparatus. The current study includes the following diseases as MSD and all the data about the MSD were captured through self-reported data confirmed by the participants and validated by the enumerators verification of prescriptions and diagnosed procedure prescribed by the medical practitioner. Data captured through self-reported information validated with the registered medical practitioner prescriptions.

a. Osteo Arthritis

Osteoarthritis is a degenerative joint disease, which mainly affects the articular cartilage. It is associated with ageing and will most likely affect the joints that have been continually stressed throughout the years including the knees, hips, fingers, and lower spine region (41). "Osteoarthritis (OA), which is also known as degenerative joint disease (DJD)" (40). Data captured through self-reported information validated with the registered medical practitioner prescriptions.

b. Rheumatoid Arthritis

"Rheumatoid Arthritis is a chronic systemic disease that affects the joints, connective tissues, muscle, tendons, and fibrous tissue. It tends to strike during the most productive years of adulthood, between the ages of 20 and 40, and is a chronic disabling condition often causing pain and deformity" (41). Data captured through self-reported information validated with the registered medical practitioner prescriptions.

C. Gout

"Gout is a form of acute arthritis that causes severe pain and swelling in the joints. It most commonly affects the big toe, but may also affect the heel, ankle, hand, wrist, or elbow. It affects

the spine often enough to be a factor in back pain" (42). Data captured through self-reported information validated with the registered medical practitioner prescriptions.

D. Ankylosing Spondylitis

"Ankylosing spondylitis (AS) is a chronic inflammatory disease that primarily affects the sacroiliac joints (SI joints) and spine" (42). Data captured through self-reported information validated with the registered medical practitioner prescriptions.

7. Population:

Population is categorized into the two groups – younger and older adult**.** Age (18yrs.≥Age ≤44yrs) is termed as younger adult group and age≥45 yrs. is termed as older adult group (43).

8. Risk factors:

In the present paper, current smoker was defined as "tobacco smoking such as cigarettes, hand rolled cigarettes, bidis, cigars in the last 30 days" (44). Currently tobacco chewing other forms (smokeless tobacco use) was defined such as "Gutka (a mixture of tobacco, areca nut, peppermint, and additive flavour)", "khaini (mixture of dry tobacco leaf and lime)", "Nassi' (powder forms of tobacco leaf for snuffing)" in the last 30 days (44). Alcohol consumption was defined as "users were those who drank at least one standard drink of alcohol (285 ml of beer or 120 ml of wine, and 30 ml of spirits) in the last 12 months" (44). Physical inactivity was defined as "no self-reported moderate or vigorous physical activity at work place and/or home".

Study designing:

The current study enrolled 3654 participants aged 18 years and above from the Longitudinal Population Health Survey (LPHS) Phase-II in 2011-12. Those eligible participants are consisting in the both survey Baseline Phase-I Survey-2001-02 and Phase-II Survey 2011-12.

a. Inclusion criteria:

1. Only consenting adult (Age ≥ 18 years) who are participated in the both survey (Baseline Phase-I Survey-2001-02 and Phase-II Survey 2011-12)

b. Exclusion criteria

1. New member in the household, member expired in between Phase-I and Phase-II Survey, refused and migrated out population were excluded in this study.
2. Partially completed data were excluded.

Tools and techniques of data collection:

A set of administered structured questionnaire was used for data collection activities. All the questionnaires were pretested and validated and translated in local language. Based on this questionnaire information was collated by the enumerators by visiting every selected individual and taking face to face interview on socio-demographics: age, hours usually spent on manual activities per day, hours spent on other physical activities, hours spent for sleep per day, gender, marital status, education, occupation, dietary habits. Lifestyle and behaviours: current and passive smoking, alcohol, history of snoring, perceptions of own health, any past or present illness (NCDs) confirmed by medical practitioner.

Data management:

Collected survey data was entered into the computer on daily basis on two separate computers by trained data entry operators. For ensuring data safety and confidentiality, both computers were password protected and all questionnaires were kept under lock and key.

Data were cleaned after completion of data entry. An exhaustive codebook was prepared from the questionnaire and was updated with newly formed recoded variables with its value label. Following factors were considered for the entire data management activities.

- Baseline survey (Baseline Phase-I Survey-2001-02):
  - Data entry:

    - Collected paper based information entered into the data entry application by trained operators using a unique identification number for each individual
    - Robust data entry platform
    - Multiple logic checks
    - Double entry
    - Coded forms
    - Error alarms
  - Continuous progressive automated additional coding system
- Follow up (Phase-II Survey 2011-12):
  - Data Entry:
    - Same unique identification number were entered the collected post-intervention information based on the same questionnaire used at the baseline
    - Appropriate synchronization based on the unique identification number between the baseline and mid line information.

Data analysis procedure:

a. Descriptive analysis

Descriptive analyses were conducted to determine the frequency distribution [means (for continuous variables) with standard deviation (SD) and proportions (for categorical variable) with 95 percent Confidence Intervals (95 percent CIs)]

b. Inferential analysis

For the inferential analyses, bivariate (unadjusted model) and multiple logistic regression analyses (adjusted model) were performed to find out the strengths associations [Odds Ratios (OR) and corresponding 95% CIs] (45). After comparing with the unadjusted model, outcomes from adjusted

model was considered for the interpretation. All statistical analysis was performed by using SPSS 20 and SAS 9.2 (46).

Ethical consideration:

Written informed consent were collected during survey data collection from each eligible participant before interview, after explaining all associated positive and negative aspects regarding the study in a language that they understand clearly.

Confidentiality of the provided information also explained properly in a similar manner ensuring that they clearly understand that there were no negative consequences due to their participation or non-participation regarding their enrolment in the cohort.

Participation in this longitudinal study was entirely voluntary and volunteers can withdraw themselves from the study at any time without any consequences.

Privacy of the participants and confidentiality of the provided information was ensured. All the filled in questionnaires and records were securely preserved under ensuring safety and confidentiality.

Results and Discussion:

Table 1: Descriptive analyses of the continuous variables under study participants

Continuous Variables	LPHS-I			LPHS-II		
	Frequency	Mean (95%CI)	SD	Frequency	Mean (95%CI)	SD
Age	3654	39.66 (39.22-40.10)	13.55	3654	49.66 (49.22-50.10)	13.55
Age Gr.18-44 yrs.	2318	31.13 (30.84-31.42)	7.19	1400	36.24 (36.01-36.48)	4.47
Age Gr.≥45 yrs.	1336	54.45 (54.01-54.89)	8.21	2254	57.99 (57.57-58.41)	10.21
Sedentary activities (hrs.)	1300	2.19 (2.09-2.30)	3.24	3265	3.78 (3.70-3.86)	2.53
Manual activities (hrs.)	2089	3.69 (3.58-2.81)	3.59	3582	4.44 (4.37-4.51)	2.13

A descriptive analysis of the continuous variables under the study is shown in **Table 1**. Of total 3654 study participants both surveys, mean age was 39.66 years for LPHS-I and 49.66 years for LPHS-II. In the age category, age group 18-44 yrs., mean age was 31.13 years and 54.45 years for the group age more than equal to 45 years in the baseline survey LPHS-I; in LPHS-II, mean age was 36.24 years for age group 18-44 years and 57.99 years for age group 45 years or more. On average, each participant spent 2.19 hours for sedentary activities in LPHS-I and 3.78 hours for LPHS-II. On average, each participant spent 3.69 hours for manual activities in LPHS-I and 4.44 hours spent for the same activity in LPHS-II.

Table 2. Distribution of the categorical socio-behavioral characteristics of participants					
		LPHS-I		LPHS-II	
Categorical Variables	**Categories**	**N**	**% (95%CI)**	**N**	**% (95%CI)**
Gender	Male	1804	49.37 (47.75-50.99)	1804	49.37 (47.75-50.99)
	Female	1850	50.63 (49.01-52.25)	1850	50.63 (49.01-52.25)
Marital status	Single	704	19.27 (17.99-20.55)	378	10.34 (9.36-11.33)
	Married	2715	74.30 (72.88-75-82)	2762	75.59 (74.19-76.98)
	Widow/ Widower	226	6.18 (5.40-6.97)	493	13.49 (12.38-14.60)
	Separated / Divorced	9	0.25 (0.089-0.41)	21	0.58 (0.33-0.82)
Education	Can't read or write	465	12.73 (11.64-13.80)	349	9.55 (8.60-10.50)
	Non-formal education	293	8.02 (7.1--8.90)	203	5.56 (4.81-6.30)
	Primary incomplete	549	15.02 (13.87-16.18)	203	5.56 (4.81-6.30)
	Primary complete	677	18.53 (17.27-19.89)	628	17.19 (15.96-18.41)
	Middle school complete	485	13.27 (12.17-14.37)	671	18.36 (17.11-19.62)
	High school complete	141	3.86 (3.23-4.48)	547	14.97 (13.81-16.13)
	Higher secondary or above	1044	28.57 (27.11-30.04)	1053	28.82 (27.35-30.29)
Occupation	Unemployed/ Retired	704	19.27 (17.99-20.55)	523	14.31 (13.18-15.45)
	Labourer	497	13.60 (12.49-14.71)	471	12.89 (11.80-13.98)
	Business	420	11.49 (10.46-12.53)	425	11.63 (10.59-12.67)
	Service	331	9.06 (8.13-9.99)	505	13.82 (12.70-14.94)
	Professional	227	6.21 (5.43-6.99)	235	6.43 (5.64-7.23)
	Homemaker	1475	40.37 (38.78-41.96)	1495	40.91 (39.32-42.51)
Activity in work place	No activity	641	15.54 (16.31-18.78)	61	1.67 (1.25-2.09)
	Sedentary only	924	25.28 (23.88-26.70)	11	0.30 (0.12-0.48)
	Manual only	1713	46.88 (45.26-48.50)	328	8.97 (8.05-9.90)
	Both	376	10.29 (9.30-11.26)	3254	89.05 (88.04-90.07)
Exposure to Dust and Fumes	Yes	1367	37.41 (35.84-38.98)	2576	70.50 (69.02-71.98)
	No	2287	62.59 (61.02-64.16)	1078	29.50 (28.02-30.98)
Diet	Vegetarian	122	3.34 (2.76-3.92)	182	4.98 (4.28-5.69)
	Non-vegetarian	3532	96.66 (96.07-97.24)	3472	95.02 (94.31-95.72)
Salt intake	Rarely or never	1313	35.93 (34.38-37.49)	1950	53.37 (51.75-54
	Sometimes	873	23.89 (22.51-25.27)	585	16.01 (14.82-17.20)
	Almost always or always	1468	40.18 (38.58-41.77)	1119	30.62 (29.13-32.20)

A descriptive analysis of the categorical variables of socio-behavioral characteristics under the study is shown in **Table 2**. In LPHS-I, of 3654 participants, 50.63 percent were females, 74.30 percent were

currently married, 19.27 percent were unmarried, 6.18 percent were widow or widower, 12.73 percent can't read or write, 8.02 percent non-formal education, 18.53 percent primary incomplete, 19.27 percent were unemployed and retired, 40.37 percent were engaged in home making, 11.49 percent were business persons, 9.06 percent were engaged in service, 25,28 percent were labourer, 8.21 percent reported sedentary type activity, 37.41 percent were exposed to dust and fumes in their work areas, 96.66 percent were non-vegetarian. 40.18 percent had intake salt almost always/ always every day, 23.89 percent took salt sometimes, 35.93 percent took salt rarely or never during meal.

In LPHS-II, among same participants, 50.63 percent were females, 75.59 percent were currently married, 10.34 percent were unmarried, 13.49 percent were widow or widower, 9.55 percent can't read or write, 5.56 percent non-formal education, 5.56 percent primary incomplete, 14.31 percent were unemployed and retired, 40.91 percent were engaged in home making, 11.63 percent were business persons, 13.82 percent were engaged in service, 12.89 percent were labourer, 89.05 percent reported both types of activities in work place, 70.50 percent were exposed to dust and fumes in their work areas, 95.02 percent were non-vegetarian. 30.62 percent had intake salt almost always/ always every day, 16.01 percent took salt sometimes, 53.37 percent took salt rarely or never during meal.

Table 3. Distribution of behavioral and lifestyle pattern of participants					
		LPHS-I		LPHS-II	
Categorical Variables	**Categories**	**N**	**% (95%CI)**	**N**	**% (95%CI)**
Alcohol (Ever drinker)	Yes	157	4.30 (3.64-4.95)	681	18.64 (17.37-19.90)
	No	3497	95.70 (95.05-96.36)	2973	81.36 (80.10-82.63)
Alcohol (Current drinker)	Yes	131	3.59 (2.98-4.19)	511	13.98 (12.86-15-11)
	No	3523	96.41 (95.81-97.02)	3143	86.05 (84.89-87.14)
Type of drinker	Every day	29	0.79 (0.51-1.08)	76	2.08 (1.62-2.54)
	Sometimes	32	0.88 (0.57-1.18)	243	6.65 (5.84-7.46)
	Occasionally	70	1.92 (1.47-2.36)	191	5.23 (4.51-5.95)
Smoking (Ever smoker)	Yes	713	19.51 (18.23-20.80)	975	26.68 (25.25-28.12)
	No	2941	80.49 (79.20-81.77)	2679	73.32 (7188-74.75)
Current Smoker	Yes	666	18.23 (16.97-19.48)	731	20.01 (18.71-21.30)
	No	2988	81.77 (80.52-83.03)	2923	79.99 (78.70-81.29)
Smoking category	Never Smoker	2941	80.49 (79.20-81.77)	2679	73.32 (71.88-74.75)
	Former Smoker	47	1.29 (0.92-1.65)	244	6.68 (5.87-7.49)
	Current Smoker	666	18.27 (16.97-19.48)	731	20.01 (18.71-21.30)
Passive smoking	Yes	1905	52.13 (50.51-53.76)	574	15.71 (14.53-16.89)
	No	1749	47.87 (46.24-49.49)	3080	84.29 (83.11-85.47)
Tobacco (Chewing/snuff)	Yes	509	13.93 (12.81-15.05)	806	22.06 (20.71-23.40)
	No	3145	86.07 (84.95-87.19)	2848	77.94 (76.60-79.29)

A descriptive analysis of the categorical variables of lifestyle pattern among the study participants is shown in **Table 3**. Of 3654 participants in LPHS-I, 80.49 percent were never smoker, 18.27 percent were present smoker and 1.29 percent were former smoker. 96.41 percent were non-alcoholic, 3.59 percent were currently alcoholic and 0.71 percent were previously alcoholic. 0.79 percent were every day drinker, 0.88percent frequently drinker and 1.92 percent were occasionally drinker. Passive smoking was reported 47.87 percent and chewing/ snuffing tobacco was reported 13.93 percent.

in LPHS-II, 73.32 percent were never smoker, 20.01 percent were present smoker and 6.68 percent were former smoker. 86.05 percent were non-alcoholic, 13.98 percent were currently alcoholic and 4.65 percent were previously alcoholic. 2.08 percent were every day drinker, 6.65 percent frequently

drinker and 5.23 percent were occasionally drinker. Passive smoking was reported 15.71 percent and chewing/ snuffing tobacco was reported 22.06 percent.

Table 4. Distribution of physical characteristics of participants

		LPHS-I		LPHS-II	
Categorical Variables	**Categories**	**N**	**% (95%CI)**	**N**	**% (95%CI)**
Physical Activity	No activity	641	17.54 (16.31-18.78)	61	1.67 (1.25-2.09)
	Sedentary	924	25.29 (23.88-26.70)	11	0.30 (0.12-0.48)
	Manual	1713	46.90 (45.26-48.50)	328	8.98 (8.05-9.90)
	Both	376	10.29 (9.30-11.28)	3254	89.05 (88.04-90.07)
Physical Exercise	Yes	251	6.87 (6.05-7.69)	548	15.00 (13.84-16.16)
	No	3403	93.13 (92.31-93.95)	3106	85.00 (83.84-86.16)
Physical Exercise (Hr./day)	Less than half an hour	134	3.67 (3.06-4.28)	323	8.84 (7.92-9.76)
	Half an hour but less than one hour	72	1.97 (1.52-2.42)	157	4.30 (3.64-4.95)
	One hour and more	45	1.23 (0.87-1.59)	68	1.86 (1.42-2.30)
Sleep in a day	Less than 8 hrs.	2222	60.81 (59.23-62.39)	2865	78.41 (77.07-79.74)
	8 hrs. or more	1432	39.19 (37.61-40.77)	789	21.59 (20.26-22.93)
Snoring	Never	2510	68.69 (67.18-70.20)	2163	59.20 (57.60-60.79)
	Sometimes	695	19.02 (17.75-20.29)	665	18.20 (16.95-19.45)
	Always	449	12.29 (11.22-13.35)	826	22.61 (21.25-23.96)
Own health perception	Poor	83	2.27 (1.79)	105	2.87 (2.33-3.42)
	Fair	937	26.54 (25.64-24.23)	1265	34.62 (33.08-36.16)
	Good	2628	71.92 (70.46-73.38)	2282	62.45 (60.88-64.02)
	Don't know	6	0.16 (0.03-0.30)	2	0.05 (0.00-0.13)
Weight (last 3 months)	Increased	333	9.11 (8.18-10.05)	838	22.93 (21.57-24.30)
	Decreased	208	5.69 (4.94-6.44)	564	15.44 (14.26-16.61)
	No change	1418	38.81 (37.23-40.39)	2062	56.43 (54.82-58.04)
	Don't know	1695	46.39 (44.77-48.01)	190	5.20 (4.48-5.92)

A descriptive analysis of the categorical variables of physical characteristics under the study is shown in **Table 4**. Of the 3654 study participants of LPHS-I, 46.90 percent reported manual activities, 25.29 percent reported sedentary physical activity and 10.29 percent reported both activities. 6.87 percent reported doing physical exercise. 3.67 percent were reported for the less than half an hour exercise on regular basis and 1.23 percent were reported one hour or more. 60.81 percent reported sleep in a day less than eight hours. 68.69 percent were never snorer and 12.29 percent were always snorer. Own health perception was reported by poor health 2.27 percent, fair health 26.54 percent and good

health 71.92 percent. Increased weight was reported 9.11percent, decreased weight was reported 5.69 percent and no change in weight was reported 38.81 percent.

In LPHS-II, 8.98 percent reported manual activities, 0.30 percent reported sedentary physical activity and 89.05 percent reported both activities. 15.00 percent reported doing physical exercise. 8.84 percent were reported for the less than half an hour exercise on regular basis and 1.86 percent were reported one hour or more. 78.41 percent reported sleep in a day less than eight hours. 59.20 percent were never snorer and 22.61 percent were always snorer. Own health perception was reported by poor health 2.87 percent, fair health 34.62 percent and good health 62.45 percent. Increased weight was reported 22.93 percent, decreased weight was reported 15.44 percent and no change in weight was reported 56.43 percent.

Table 5. Distribution of doctor diagnosed NCDs of participants

Categorical Variables	Categories	LPHS-I		LPHS-II	
		N	% (95%CI)	N	% (95%CI)
Diabetes	Yes	132	3.61 (3.01-4.22)	418	11.44 (10.41-12.47)
	No	3522	96.39 (95.78-97.00)	3236	88.56 (87.53-89.59)
Hypertension	Yes	350	9.58 (8.62-10.53)	906	24.79 (23.39-26.20)
	No	3304	90.42 (89.47-91.38)	2748	75.21 (73.80-76.61)
Angina	Yes	46	1.26 (0.90-1.62)	21	0.57 (0.33-0.82)
	No	3608	98.74(98.38-99.10)	3633	99.43 (99.18-99.67)
Heart Failure	Yes	3	0.08 (0.00-0.18)	9	0.25 (0.09-0.41)
	No	3651	99.92 (99.83-100.00)	3654	99.75 (99.59-99.91)
Heart Attack	Yes	30	0.82 (0.53-1.11)	47	1.29 (0.92-1.65)
	No	3624	99.18 (98.89-99.47)	3607	98.71 (98.35-99.08)
Rheumatic Heart Disease	Yes	7	0.19 (0.05-0.33)	14	0.38 (0.18-0.58)
	No	3647	99.81 (99.67-99.95)	3640	99.62 (99.42-99.82)
Stroke	Yes	37	1.01 (0.69-1.34)	72	1.97 (1.52-2.42)
	No	3617	98.99 (98.66-99.31)	3582	98.03 (97.58-98.48)
Epilepsy	Yes	6	0.16 (0.03-0.30)	18	0.49 (0.27-0.72)
	No	3648	99.84 (99.70-99.97)	3636	99.51 (99.28-99.73)
Osteo Arthritis	Yes	84	2.30 (1.81-2.79)	156	4.27 (3.61-4.93)
	No	3570	97.70 (97.22-98.18)	3498	95.73 (95.07-96.39)
Rheumatoid Arthritis	Yes	22	0.60 (0.35-0.85)	23	0.63 (0.37-0.89)
	No	3632	99.40 (99.15-99.65)	3631	99.37 (99.11-99.63)
Gout	Yes	96	2.63 (2.11-3.15)	258	7.06 (6.23-7.89)
	No	3558	97.37 (96.85-97.89)	3396	92.94 (92.11-93.77)
Ankylosing Spondylitis	Yes	30	0.82 (0.52-1.11)	40	1.09 (0.76-1.43)
	No	3624	99.18 (98.89-99.47)	3614	98.91 (98.57-99.24)

A descriptive analysis of the categorical variables of doctor diagnosed non-communicable diseases reported by under the study is shown in Table 5. In LPHS-I, out of 3654 population, 3.61 percent had diabetes, 9.58 percent had hypertension, 1.26 percent had angina, 0.08 percent had heart failure, 0.82 percent had heart attack, 0.19 percent had rheumatic heart disease, 1.01 percent had stroke, 2.30 percent had epilepsy, 2.30 percent had osteo arthritis, 2.63 percent had gout, and 0.82 percent had ankylosing spondylitis.

In LPHS-II, 11.44 percent had diabetes, 24.79 percent had hypertension, 0.57 percent had angina, 0.25 percent had heart failure, 1.29 percent had heart attack, 0.38 percent had rheumatic heart disease, 1.97 percent had stroke, 0.49 percent had epilepsy, 4.27 percent had osteo arthritis, 7.06 percent had gout, 1,09 percent had ankylosing spondylitis.

Table 6: Adjusted association between socio-demographic factors and Diabetes and Hypertension

Variables	Categories	LPHS-I		LPHS-II		LPHS-I		LPHS-II	
		Diabetes (Ref. Category: No)				Hypertension (Ref. Category No)			
		OR (95% CI)	p value	OR (95% CI)	p value	OR (95% CI)	p value	OR (95% CI)	p value
Age (Ref. Age group 18-44 yrs.)	**Age group ≥ 45**	**5.66 (3.76-8.52)**		**4.42 (3.24-6.04)**	**<.0001**	0.99(0.78-1.26)	0.9551	3.40(2.85-4.04)	<.0001
Physical Activity (Ref. No work)	**Sedentary only**	0.47 (0.28-0.81)	0.0064	-	0.972	0.84(0.61-1.15)	0.2698	0.75(0.09-6.54)	0.7921
	Manual only	0.60 (0.38-0.95)	0.0302	1.84 (0.83-4.08)	0.1352	0.59(0.44-0.80)	0.0006	1.69(0.91-3.13)	0.0977
	Both	0.75 (0.40-1.43)	0.3883	1.09 (0.51-2.34)	0.8335	0.71(0.47-1.10)	0.1229	1.35(0.75-2.42)	0.3161
Diet (Ref. Vegetarian)	**Non-vegetarian**	0.55 (0.28-1.07)	0.0774	1.07 (0.70-1.66)	0.7463	0.80(0.44-1.43)	0.4428	0.73(0.52-1.02)	0.0639
Salt intake (Ref. Rarely or never)	**Sometimes**	**0.56 (0.35-0.89)**	**0.0144**	0.90 (0.67-1.20)	0.4519	1.09(0.81-1.48)	0.5648	**0.60(0.48-0.76)**	**<.0001**
	Almost always or always	**0.47 (0.31-0.71)**	**0.0004**	**0.71 (0.55-0.92)**	**0.0101**	1.25(0.96-1.61)	0.0936	**0.47(0.38-0.57)**	**<.0001**
Sleep (Ref. Less than 8 hrs./day)	**8 hrs. or more**	1.06 (0.73-1.54)	0.7566	1.10 (0.86-1.42)	0.4478	0.86(0.68-1.10)	0.2269	0.98(0.81-1.20)	0.8701
Snoring (Ref. Never)	**Sometimes**	0.91 (0.56-1.48)	0.7057	1.27 (0.96-1.68)	0.0971	**1.71(1.29-2.25)**	**0.0002**	**1.86(1.51-2.30)**	**<.0001**
	Always	0.99 (0.57-1.71)	0.9681	**1.74 (1.36-2.23)**	**<.0001**	**2.38(1.77-3.19)**	**<.0001**	**2.34(1.93-2.85)**	**<.0001**
Physical Exercise (Ref. No)	**Yes**	1.15 (0.61-2.18)	0.6709	1.27 (0.96-1.67)	0.0755	**1.95(1.37-2.78)**	**0.0002**	**1.33(1.07-1.64)**	**0.0097**
Alcohol (Ref. No)	**Yes**	0.58 (0.18-1.90)	0.3669	1.19 (0.82-1.71)	0.3590	0.65(0.32-1.30)	0.2214	1.24(0.93-1.65)	0.1513
Smoker (Ref. Never)	**Former Smoker**	0.91 (0.20-4.06)	0.9006	1.44 (1.02-2.03)	0.0385	1.89(0.92-3.89)	0.0848	1.03(0.76-1.38)	0.8739
	Current Smoker	0.85 (0.53-1.38)	0.5212	0.90 (0.66-1.22)	0.4822	1.20(0.90-1.61)	0.2107	**0.49(0.38-0.63)**	**<.0001**

Compare to younger adult age group, older adult age group was five times like to be higher in diabetic group in adjusted model [AOR= 5.66 (3.76-8.52)] in LPHS-I and four times like to be higher in diabetic group in adjusted model [AOR= 4.42 (3.24-6.04)] in LPH-II. In compare to never salt intake during meal, participants who have sometimes use raw salt were 44percent less likely [AOR= 0.47 (0.31-0.71)] in LPHS-I and 29 percent less likely [AOR= 0.71 (0.55-0.92)] in LPHS-II to be diabetic population. Compare to non-snorer, snorers were 74 percent higher to be diabetic population in adjusted model [1.74 (1.36-2.23)]. For snorers, odds were 71 percent [AOR=1.71(1.29-2.25)] higher

among sometimes snorers and two times likely to be higher among always snores [AOR=2.38(1.77-3.19)] in adjusted model in the baseline survey (LPHS-I) and the result was little more among sometimes snorer [AOR=1.86(1.51-2.30)] and little less among always snorers [AOR=2.34(1.93-2.85)] in the midline survey (LPHS-II).

Table 7: Adjusted association between socio-demographic factors and Cardiovascular Diseases

Variables	Categories	LPHS-I		LPHS-II		LPHS-I		LPHS-II	
		Angina (Ref. No)				Heart Attack (Ref. No)			
		OR (95percent CI)	p value	OR (95percent CI)	p value	OR (95percent CI)	p value	OR (95percent CI)	p value
Age (Ref. Age group 18-44 yrs.)	**Age group ≥ 45**	1.07(0.58-1.96)	0.8300	-	0.9392	**1.19(0.55-2.57)**	**0.0002**	**17.34(13.35-47.96)**	**0.0051**
Physical Activity (Ref. No work)	**Sedentary only**	0.64(0.29-1.40)	0.2617	-	0.9944	0.06(0.02-0.28)	0.0002	-	0.9998
	Manual only	**0.43(0.20-0.91)**	**0.0277**	0.29(0.05-1.75)	0.1784	**0.09(0.03-0.27)**	**<.0001**	-	0.9584
	Both	0.49(0.16-1.54)	0.2225	0.22(0.05-1.06)	0.0593	**0.17(0.04-0.78)**	**0.0223**	-	0.9629
Diet (Ref. Vegetarian)	**Non-vegetarian**	1.44(0.19-10.79)	0.7203	0.37(0.10-1.39)	0.1412	0.47(0.10-2.30)	0.3492	2.21(0.52-9.49)	0.2854
Salt intake (Ref. Rarely or never)	**Sometimes**	0.77(0.33-1.83)	0.5588	0.51(0.11-2.27)	0.3739	0.76(0.26-2.22)	0.6172	0.70(0.30-1.610)	0.3954
	Almost always or always	1.19(0.62-2.29)	0.6040	0.74(0.26-2.13)	0.5801	0.93(0.41-2.11)	0.8584	0.62(0.28-1.37)	0.2351
Sleep (Ref. Less than 8 hrs. in a day)	**8 hrs. or more**	0.95(0.51-1.77)	0.8665	0.73(0.24-2.27)	0.5889	1.29(0.60-2.79)	0.5107	0.94(0.46-1.89)	0.8541
Snoring (Ref. Never)	**Sometimes**	1.94(0.97-3.85)	0.0605	0.56(0.12-2.62)	0.4632	**3.29(1.4-7.76)**	**0.0065**	1.77(0.82-3.79)	0.1449
	Always	1.78(0.79-4.05)	0.1655	2.05(0.80-5.24)	0.1350	1.94(0.68-5.48)	0.2138	1.93(0.97-3.84)	0.0616
Physical Exercise (Ref. No)	**Yes**	0.65(0.19-2.20)	0.4911	0.83(0.24-2.91)	0.7708	2.13(0.83-5.45)	0.1153	0.88(0.40-1.93)	0.7418
Alcohol (Ref. No)	**Yes**	1.36(0.40-4.62)	0.6232	1.02(0.27-3.81)	0.9829	-	0.9753	2.70(0.62-11.75)	0.1860
Smoker (Ref. Never)	**Former Smoker**	**4.89(1.36-17.63)**	**0.0152**	**5.71(2.01-16.21)**	**0.0011**	**5.34(1.69-16.84)**	**0.0043**	**3.29(1.67-6.47)**	**0.0006**
	Current Smoker	**2.28(1.18-4.40)**	**0.0138**	1.86(0.53-6.49)	0.3312	1.44(0.56-3.72)	0.4482	0.49(0.14-1.66)	0.2496

Older adult population have 19 percent likely to be higher odds to heart attack [AOR=1.19(0.55-2.57)] in the LPHS-I. Whereas, in LPHS-II, seventeen times likely to be heart attack in adjusted model [AOR=17.34(13.35-47.96)]

Former smokers were four times higher [AOR=4.89(1.36-17.63)] and current smokers were two times higher [AOR=2.28(1.18-4.40)] than the never smokers in the doctor diagnosed angina in the LPHS-I. In LPHSII, Former smokers were five times higher [AOR=5.71(2.01-16.21)] than the never smokers in the doctor diagnosed angina. In compare to never smokers, former smokers were five times likely to be diagnosed heart attack in adjusted model [AOR=5.34(1.69-16.84)] and for current smokers, thrice higher odds to diagnosed heart attack in adjusted model [AOR=.29(1.67-6.47)].

Table 7: Adjusted association between socio-demographic factors and Stroke

Variables	Categories	LPHS-I		LPHS-II	
		Stroke (Ref. No)			
		OR (95percent CI)	p value	OR (95percent CI)	p value
Age (Ref. Age group 18-44 yrs.)	**Age group ≥ 45**	1.29(0.66-2.53)	0.4606	**25.67(22.52-76.12)**	**0.0014**
Physical Activity (Ref. No work)	**Sedentary only**	**0.32(0.14-0.73)**	**0.0068**	-	0.9846
	Manual only	**0.16(0.07-0.39)**	**<.0001**	0.55(0.24-1.28)	0.1675
	Both	**0.19(0.04-0.85)**	**0.0299**	**0.11(0.05-0.25)**	**<.0001**
Diet (Ref. Vegetarian)	**Non-vegetarian**	1.36(0.18-10.52)	0.7696	0.76(0.36-1.59)	0.4639
Salt intake (Ref. Rarely or never)	**Sometimes**	**0.17(0.04-0.72)**	**0.0165**	**0.36(0.15-0.85)**	**0.0195**
	Almost always or always	0.73(0.37-1.45)	0.3723	0.60(0.32-1.13)	0.1122
Sleep (Ref. Less than 8 hrs. in a day)	**8 hrs. or more**	1.46(0.74-2.89)	0.2796	0.77(0.42-1.41)	0.3991
Snoring (Ref. Never)	**Sometimes**	**2.86(1.3-6.26)**	**0.0088**	1.42(0.77-2.64)	0.2626
	Always	**2.94(1.26-6.84)**	**0.0126**	1.36(0.76-2.45)	0.3039
Physical Exercise (Ref. No)	**Yes**	1.59(0.63-4.04)	0.3273	0.99(0.52-1.92)	0.9856
Alcohol (Ref. No)	**Yes**	0.62(0.08-4.78)	0.6488	3.94(0.92-16.91)	0.0646
Smoker (Ref. Never)	**Former Smoker**	1.67(0.35-7.89)	0.5209	1.62(0.82-3.23)	0.1660
	Current Smoker	1.76(0.82-3.77)	0.1460	0.92(0.42-2.02)	0.8322

Compare to younger adult age group, adult older age group was twenty-five times higher odds to be stroke in adjust model [AOR=25.67(22.52-76.12)] the LPHS-II. With reference to never snorer, participants who sometimes snored [AOR=2.86(1.3-6.26)] and always snored [AOR=2.94(1.26-6.84)] had two times higher odds to be stroke in adjusted model in LPHS-I

Table 8A: Adjusted association between socio-demographic factors and Musculoskeletal Disorder

Variables	Categories	LPHS-I		LPHS-II		LPHS-I		LPHS-II	
		Osteo Arthritis (Ref. No)				Rheumatoid Arthritis (Ref. No)			
		OR (95percent CI)	p value	OR (95percent CI)	p value	OR (95percent CI)	p value	OR (95percent CI)	p value
Age (Ref. Age group 18-44 yrs.)	**Age group ≥ 45**	**2.90(1.84-4.57)**	**<.0001**	**4.27(2.49-7.30)**	**<.0001**	**6.71(2.45-18.35)**	**0.0002**	1.19(0.46-3.10)	0.7248
Physical Activity (Ref. No work)	**Sedentary only**	1.23(0.59-2.58)	0.5788	-	0.9796	5.04(0.58-43.65)	0.1419	-	0.9914
	Manual only	1.55(0.79-3.02)	0.2019	1.15(0.38-3.49)	0.7995	4.86(0.58-40.54)	0.1437	0.13(0.02-0.70)	0.0174
	Both	1.20(0.45-3.16)	0.7152	0.69(0.24-1.99)	0.4955	6.20(0.59-65.58)	0.1293	**0.08(0.02-0.30)**	**0.0002**
Diet (Ref. Vegetarian)	**Non-vegetarian**	0.79(0.31-2.02)	0.6195	0.86(0.48-1.55)	0.6231	-	0.9832	1.02(0.22-4.72)	0.9841
Salt intake (Ref. Rarely or never)	**Sometimes**	1.50(0.88-2.56)	0.1333	0.65(0.40-1.06)	0.0817	1.17(0.37-3.73)	0.7951	2.02(0.67-6.05)	0.2091
	Almost always or always	0.89(0.52-1.53)	0.6800	0.70(0.45-1.07)	0.0949	1.38(0.52-3.67)	0.5237	1.86(0.71-4.83)	0.2050
Sleep (Ref. Less than 8 hrs. in a day)	**8 hrs. or more**	1.06(0.67-1.66)	0.8165	1.04(0.69-1.57)	0.8389	1.63(0.68-3.89)	0.2732	1.02(0.37-2.80)	0.9680
Snoring (Ref. Never)	**Sometimes**	**0.41(0.18-0.91)**	**0.0276**	**2.02(1.36-2.99)**	**0.0005**	1.27(0.43-3.71)	0.6645	0.73(0.24-2.22)	0.5742
	Always	1.09(0.59-2.03)	0.782	1.33(0.88-2.02)	0.1781	1.26(0.36-4.46)	0.7197	0.43(0.12-1.53)	0.1923
Physical Exercise (Ref. No)	**Yes**	**2.05(1.04-4.03)**	**0.0381**	**3.16(2.22-4.50)**	**<.0001**	<0.001(0-100)	0.9698	**3.18(1.25-8.10)**	**0.0154**
Alcohol (Ref. No)	**Yes**	0.41(0.06-3.06)	0.387	1.77(0.79-3.96)	0.1635	1.87(0.23-15.06)	0.5551	0.95(0.19-4.66)	0.9493
Smoker (Ref. Never)	**Former Smoker**	1.90(0.42-8.54)	0.4033	1.10(0.64-1.88)	0.7336	6.92(0.78-61.72)	0.0834	0.54(0.07-4.22)	0.5549
	Current Smoker	0.59(0.30-1.17)	0.1304	**0.17(0.07-0.42)**	**0.0001**	0.36(0.08-1.60)	0.1789	0.41(0.08-2.01)	0.2720

Reference to younger adult age group, adult older age group was two times higher odds to be develop osteo arthritis in adjust model [AOR=2.90(1.84-4.57)] in LPHS-I and four times develop osteo

arthritis in adjust model [AOR=4.27(2.49-7.30)] the LPHS-II. Compared to no physical exercise, subjects engaged regular physical exercise were twice [AOR=2.05(1.04-4.03)] likely to be developed osteo arthritis in adjusted model in LPHS-I and thrice [AOR=3.16(2.22-4.50)] likely to be developed osteo arthritis in adjusted model in LPHS-II. Compared to no physical exercise, subjects engaged regular physical exercise were thrice [AOR=3.18(1.25-8.10)] likely to be developed rheumatoid arthritis in adjusted model in LPHS-II.

Table 8B: Adjusted association between socio-demographic factors and Musculoskeletal Disorder

Variables	Categories	LPHS-I		LPHS-II		LPHS-II	
		Gout (Ref. No)				Ankylosing Spondylitis (Ref. No)	
		OR (95percent CI)	p value	OR (95percent CI)	p value	OR (95percent CI)	p value
Age (Ref. Age group 18-44 yrs.)	**Age group ≥ 45**	**2.99(1.96-4.55)**	**<.0001**	**1.82(1.34-2.47)**	**0.0001**		
Physical Activity (Ref. No work)	**Sedentary only**	1.45(0.72-2.93)	0.3000	1.53(0.16-15.17)	0.7160		
	Manual only	1.70(0.89-3.25)	0.1084	0.82(0.30-2.25)	0.6945		
	Both	0.73(0.25-2.12)	0.5589	0.94(0.37-2.40)	0.8933		
Diet (Ref. Vegetarian)	**Non-vegetarian**	1.14(0.41-3.19)	0.8063	0.98(0.57-1.67)	0.9366		
Salt intake (Ref. Rarely or never)	**Sometimes**	1.31(0.76-2.26)	0.3317	1.36(0.96-1.93)	0.0869		
	Almost always or always	1.39(0.86-2.25)	0.1850	**1.39(1.04-1.87)**	**0.0276**		
Sleep (Ref. Less than 8 hrs. in a day)	**8 hrs. or more**	1.31(0.86-1.99)	0.2030	0.90(0.65-1.25)	0.5374		
Snoring (Ref. Never)	**Sometimes**	1.00(0.57-1.75)	0.9967	1.04(0.74-1.48)	0.8120		
	Always	1.02(0.54-1.92)	0.9473	**1.41(1.04-1.91)**	**0.0259**		
Physical Exercise (Ref. No)	**Yes**	0.76(0.3-1.93)	0.5639	**1.82(1.34-2.48)**	**0.0001**	**3.32(1.68-6.56)**	**0.0006**
Alcohol (Ref. No)	**Yes**	1.01(0.31-3.34)	0.9843	1.61(0.94-2.75)	0.0803		
Smoker (Ref. Never)	**Former Smoker**	1.90(0.43-8.34)	0.3947	0.93(0.57-1.53)	0.7820		
	Current Smoker	0.68(0.38-1.23)	0.2005	**0.40(0.25-0.64)**	**0.0001**		

Reference to younger adult age group, adult older age group was two times higher odds to be develop osteo arthritis in adjust model [AOR=2.99(1.96-4.55)] in LPHS-I and 82percent higher to develop gout in adjust model [AOR=4.27(2.49-7.30)] the LPHS-II. Compared to no physical exercise, subjects engaged regular physical exercise were 82 percent [AOR=1.82(1.34-2.48)] likely to be developed gout in adjusted model in LPHS-II. Compared to no physical exercise, subjects engaged regular physical exercise were thrice [AOR=3.32(1.68-6.56)] likely to be Ankylosing Spondylitis in adjusted model in LPHS-II.

Table 9. Prevalence, Incidence and new cases in the cohort

NCD's	LPHS-I (Total No.)	LPHS-II (Total No.)	No. of new cases	Incidence (Per 100)	LPHS-I (NCD's Prevalence)	LPHS-II (NCD's Prevalence)
Diabetes	132	418	286	22.46	3.61	11.44
Hypertension	350	906	556	43.66	9.58	24.79
Angina	46	21	0	0.00	1.26	0.57
Heart Failure	3	9	6	0.47	0.08	0.25
Heart Attack	30	47	17	1.34	0.82	1.29
Rheumatic Heart Disease	7	14	7	0.55	0.19	0.38
Stroke	37	72	35	2.75	1.01	1.97
Epilepsy	6	18	12	0.94	0.16	0.49
Osteo Arthritis	84	156	72	5.65	2.30	4.27
Rheumatoid Arthritis	22	23	1	0.08	0.60	0.63
Gout	96	258	162	12.72	2.63	7.06
Ankylosing Spondylitis	30	40	10	0.79	0.82	1.09

Prevalence, incidence per 1000 and new cases under the cohort is depicted in the **table 9**. The table demonstrate that the burden of NCDs were increased from the baseline to mid-line survey in the cohort except angina.

Figures of associations between dependent and independent variables:

Figure 1: Adjusted association between socio-demographic factors and Doctor Diagnosed Diabetes (Ref. category= No)

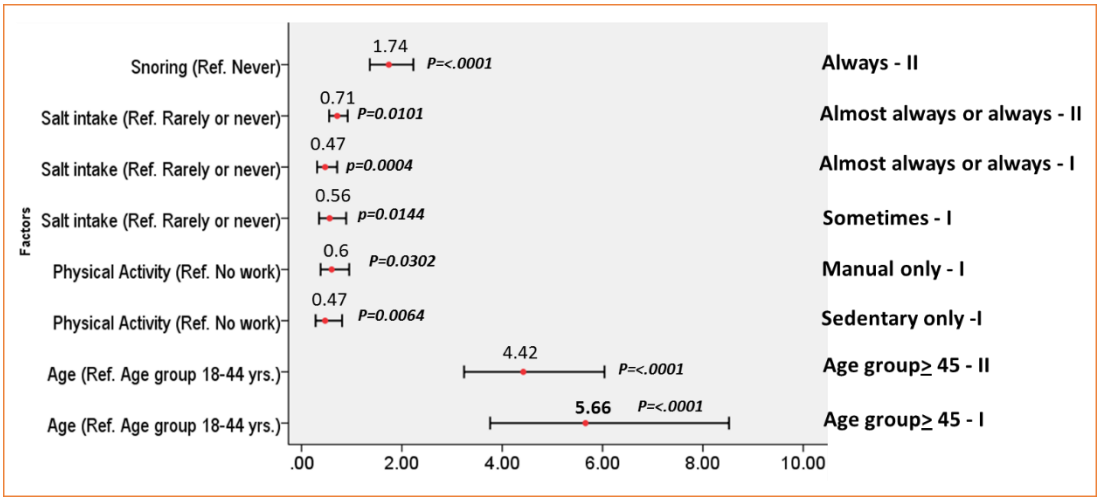


Figure 2: Adjusted association between socio-demographic factors and Doctor Diagnosed Hypertension (Ref. category= No)

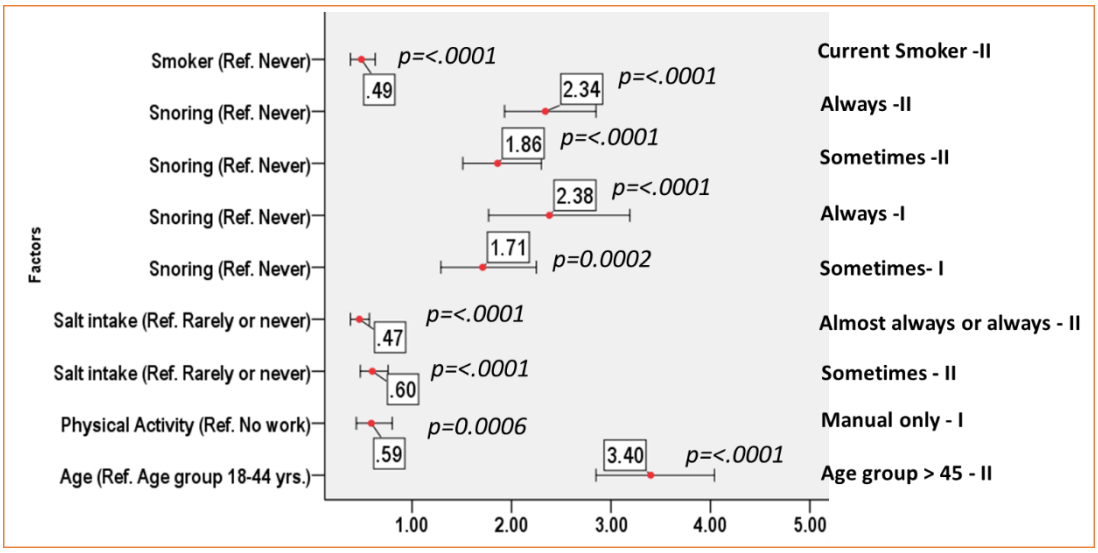
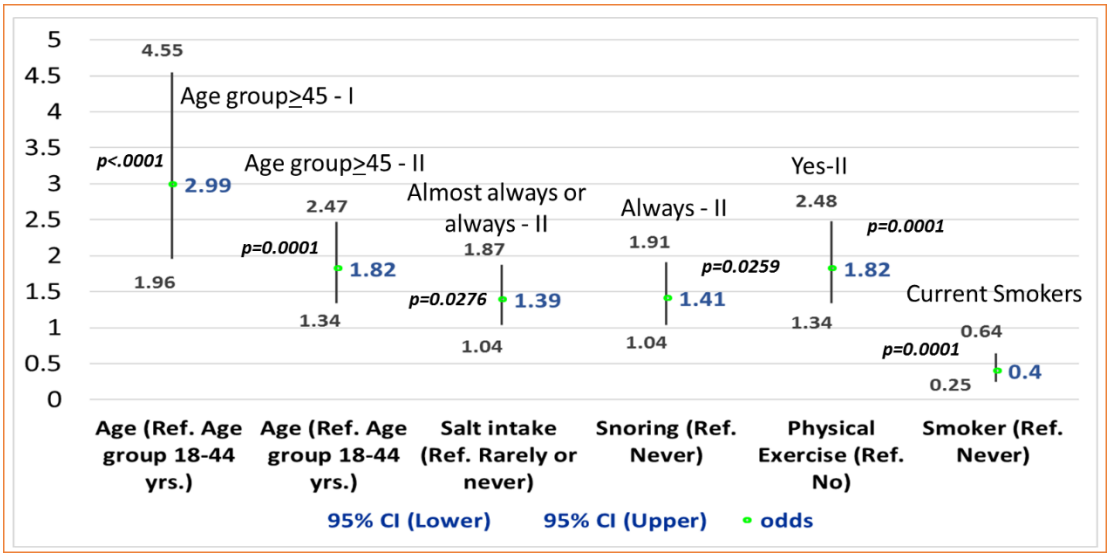


Figure 3: Adjusted association between socio-demographic factors and Doctor Diagnosed Gout (Ref. category= No)



In a representative sample of the current study of an urban adult population cohort, the prevalence of NCDs was found to be significant, the results showed high prevalence of, smoking, alcohol drinking, raw salt intake during meal, snoring, low mean hours of physical exercise, hypertension, diabetes, stroke, osteo arthritis and gout among adult in an urban set up. The observed burden of lifestyle factors seemed to have the likely to be increasing the risk of NCDs and its complications among the urban population in West Bengal (47–50). In Indian context prevalence of doctor diagnosed hypertension was 30.7 percent among the adult population, the present study current prevalence 24.79 percent as per LPHS-II (51). In the present study, it was found that gout prevalence rate was 7.06 percent and osteo arthritis was 4.27 percent. A study on musculoskeletal (MSK) complaints in Paschim Medinipur District of West Bengal reported 12 percent MSK diagnosed correctly (52). The current study found no significance change in the prevalence of rheumatoid arthritis between two surveys. Also, angina reported cases were less reported than the baseline survey.

The current study observed number of strengths: (a) The longitudinal prospective cohort design assesses the change and association of risk factors for NCDs, providing valid and reliable information

compared with other surveys. (b) the study followed international validated approach and protocol to measure NCD risk factors at both baseline and mid-line survey. (c) the data completeness was accurate at both baseline and mid-line survey.

Limitations of the study:

The current study has some limitations. (a) survey of the cohort follows ten years interval. Gap between the two surveys were sufficiently long to determine changes or keep record in most of the associated risk factors of NCDs (44), also difficult to identify when a change in behaviour occurred (for example onset of smoking, alcoholism). (b) required more household recruitment for accurate estimation to identify some NCDs risk factors in the study population. However, best of the knowledge this is one of the first longitudinal study in India and in future the study will recruit more participants to validate our study findings. (c) the study was conducted in the eastern part of India. Therefore, the study findings may not necessarily be extrapolated or generalize to other parts of population in India or low-middle-income countries (LMICs). However, by epidemiologic transition characteristics, West Bengal follows the late stage (53) of demographic transition and therefore change in NCD associated risk factors in this state is likely to emulate the future change in most parts of India.

Conclusion:

NCD burden is a growing concern across the globe, particularly alarming in the LMICs. Therefore, it is necessary to continuously surveillance in India for the effective control and prevention in the NCDs burden. The magnitude of change for some associate risk factors in the present study is noticeable. It is necessary to focus on the underlying mechanisms and encourage researchers to combine and integrate data derived from longitudinal population based cohorts to validate and identify risk factors. Many socio-behavioural and modifiable factors have an association with NCDs. Both surveys results were revealed the factors like age, smoking alcohol consumption, dietary patterns are modifiable so with reversibility of the factors and with a proper intervention of the NCDs are related comorbidities and mortality can be reduced.

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